Summary of Alternatives Considered

Union Station Building and Track Improvements Project

Prepared for

Federal Railroad Administration
Oregon Department of Transportation
Portland Development Commission

November 2016

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Prepared in accordance with the
National Environmental Policy Act (NEPA) of 1969, as amended 42 U.S.C. 4332(2)(c)
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Council on Environmental Quality's (CEQ) NEPA implementing regulations (40 CFR 5§ 1500-08).

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Written Comments at Meetings	A comment box is available at meetings for submitting written comments. Refer to PDC's website for the dates and locations of meetings.

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1. Introduction

The Portland Development Commission (PDC) and the Oregon Department of Transportation (ODOT) are currently investigating infrastructure and operating improvement options for Portland's Union Station. This includes reviewing options to upgrade and renovate the existing buildings, as well as to improve and increase the amount of passenger rail trains served daily at the station, both in the near term (2017) and the long term (2035).

This document summarizes the process to develop and evaluate conceptual designs, the scope of proposed improvements, and the identification of elements comprising a preliminary preferred alternative for the Portland Union Station.

Conceptual design alternatives were developed in response to the needs and issues identified in the Detailed Work Plan (DWP) and during the conditions assessment phase of the project, completed in December 2015. This work identified deficiencies in the existing condition and functionality of existing Union Station facilities, as well as key requirements to meet the need of future rail operations, passengers, tenants, and visitors to Union Station.

In addition to the structural and operational needs assessment, ODOT and the PDC engaged in a robust process with the Oregon State Historic Preservation Office (Oregon SHPO) to determine the most appropriate scope of improvements for Union Station, a National Register of Historic Places (NRHP)-listed resource. ODOT and the PDC considered preserving the stature and integrity of this National Register resource as a significant priority. During this project phase, ODOT and the PDC conducted limited outreach with the public and other community stakeholders. The agencies worked closely with the Oregon SHPO to determine the scope of improvements for Union Station. Also during the alternatives development and evaluation phase, ODOT and the PDC consulted extensively with Amtrak regarding building and rail yard improvements. The outcomes of this consultation with the Oregon SHPO and Amtrak guided the development of a broad set of conceptual design alternatives that respond to the issues, needs, and opportunities identified.

ODOT and the PDC evaluated the range of conceptual design building and rail improvement alternatives against the project's Purpose and Need, and Goals and Objectives (PNGO). In May 2016, ODOT and the PDC identified a preliminary preferred alternative that most effectively met the project's PNGO and preserved Union Station's historic integrity

In many cases, ODOT and the PDC considered multiple and mutually exclusive alternatives to address the needs of Union Station's owner, operators, and tenants. In these cases, the goal of the evaluation of alternatives was to identify a preliminary preferred alternative that would be reviewed by the public and project stakeholders and, as appropriate, refined as part of project development.

With the identification of a preliminary preferred alternative, ODOT and the PDC will conduct a more extensive public outreach program in compliance with Section 106 of the National Historic Preservation Act (NHPA). This outreach effort will provide the public and other interested parties the opportunity to review the preliminary preferred alternative and provide feedback on possible adverse effects and their resolution. ODOT and the PDC will consider all feedback received in the refinement of the preferred alternative.

After public and stakeholder review of the preliminary preferred alternative, the narrowed range of conceptual alternatives will be combined into one design approach which will allow for design refinement and cost estimating based on one confirmed design approach.

1.1. Project Overview and Background

Portland Union Station is a historic and operational inter-city passenger rail facility serving Portland (Multnomah County), Oregon. Construction of Union Station began in 1890, and the facility opened for service on February 6, 1896. The facility has been in continuous use as a passenger rail station and gateway to the City of Portland ever since.

In 1975, Union Station was placed on the National Register of Historic Places. It is one of the most architecturally prominent and recognized structures in the City of Portland.

Amtrak is the principal tenant at Union Station, which currently ranks as Amtrak's 16th busiest station nationally. Over 650,000 riders pass through Union Station annually, comparable to the passenger volumes of Seattle's King Street Station. Union Station is served by Amtrak Cascades intercity services, connecting Portland to cities in the Pacific Northwest, as well as long-distance Amtrak services to Los Angeles and Chicago. Union Station is a key anchor of the United States Department of Transportation's (USDOT's) Pacific Northwest high speed rail corridor (Eugene-Portland-Seattle-Vancouver, BC).

The PDC, the urban renewal and economic development agency of the City of Portland, acquired Union Station and Tracks 1-4 in 1987. The Portland Terminal Railroad (PTRR) owns the adjacent Track 5 and the right-of-way of the former Track 6. Since assuming ownership in 1987, the PDC has implemented multiple phases of improvements to both buildings and tracks.

After nearly 120 years of continuous passenger railroad service, Union Station is in need of critical repairs and upgrades to preserve Union Station's historic integrity, meet the future demands of intercity passenger rail service, and position Union Station as an economically and socially vital landmark into the future.

In 2014, PDC retained architectural and engineering (A/E) consultant teams to perform a conditions assessment of Union Station as part of the Portland Union Station Building and Track Improvements PE/NEPA project (Union Station Building and Track Improvements project). Through the Union Station PE/NEPA project, PDC will complete necessary preliminary engineering work and NEPA environmental review in compliance with FRA's Procedures for Considering Environmental Impacts (64 CFR 28545, May 26, 1999), FRA's Updated Procedures for Considering Environmental Impacts by adding categorical exclusions [78 FR 2713 (January 14, 2013)], and the Council on Environmental Quality's (CEQ) NEPA implementing regulations (40 CFR 5§ 1500-08).

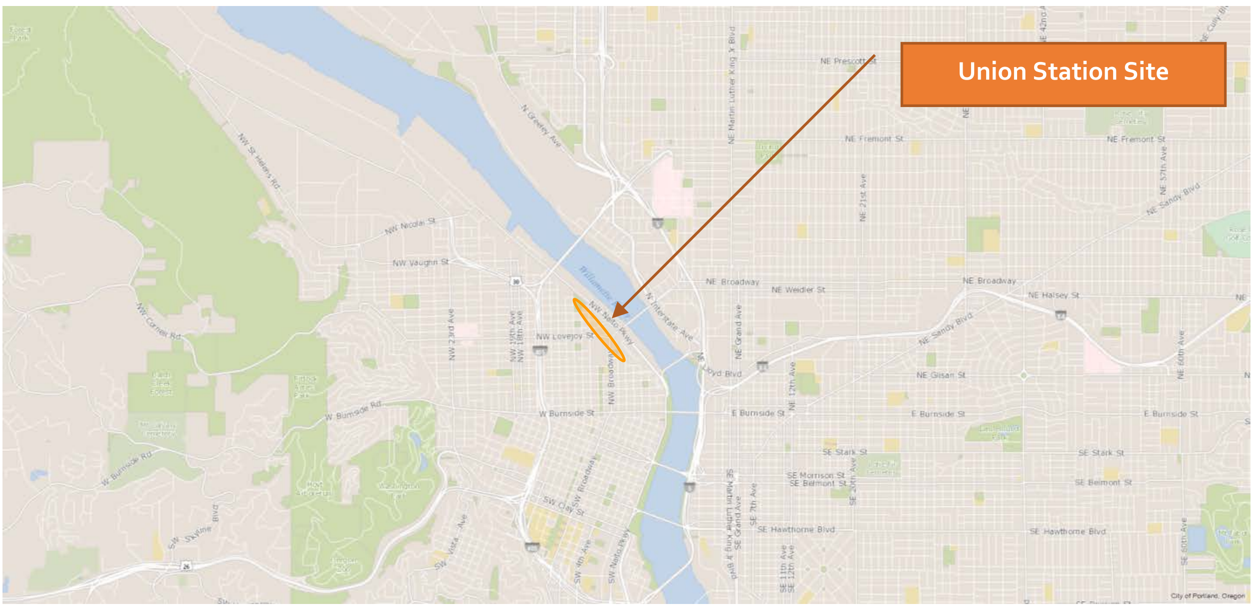
The Union Station Building and Track Improvements project is funded in part through a grant from the Federal Railroad Administration (FRA) to ODOT. This grant was awarded to ODOT on October 28, 2010 through FRA's High-Speed Intercity Passenger Rail Program.

The PDC is the lead agency for the Portland Union Station Building and Track Improvements project as a grant sub-recipient to ODOT. ODOT and PDC executed an intergovernmental agreement outlining the roles and responsibilities of ODOT and PDC in execution and administration of the FRA grant.

1.2. Project Area Description

Portland's Union Station is located on the west side of the Willamette River in the Old Town / Chinatown section of downtown Portland (Figure 1.2-1). The Union Station site is generally bounded by NW Glisan, Hoyt and Irving Streets on the south, NW Broadway Street and NW Station Way on the west, NW Overton Street and NW Naito Parkway on the north, and NW Ironside Terrace and partially developed industrial and commercial land on the east (Figure 1.2-2).

Figure 1.2-1. Project Vicinity



Source: Portland Maps. www.portlandmaps.com. 2016.

The Union Station site between the Broadway Bridge and south to the intersection of NW Naito Parkway and NW Glisan Street is zoned Central Commerce with a design overlay (CX-d) and between the Broadway Bridge and north to the intersection of NW 9th Avenue and NW Naito Parkway is zoned Central Employment with a design overlay (EX-d). The Central Commerce Zone (CX) is intended to provide for commercial development within the City's most urban and intense areas and allows a broad range of uses. The Central Employment Zone (EX) allows mixed-uses and is intended for areas in the center of the City that have predominantly industrial type development. Zoning of abutting properties is Central Commerce and Central Employment with a design overlay. The surrounding area is comprised of the Broadway and Steel Bridges, market rate and subsidized high density residential development, social services (Bud Clark Commons), transportation services (Greyhound Bus, public parking garages), commercial uses, education (Pacific Northwest College of Art), and government (U.S. Postal Service facility).

Figure 1.2-2. Union Station Project Area

Source: IBI Group. 2016.

1.3. Evaluation of Alternatives

1.3.1. Purpose

Evaluating alternatives is a part of established transportation planning practice. At its core, alternatives analysis is about serving local decision making and is a locally managed study process.

The purpose of evaluating alternatives is:

- To aid the agency in identifying a project that is likely to be built.
- To enhance the project's likelihood of success by:
    - Identifying a preferred alternative whose scope and cost address the defined problem and whose costs are consistent with expected benefits.
    - Advancing the development of supportive land use and other policies.
    - Providing analysis and information critical to reaching decisions on the investment strategy to pursue for good stewardships of the facility.

This Summary of Alternatives Considered Report:

- Captures the reasons why an alternative should or should not be identified as a preferred alternative and carried forward for analysis in a project's environmental documentation.
- Provides a summary of findings from technical studies and engineering.
- Provides a recommendation to decision makers regarding preferred improvements for the Union Station buildings and rail yard.

1.3.2. Report Organization

This report includes the following chapters:

Chapter 1. Introduction: a summary description of the project and this report's purpose and organization.

Chapter 2. Purpose and Need: cites the project's Purpose and Need, and Goals and Objectives.

Chapter 3. Description of Alternatives: provides a summary description of the building and rail yard improvement alternatives considered.

Chapter 4. Analysis Framework: describes the evaluation framework and criteria used to assess the conceptual alternatives.

Chapter 5. Building Improvements Considered: describes the building improvement alternatives considered, the potential range of impacts associated with each alternative, the recommended preliminary preferred alternative, and a summary table comparing each of the alternatives to the evaluation criteria.

Chapter 6. Rail Yard Improvements Considered: describes the rail yard improvement alternatives considered, the potential range of impacts associated with each alternative, the recommended preliminary preferred alternative, and a summary table comparing each of the alternatives to the evaluation criteria.

Chapter 7. Preliminary Preferred Alternative: summarizes the recommended building and rail side improvements that comprise the preliminary preferred alternative.

Chapter 8. Coordination and Consultation: summarizes the public outreach and agency coordination that have occurred as of the publication of this report.

Chapter 9. List of Preparers: lists the individuals who participated in the preparation of this report and their qualifications.

Chapter 10. References: lists the documents and resources used in the preparation of this report.

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2. Purpose and Need

The project's Purpose and Need, and Goals and Objectives (PNGO) guide the development and evaluation of project alternatives. The PNGO is also used in the decision making to select a preferred alternative.

2.1. Purpose and Need

The **Purpose** of the Portland Union Station Building and Tracks Improvement Project is to support future Union Station building and adjoining track repairs needed to stabilize and rehabilitate the historically signficiant Union Station and to accommodate existing and future passenger rail traffic at Union Station.

The **Need** for the project is based on: does not meet some current building code requirements and City policies; current passenger service operations are inefficient and outdated; the building and site do not support long term financially and environmental sustainable operations in a manner that supports the vitality of the facility and surrounding area; increasing track congestion diminishes on-time performance of passenger rail service and multi-modal connectivity; existing rail facilities do not meet some passenger safety and accessibility requirements; existing rail facilities cannot accommodate forecasted increases in passenger service; and, existing rail facilities and yard do not support long term finanancially and environmentally sustainable operations and maintenance.

2.2. Goals and Objectives

The Goals and Objectives of the Portland Union Station Building and Tracks Improvement Project, as defined by PDC and the project stakeholders are as follows:

GOAL #1: Revitalize Union Station as a multi-modal transportation hub that can accommodate the future growth and operational needs of passenger and freight rail in the region.

Objective 1-1. Meet the capacity and operating needs of expanded intercity passenger rail.

Objective 1-2. Ensure adequate capacity for freight movement through the station.

Objective 1-3. Improve and enhance the experience of passengers and visitors.

Objective 1-4. Modernize station operations in accordance with Amtrak requirements and design guidelines.

Objective 1-5. Reinforce multi-modal connections and convenience for connecting passengers.

Objective 1-6. Improve station, railside, and streetside ADA accessibility.

Objective 1-7. Upgrade facilities to reflect current seismic and building codes.

Objective 1-8. Upgrade critical life safety and security standards.

GOAL #2: Preserve and protect the historic character of Union Station as an operational passenger station for future generations.

Objective 2-1. Ensure that Union Station is a functional and vibrant a historic landmark for the future.

Objective 2-2. Restore and preserve historic materials, finishes, and building elements.

Objective 2-3. Honor the historic legacy of Union Station as a passenger rail facility.

GOAL #3: Improve the financial viability of Union Station and its contributions to the redevelopment of surrounding neighborhoods.

Objective 3-1. Minimize building operating costs.

Objective 3-2. Improve the quality, marketability, and economic return on leased tenant spaces.

Objective 3-3. Identify opportunities to repurpose underutilized space to benefit both travelers and non-travelers.

Objective 3-4. Support revitalization of the surrounding neighborhoods by positioning Union Station as a key activity center that is integrated into the surrounding urban fabric.

Objective 3-5. Contribute to the economic and social vitality of the surrounding neighborhoods.

GOAL #4: Ensure that Union Station, as a Portland icon, reflects the community's values and best practices for environmental sustainability.

Objective 4-1. Meet or exceed the City's LEED Gold sustainability rating.

Objective 4-2. Incorporate sustainability best practices of project partners.

Objective 4-3. Reduce energy use, water consumption, and trash generation.

Objective 4-4. Reduce greenhouse gas and air pollutant emissions.

Objective 4-5. Remediate hazardous materials in building components.

Objective 4-6. Improve stormwater management and containment of potential groundwater pollutants.

Objective 4-7. Minimize detrimental impacts of station operations (e.g. noise) on passengers, tenants, and surrounding land uses.

Objective 4-8. Promote sustainable transportation options to and from Union Station.

3. Analysis Framework

The project team developed an evaluation framework and evaluation criteria to assess conceptual design alternatives against the project's Purpose and Need as well as a range of strategic and practical considerations, including the factors identified in the approved September 2013 Detailed Work Plan (DWP).

3.1. Evaluation Criteria

The evaluation criteria are divided into four categories:

- Ability to Meet Project Goals
- Cost and Financing
- Implementation and Constructability
- Environmental Impacts and Approvals

Within each category the evaluation criteria are divided into sub-criteria. Contributing factors used to evaluate project alternatives are defined for each sub-criteria and these are described below.

Alternatives were qualitatively assessed based on their ability to best meet the sub-criteria and were rated on a scale of level of potential impact: positive impact, neutral impact, or negative impact. The potential impact and any substantiating notes are included in tables summarizing the comparison of alternatives.

Evaluation Ratings:	● Positive Impact	□ Neutral Impact	◆ Negative Impact

3.1.1. Ability to Meet Project Goals

This criterion measures the extent to which the project alternatives most effectively address the project's PNGO. This category includes the following sub-criteria:

- Accommodate Future Capacity and Operational Needs of Passenger and Freight Rail
- Preserve and Protect the Historic Character of Union Station
- Improve Economic and Social Vitality
- Improve Environmental Sustainability

Table 3.1-1. Ability to Meet Project Goals

Evaluation Sub-Criteria	Contributing Factors
Accommodate Future Capacity and Operational Needs of Passenger and Freight Rail	• Meet the future capacity and operating needs of intercity passenger rail • Improve and enhance the experience of passengers and visitors • Accommodate Amtrak business/operational needs and design standards • Accommodate freight movement • Reinforce multi-modal connections and convenience for connecting passengers • Improve ADA accessibility • Accommodate critical seismic and life safety upgrades • Improve site and facility security

Evaluation Sub-Criteria	Contributing Factors
Preserve and Protect the Historic Character of Union Station	• Preserve and enhance the historic character of Union Station • Safeguard historic materials and finishes • Incorporate facility improvements in a historically sensitive manner
Improve Economic and Social Vitality	• Contribute to the economic and social vitality of the surrounding neighborhoods • Repurpose underutilized space to productive use • Improve the quality, marketability, and economic return on leased tenant spaces • Improve building management and operating efficiency over the building lifecycle
Improve Environmental Sustainability	• Meet or exceed the City of Portland's LEED Gold sustainability rating • Reduce energy use, water consumption, and trash generation • Reduce greenhouse gas and air pollutant emissions • Remediate existing hazardous materials impacted by facilities improvements • Improve stormwater management and containment of potential groundwater pollutants

3.1.2. Cost and Financing

This criterion addresses likely capital and life cycle cost impacts of the project alternatives. While a full construction cost estimate will not be prepared until the preliminary engineering (PE) phase of the project, this criterion provides a valuable comparison of likely costs as well as cost risk based on the professional judgement of the project team in comparable circumstances.

This category includes the following sub-criteria:

- Estimated Capital Cost
- Lifecycle Cost Impacts
- Cost Risk
- Financial Leverage

Table 3.1-2. Cost and Financing

Evaluation Sub-Criteria	Contributing Factors
Capital Cost	Order of magnitude capital costs relative to other viable alternatives
Lifecycle Cost Impacts	Impact on long-term operations and maintenance costs for PDC and/or tenants
Cost Risk	Disproportionate cost uncertainties due to unknown factors, complexity, approvals, etc.
Financing Leverage	Ability to capture diverse/alternative funding sources to implement the improvement

3.1.3. Implementation and Constructability

Union Station is a complex transportation facility with sensitive historic features and a constrained urban site. This criterion is a measure of the practicality of each alternative from a technical and construction perspective, taking into account the likely requirement to maintain rail operations at Union Station through the duration of the future construction period. The project team was tasked with identifying a preferred alternative that could be implemented according to the schedule in the approved 2013 DWP. As part of the local decision-making process, changes to the scope and schedule approved through the DWP were considered an essential contributing factor in the consideration of alternatives. Alternatives with a greater number of unknown conditions were considered to have greater risk in terms of scope, schedule and constructability.

This category includes the following sub-criteria:

- Technical Complexity and Constructability
- Schedule and Schedule Risk
- Construction Impact on Passenger and Freight Rail Operations
- Construction Impact on Union Station Tenants
- Phasing and Project Segmentation
- Risks, Assumptions, and Unknowns

Table 3.1-3. Implementation and Constructability

Evaluation Sub-Criteria	Contributing Factors
Technical Complexity and Constructability	• Complexity and viability of the design, materials, and methods proposed • Construction timeframe relative to other alternatives
Schedule and Schedule Risk	• Relative timeframe for design, approvals, permitting, and construction • Risk of delays due to unforeseen conditions, approvals, stakeholder decision making, etc.
Construction Impact on Passenger and Freight Rail Operations	• Degree and duration of disruption to ongoing rail operations during construction • Passenger impacts or inconvenience • Reductions in station or trackside capacity • Freight rail impacts
Construction Impact on Union Station Tenants	• Degree and duration of disruption or displacement to Union Station tenants • Impact of construction on the ability of tenants to conduct business (e.g. noise, closures)
Phasing and Project Segmentation	• Ability to phase work over time to reduce impacts/spread costs • Ability to accomplish work independent of other improvements • Cost or schedule efficiencies of coordinating work with other improvements
Risks, Assumptions, and Unknowns	• Unknown conditions • Reliance on critical assumptions • Risk of damage to historic features or materials • Ability to minimize or mitigate risks

3.1.4. Environmental Impacts and Approvals

This criterion is a measure of the potential impacts of the project alternatives from a historic preservation, NEPA, and project permitting perspective. Consistent with the approved September 2013 DWP, the project team was tasked with identifying a preferred alternative that met the operational goals for the transportation facility while avoiding significant adverse effects on the built or natural environment, especially to the Section 106 resource. Additionally, as part of the local decision-making process, changes to the scope and schedule approved through the 2013 DWP were considered an essential contributing factor in the consideration of alternatives.

This category includes the following sub-criteria:

- Environmental Impacts and Project Classification
- Historic Impacts and Approvals
- Decision Making and Approvals

Table 3.1-4. Environmental Impacts and Approvals

Evaluation Sub-Criteria	Contributing Factors
Environmental Impacts and Project Classification	• Potential for direct and cumulative environmental impacts/adverse effects • Potential for direct and cumulative beneficial effects of improvements • Likelihood of avoiding significant adverse impacts • Potential for scope and schedule changes due to NEPA process and approvals
Historic Impacts and Approvals	• Issues of potential concern to review agencies • Complexity associated with historic review and approvals • Potential impacts on process and schedule
Decision Making and Approvals	• Key stakeholder or regulatory decisions or approvals associated with the alternative • Impacts to schedule, cost, or feasibility associated with key stakeholder decisions or approvals • Permitting/regulatory requirements

4. Description of Alternatives

This section provides a brief description of alternatives considered for this proposed project. Build alternatives were considered for the Union Station terminal building, the annex building and the rail yard. The build alternatives are compared to the No-Build Alternative to allow decision makers the opportunity to better consider the key differences among the alternatives across all perspectives. This broad view highlights the advantages and disadvantages of each alternative that must be considered in identifying a preliminary preferred alternative and, along with public and agency feedback, selecting a locally preferred alternative.

4.1. Development of Alternatives

The development of conceptual design alternatives was based on:

- Consultation with project stakeholders from 2014 through 2016.
- On-site evaluation of existing conditions.
- Interviews with station personnel.
- Observing existing rail and building operations.

Project stakeholders involved in the Conceptual Design process include:

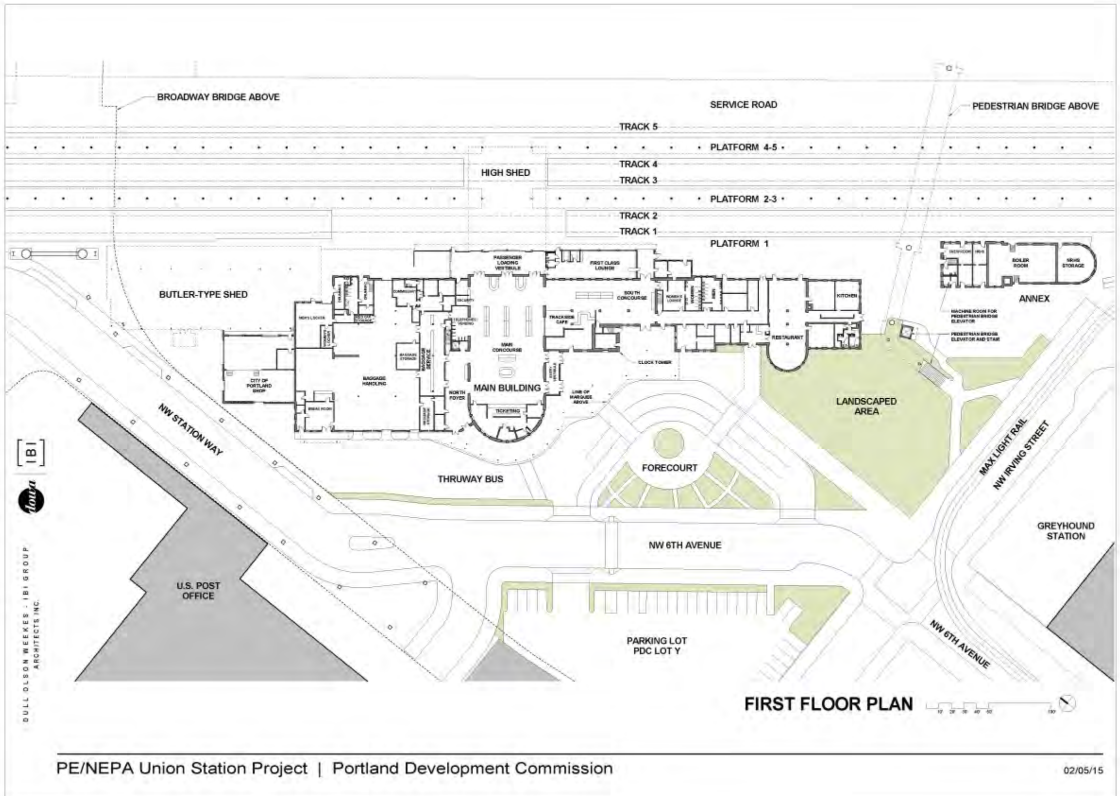
- Portland Development Commission
- Federal Railroad Administration (FRA)
- Oregon Department of Transportation (ODOT)
- Oregon State Historic Preservation Office (SHPO)
- Amtrak
- City of Portland Office of Management and Finance (OMF)
- Portland Terminal Railroad (PTRR)
- Washington Department of Transportation (WSDOT)

4.2. No-Build Alternative

The No-Build Alternative, as required by NEPA, serves as the basis for comparison of the benefits and impacts of build or action alternatives.

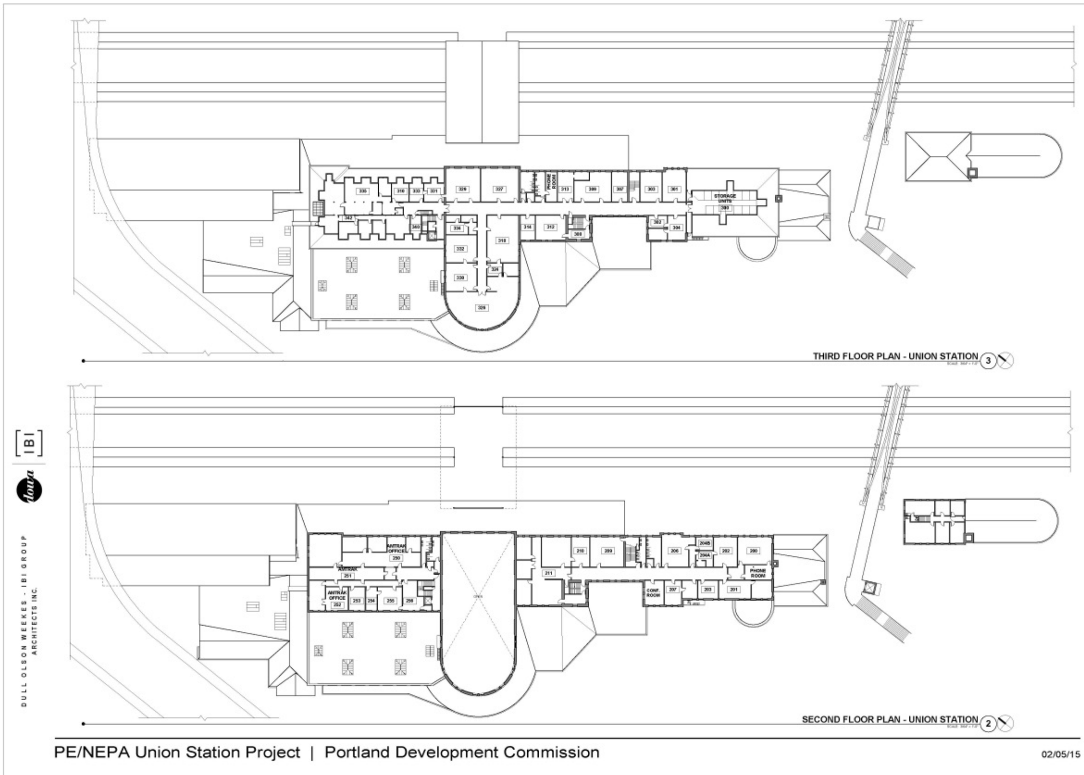
For the Union Station Building and Track Improvements Project the No-Build Alternative is a future year scenario defined as maintaining the current building and rail yard as it is today with a minimum capital investment.

Figure 4.2-1. Union Station Existing Floor Plans – 1st Floor



Source: IBI Group. 2016.

Figure 4.2-2. Union Station Existing Floor Plans – 2nd and 3rd Floors



Source: IBI Group. 2016.

4.3. Build Alternatives

Build alternatives are organized into two categories: Building Improvements (including the main building, Annex, Platforms/Canopies, and Maintenance Area) and Rail Yard Improvements (including tracks, signals, and related rail infrastructure).

4.3.1. Building Improvements

The proposed scope of the building improvement alternatives discussed in this section reflects the full range of improvements necessary to ensure the preservation, safety, and efficiency of the 120-year-old railway station, and enhance its function as a principal multimodal transportation hub in the central city.

Building improvements are based on a 5% architectural/engineering design level to develop conceptual designs for a range of alternatives.

The proposed building improvement alternatives are organized under the following four categories:

- Architectural and Operational Improvements
- Core Building Improvements
- Railside Improvements
- Union Station Annex Improvements

4.3.1.1 Architectural and Operational Improvements

The architectural / program Improvements include re-design, adaptations, and re-purposing of portions of Union Station to address the Project's PNGO and issues identified through the conditions assessment.

The architectural and operational improvements include public spaces, rail operations spaces (e.g. passenger concourses, Amtrak operations areas, and platforms/canopies), spaces that are currently or potentially leasable to non-Amtrak tenants, and building support spaces.

Re-design and re-programming alternatives for non-rail spaces in Union Station were developed with an eye towards continued urban intensification and redevelopment of the North Broadway corridor surrounding Union Station over the next 10 to 20 years. This redevelopment could have profound implications for Union Station as a focal point of an emerging Central City neighborhood.

The proposed improvements include re-purposing and reconfiguration of spaces to public, rail operations, and leasable spaces across the facility to increase operational efficiency, address the changing needs of current and future rail passengers, and maximize the vitality of Union Station as a multi-modal passenger hub.

Many of the existing spaces at Union Station, including passenger concourses, ticketing, the baggage counter, rail operations spaces, offices, restrooms, and other features, exist substantially unchanged from the last major renovation of Union Station in the 1930's. The extensive outreach to Amtrak and building management personnel during the conditions assessment provided insight into existing operational deficiencies as well as future needs that could be addressed through careful re-configuration of portions of the facility.

A significant portion of Union Station consists of leasable space and is available for non-rail uses, and the proposed improvements will increase the quality and economic vitality of leasable spaces in the main terminal building and the annex building, improving the long-term financial stability of the station. Revitalizing Union Station through new retail and office development will create a more vibrant hub that will benefit both passengers and the surrounding community.

4.3.1.1.1. Vertical Circulation and Access

This improvement addresses code, accessibility, emergency egress, and deterioration issues associated with the existing stairs and elevators as identified in the conditions assessment.

The following alternatives were evaluated:

- The No-Build Alternative would make no changes to the existing stairways or elevator.
- The Two Elevators - Enclosed Stair to 2nd and 3rd Floors alternative replaces and relocates the existing elevator and reconfigures stairways to address access and emergency egress requirements.
- The Two Elevators - Open Internal Stair to 2nd Floor alternative also replaces and relocates the existing elevator and reconfigures stairways to address access and emergency egress requirements, but arranges these elements differently.
- The Second Floor Connector Bridge alternative provides a new pedestrian bridge through the main concourse that restores the connection between the two halves of the second floor that existed prior to the 1930 remodel.

4.3.1.1.2. Amtrak Operations and Passenger Concourses

This improvement would provide improvements to rail passenger and rail operations spaces to accommodate the needs of future intercity rail, accommodate evolving passenger requirements (e.g. assisted boarding), improve accessibility, and preserve historic materials and finishes in Union Station's most prominent interior public spaces. It would also address the security and deteriorated conditions of the passenger restrooms.

The following alternatives were evaluated:

- The No-Build Alternative would preserve existing passenger and rail operations as-is.
- The Existing Boarding Gates alternative preserves the configuration of the existing passenger boarding gates, so that all passenger boarding and alighting activity occurs through the main concourse at existing capacity levels.
- The north foyer hallway -Configuration 1 alternative creates a new hallway connection and arriving passenger gate along with reconfigured restrooms and customer services.
- The north foyer hallway -Configuration 2 alternative is similar to the above alternative, with variations in the configuration of restrooms, customer services, and Amtrak operations spaces.

4.3.1.1.3. Ticketing Area

This improvement repurposes the existing ticket counter area as a new rail passenger amenity. The ticket counter is anticipated to be vacated due to the proposed consolidation of the Amtrak ticketing function is combined with the baggage counter in the north foyer, in accordance with Amtrak's stated business requirements.

The following alternatives were evaluated:

- The No-Build Alternative would maintain Amtrak ticketing function in the existing location.
- The Café/Retain Existing Ticket Counter alternative repurposes the ticket counter as a retail concession. (This alternative assumes consolidation of the Amtrak ticketing function is combined with the baggage counter in the north foyer.)
- The Passenger Seating/Retain Existing Ticket Counter alternative repurposes the ticket counter as an additional passenger waiting area. (This alternative assumes consolidation of the Amtrak ticketing function is combined with the baggage counter in the north foyer.)
- The Remove Existing Ticket Counter alternative removes the ticket counter and replaces it with an open, contiguous passenger waiting area, potentially with a freestanding retail or display kiosk. (This alternative assumes consolidation of the Amtrak ticketing function is combined with the baggage counter in the north foyer.)

4.3.1.1.4. South Concourse

This improvement would improve passenger waiting areas and amenities of south concourse through reconfiguration of seating, retail amenities, and potential changes to the seating area. These improvements would support re-activation of the main floor was well as improving the quality of rail passenger facilities.

The following alternatives were evaluated:

- The No-Build Alternative preserves the south concourse leasable spaces in the current configuration.
- The Expanded Retail Concessions With Shared Use Seating alternative activates the south concourse by introducing additional retail concessions in the south concourse, and created a shared-use seating area for both retail and rail passengers.
- The Passenger Waiting Area with Existing Concession alternative retains the existing concession area along with improve passenger and concession seating in the south concourse.
- The Dedicated Rail Passenger Seating alternative removes the existing concession area and refurbishes the south concourse as an expanded seating area dedicated to rail passengers.

4.3.1.1.5. First Class Lounge

This improvement considers upgrades and potential re-use of the existing Amtrak First Class Lounge located off of the south concourse.

The following alternatives were evaluated:

- The No-Build Alternative preserves the existing first class lounge as-is.

- The Retain Amtrak First Class Lounge alternative retains the lounge function but completes upgrades and reconfigurations per Amtrak requirements.
- The Repurpose First Class Lounge alternative would reprogram the space as a retail concession or restaurant space, creating an additional amenity for rail passengers and increased vitality along the south concourse, should Amtrak's business decision to retain the First Class Lounge change in the future.

4.3.1.1.6. South Main Floor Leasable Spaces

This improvement would provide additional amenities that would enhance the experience for passengers and visitors, support the revitalization of the surrounding neighborhood, and improve the financial sustainability of the building. The following alternatives were considered:

- The No-Build Alternative preserves the existing restaurant use and south hallways as is, without structural, systems, or accessibility upgrades.
- The Core and Shell Only alternative upgrades the south main floor Leasable Spaces to core and shell conditions following major structural, seismic, and systems work, with programing and tenanting decision deferred until a future phase of design.
- The Restaurant alternative retains the existing use of the space as a full-service restaurant, with necessary changes to accommodate seismic, systems, accessibility, and life safety upgrades.
- The Single Tenant Space would create a contiguous floorplate to house an office-type, shared work, studio, or similar tenant, much like the current and proposed tenants on the upper floors.
- The Market Hall alternative creates and active space consisting of multiple retail and food service tenant stalls, and would serve as supplemental waiting areas for rail passengers while also providing a gathering spot and amenity for the surrounding, revitalizing Broadway Corridor.

4.3.1.1.7. Upper Floor Leasable Spaces

This improvement would address the need to upgrade upper floor leasable spaces and supporting infrastructure due to deterioration and deficiencies that compromise the quality and leasability of upper floors. These improvements are intended enhance the tenant/visitor experience, increase the quality and marketability of the second and third floor leasable spaces while respecting the historic character of the building.

The following alternatives were evaluated:

- The No-Build Alternative would leave upper floor leasable spaces as-is, without improvements.
- The Retain Existing Configuration and Floorplates of Leasable Spaces alternative would upgrade and refurbish upper floor leasable spaces, while keeping the floorplates of the existing rooms and hallways essentially intact.
- The Reconfigure Leasable Spaces to Create Larger Leasable Floorplates alternative creates larger floorplates for future tenants (core and shell) to accommodate a more diverse range of future office, creative, or other suitable tenants.

4.3.1.1.8. Nursery

This improvement would address structural and deterioration issues in the 1940s Nursery addition which, because of deterioration and deficiencies, is currently not occupied.

The following alternatives were evaluated:

- The No-Build Alternative would leave the Nursery as-is, and it would continue to be left unoccupied in its current degraded condition.
- The Rehabilitate Nursery alternative would preserve the existing nursery building and complete necessary upgrades and refurbishments to restore it to a condition where it could be occupied.

- The Remove Nursery alternative would demolish the Nursery building (and restore the original building wall).
- The Replace Nursery Building would demolish and reconstruct the Nursery building as a new structure.

4.3.1.2 Core Building Improvements

The core building improvements address structural/seismic deficiencies and upgrades to mechanical, electrical, plumbing, lighting, and fire/life safety systems that were identified through the conditions assessment. Note that mandatory seismic improvements are triggered by the City of Portland code based on project construction value, as discussed in the conditions assessment.

4.3.1.2.1. Main Building Seismic Strengthening

The following alternatives were evaluated:

- The No-Build Alternative retains the unreinforced building diaphragm as-is, without improvement to the seismic condition or reduction in safety hazard to building occupants due to seismic forces.
- The Reinforced Concrete Shear Walls alternative affixes a layer of reinforced concrete to the interior side of unreinforced masonry walls to provide necessary seismic reinforcement.
- The Steel Braced Frames alternative uses structural steel in truss configurations located to the inside of unreinforced masonry walls to provide necessary seismic reinforcement.
- The Steel Plate Shear Walls alternative inserts steel plates against unreinforced masonry walls in the main building to provide necessary seismic reinforcement.

4.3.1.2.2. Diaphragm Alternatives

This improvement provides resistance to seismic forces in the horizontal diaphragms of the main building, addressing a deficiency identified in the conditions assessment.

The following alternatives were evaluated:

- The No-Build Alternative retains the unreinforced building diaphragm as-is, without improvement to the seismic condition or reduction in safety hazard to building occupants due to seismic forces.
- The Plywood Sheathing alternative uses a plywood layer inserted above or below the existing framing members to provide the necessary seismic resistance.
- The Horizontal Steel Truss alternative inserts structural steel framing at floor/ceiling levels to provide the necessary seismic resistance.

4.3.1.2.3. Out of Plane Strengthening Alternatives

This improvement addresses existing seismic deficiencies of the unreinforced masonry walls throughout Union Station that lack resistance to out of plane seismic forces.

The following alternatives were evaluated:

- The No-Build Alternative retains the unreinforced masonry walls as-is, without improvement to the seismic condition or reduction in safety hazard to building occupants due to out of plane forces.
- The Reinforced Concrete Shear Walls alternative attaches a layer of reinforced concrete to the interior side of URM walls.
- The Steel Tube Strongback System uses a tubular steel system to provide the necessary out of plane strengthening.
- The Vertical Core Drilling alternative provides strengthening by drilling vertically from the roof level to the ground and grouting in reinforcing bars inside the URM walls.

4.3.1.2.4. Tower Unreinforced Masonry (URM) Strengthening

This improvement provides seismic strengthening to the unreinforced masonry (URM) clock tower to address deficiencies identified in the conditions assessment.

The following alternatives were evaluated:

- The No-Build Alternative retains the clock tower as-is, without improvement to the seismic condition or reduction in safety hazard to building occupants.
- The Steel Braced Frames above Reinforced Concrete Shear Walls alternative uses a combination of reinforced concrete shear walls (lower level) and steel braced frames (upper level) to provide seismic strengthening.
- The Steel Braced Frames Full Height alternative provides an interior steel braced frame against the inside face of the clock tower walls for its full height.
- The Reinforced Concrete Shear Walls - Full Height alternative applies reinforced concrete shear walls cast against the inside face of the clock tower walls for its full height.

4.3.1.2.5. Tower Overturning Resistance

This improvement provides needed overturning resistance strength to withstand seismic forces on the clock tower.

The following alternatives were evaluated:

- The No-Build Alternative retains the clock tower as-is, without improvement to the seismic condition or reduction in safety hazard to building occupants.
- The Pile Foundations Improvement alternative adds new piles and a larger pile cap to the existing tower foundation underneath the clock tower.
- The Horizontal Trusses at Floor Levels alternative adds structural steel connections to each floor level to distribute the lateral load from the clock tower out to the rest of the main building.

4.3.1.2.6. Main Building Chimney

This improvement addresses existing structural deterioration and seismic deficiency in the unreinforced masonry chimneys of the main building.

The following alternatives were evaluated:

- The No-Build Alternative retains the main building chimneys as-is, without improvement to the seismic condition or reduction in safety hazard to building occupants.
- The Steel Pipe Propped to Diaphragms alternative reinforces the chimney by inserting an interior steel tube that is tied to the building diaphragm.
- The Exterior Braces alternative uses steel reinforcement or banding on the exterior of the masonry chimneys, creating a permanent visual impact
- The Remove Chimneys alternative removes the main building chimneys entirely instead of seismically reinforcing them.

4.3.1.2.7. Mechanical, Electrical and Plumbing

This improvement would replace aging mechanical, electrical, plumbing and lighting systems that have reached or exceeded their useful lives. As part of this wok, the build alternatives would relocate and consolidate existing HVAC and electrical support equipment to the north end of the building, in the location of the existing City of Portland workshop. Existing systems would be decommissioned and removed, including surface-mounted wires, pipes, and conduits currently visible in historic portions of the building.

Four alternatives were evaluated:

- The No-Build option leaves the existing mechanical, electrical, plumbing and lighting systems with no modifications;
- The LEED Gold alternative upgrades systems to meet the City of Portland's minimum LEED Gold sustainability standards
- The LEED Platinum alternative would include further sustainability features to reach the LEED Platinum level; and,
- The New Zero alternative includes LEED Platinum sustainability features and also introduces a photovoltaic system for on-site electricity generation that meets or exceeds the power demand of Union Station ("net zero").

4.3.1.3 Railside Improvements

The architectural elements of the Union Station rail side improvements, including the Platforms, Platform Canopies, High Shed, Maintenance Area, and related rail operations equipment, have been identified to have substantial operational and structural/seismic deficiencies. This area is critical to future rail operations, but has seen only modest and incremental capital improvements in recent decades.

4.3.1.3.1. Platform Canopies

This improvement addresses the operational, structural, and systems deficiencies of the existing Platform Canopies, as well as corrosion and deterioration of materials. The improvements to the rail side also include a replacement of the existing platform systems to current standards, including structural/foundations, systems, rail support equipment, and ADA accessibility.

The following alternatives were evaluated:

- The No-Build alternative would maintain the existing platform canopies as-is, without addressing operational or structural deficiencies.
- The Traditional Umbrella Canopies with High Shed alternative provides new umbrella canopies and a relocated High Shed structure constructed to current rail clearances using traditional styling and materials.
- The Contemporary Umbrella Canopies with High Shed alternative provides new umbrella canopies and a relocated High Shed structure constructed to current rail clearances using contemporary styling and materials.
- The Traditional Train Shed alternative provides a continuous train shed with a traditional design styling between the Broadway Bridge and the pedestrian bridge. North and south of these bridges, respectively, the canopies would continue as Umbrella Canopies also using a traditional styling
- The Contemporary Train Shed alternative provides a continuous train shed with a contemporary design styling between the Broadway Bridge and the pedestrian bridge. North and south of these bridges, respectively, the canopies would continue as Umbrella Canopies also using a contemporary styling

4.3.1.3.2. Rail/Building Maintenance and Operations Areas

This improvement reorganizes and rationalizes the rail and building maintenance areas on the north side of Union Station to improve operations, safety, security, and aesthetics. The improvements include replacement of the seismically-deficient and non-historic Butler-Type Shed in the rail maintenance area.

The following alternatives were evaluated:

- The No-Build Alternative would retain the rail and building operations areas as-is, without improvements. The existing Butler-type Shed would remain.
- The Attached Gable Shed Only alternative reinstates the historic gable shed that was removed for the construction of the Butler-type Shed in the 1960s (also removes the Butler-type shed).

- The Service Court with Detached Sheds alternative creates an open service court between two smaller shed structures – one adjacent to the station building (potentially, the restored attached gable shed) and another adjacent to the track maintenance area.
- The New Replacement Shed with Attached Gable alternative provides a new shed structure covering the width of the maintenance area between Track 1 and the main building.

4.3.1.3.3. *Union Station Annex Improvements*

The proposed Annex improvements would address existing deficiencies in the Annex building identified during the conditions assessment, and would address the project goals of improving the activation and re-use of the currently underutilized Annex to increase Union Station vitality and restore productive purpose to the building.

4.3.1.3.4. *Annex Plaza*

This improvement addresses existing security concerns in the existing landscaped areas, repurposes the redundant parking lot in front of the Annex, and increases the prominence of the Annex from NW Station Way to help support its re-activation.

The following alternatives were evaluated:

- The No-Build Alternative would retain the existing landscape area and Annex parking lot in its current configuration
- The Hardscaped Annex Plaza alternative creates a new, primarily hardscape, "Annex Plaza" in the location of the existing landscaped area and Annex parking lot.

4.3.1.3.5. *Annex Architectural*

This improvement addresses interior architectural reconfiguration to address the deterioration, code compliance and accessibility issues, and re-use opportunities for the underutilized Annex building.

The following alternatives were evaluated:

- The No-Build Alternative retains the existing floorplan as-is, with the boiler room decommissioned and devoted to mechanical/storage functions and the two-story offices in their existing deteriorated condition.
- The Single-Story Shell alternative removes the second floor offices in favor of a single story, high-ceiling interior space throughout the volume of the building.
- The 2+1 Floor alternative retains the two-story office portion as well as the one-story former boiler room. New elevator and egress stair are required for the remodeled two-story area.
- The Boiler Room Basement alternative retains the second floor office space and the existing boiler and storage room floor and adds a mezzanine level in the high ceilinged area, creating more leasable area in the Annex. New elevator and egress stairs are required.

4.3.1.3.6. *Annex Chimney*

This alternative would address the structural/seismic deficiencies and deterioration of the 80-foot Annex Chimney, which is currently inoperable but is a character-defining feature of the Annex.

The following alternatives were evaluated:

- The No-Build Alternative retains the chimney as-is, without improvements. Deterioration would be expected to continue, and life safety risks due to seismic hazard would remain.
- The Ghost Chimney alternative replaces the existing masonry chimney with a new reconstructed form that is evocative of the mass and height of the former chimney but with the alternate materials.
- The Full Height Chimney with Reinforcement alternative reconstructs the chimney using original face bring around a seismically upgraded foundation and core

- The Chimney Height Reduction with Reinforcement alternative similarly reconstructs the chimney using original face brick around a seismically upgraded foundation and core, but with an overall reduced height
- The Remove Chimney alternative removes the existing chimney entirely.

4.3.2. Rail Yard Improvements

The rail yard improvements alternatives focus on options to upgrade and renovate infrastructure that would improve and increase the amount of passenger rail trains served daily at the station, both in the near term (2017) and the long term (2035). The rail yard improvement alternatives build upon the recommendations presented in the Existing Rail Infrastructure and Operations Report (September 14, 2015) and the Site Utilities Report (June 19, 2015), as well as on the subsequent meetings and discussions held between the design team and project stakeholders. In most cases, the concepts evaluated and described in this Alternatives Considered report are laid out as in the earlier reports; however, there are a few cases (such as on-site yard control and the improvements to fueling) that differ from earlier reports based on more recent direction.

For this Alternatives Considered report, rail yard improvement alternatives have been developed at approximately the 5% level of design to facilitate developing conceptual level cost estimates for the potential improvements. Each improvement considered includes a description, a concept-level design sketch, an evaluation matrix, and a cost estimate. To facilitate estimating different scenarios, each improvement has been developed as if it were a stand-alone consideration. For example: the cost estimate for installing Track #6 includes all trackwork necessary for that improvement. However, in reality, the installation of Track #6 would probably require signalizing and powering up all switches, which is estimated as its own stand-alone cost. Different cost scenarios can be developed as requested based on further stakeholder input.

Rail yard improvements evaluated in this Alternatives Considered report focus on trackwork, utilities within the yard, or other improvements related to the yard and/or Amtrak operations outside of the main terminal building and annex. These rail yard improvements are described below and discussed in further detail in Chapter 6 of this Alternatives Considered report.

4.3.2.1 Improvements to Existing Trackwork Alternatives

This improvement involves replacing existing, old, or broken equipment in the yard with new equipment, installing additional equipment, and developing an improved maintenance program for tie replacement.

Two alternatives were evaluated:

- The No-Build option would not make any track improvements; and,
- The build option would implement improvements to existing trackwork as a whole (not piecemeal).

4.3.2.2 Signalize and Remotely Control All Tracks

This improvement would signalize the tracks using Centralized Traffic Control. This will require installing communications conduit from a central control point to the north and south switches, as well as installing switch point indicators and other infrastructure needed for a fully signalized system.

Two alternatives were evaluated:

- The No-Build option would leave the yard as it currently exists with no communications system or Centralized Traffic Control; and,
- The build option would install an entire signalized system.

4.3.2.3 Fuel Delivery System

This improvement would construct a new fueling system to replace the existing method of stretching hoses across the tracks from the Portland Terminal Railroad (PTRR) access road. Fueling would occur entirely within the PDC-owned site. The system would be designed to be expanded to the south in the future if desired; the expansion south would mirror the north installation in terms of equipment and layout. The system would also accommodate the Diesel Emissions Fluid (DEF) additive required for newer locomotives.

Two alternatives were evaluated:

- The No-Build option would not address fueling at Union Station now or in the future; and,
- The build option would construct the fuel pumping, piping and hose infrastructure needed to fuel from the north platforms.

4.3.2.4 Relocate and Reduce the Width of the Passenger Crossing

This improvement would relocate and reduce the width and location of the passenger crossing in order to maximize the available space for trains south of the passenger crossing. Reducing the passenger crossing will allow for the loading of passengers on the *Cascades* routes south of the crossing, increasing overall station capacity.

Two alternatives were evaluated:

- The No-Build option would leave the passenger crossing in place with no modification; and,
- The build option would relocate the passenger crossing location and reduce the overall width of the passenger crossing.

4.3.2.5 Install Powered Scissor Crossovers

This improvement would install powered scissor crossovers within the station limits in order to provide the flexibility to move trains from track to track and from north of the passenger crossing to south of the passenger crossing, without fouling the main lines, and allowing for multiple trains on site throughout the day.

Five alternatives were evaluated:

- The No-Build option would leave the existing track configuration in place ;
- Construct a set of crossovers for Tracks #1 and #2;
- Construct a set of crossovers for Tracks #3 and #4;
- Construct both sets of scissor crossovers; and,
- Construct only platform modifications and utility infrastructure to accommodate scissors at a later date.

4.3.2.6 Shorten the Existing Platforms

This improvement would shorten the existing platforms to coincide with the limits of straight track. The option also includes paving a section of track to allow for a baggage cart path to the station.

Two alternatives were evaluated:

- The No-Build option leaves the existing configuration in place; and,
- The build option shortens both platforms and constructs a baggage cart path.

4.3.2.7 Construct Track #6

This improvement would rebuild Track #6, which was removed in the mid - 1990s, to allow for a second freight main adjacent to the station yard. Freight trains would use Tracks #5 and #6 exclusively, and would not need to enter the yard on Track #4, allowing for increased passenger train volumes.

Three alternatives were evaluated:

- The No-Build option would leave the existing system of five tracks in place;
- Construct Track #6 to the west of the Broadway Bridge pier, alter the platform between Tracks 4 & 5, and shift Track #5 to accommodate freight trains; and,

- Construct Track #6 to the east of the Broadway Bridge pier and purchase Right-of-Way (ROW) to accommodate.

4.3.2.8 Raise Platform Heights

This improvement would raise the existing two platform heights to 15 inches above top of rail (TOR). This will enable level-boarding status for the Amtrak Superliner cars and qualify for Federal Railroad Administration (FRA) funding linked to the level boarding requirement.

Three alternatives were evaluated:

- The No-Build option, which would leave the platforms at existing heights with no modifications;
- Raise both platforms between Tracks 2 & 3 and Tracks 4 & 5 to 15" above TOR; and,
- Raise the platform between Tracks 2 & 3 to 15" and raise the platform between Tracks 4-5 to 8" above TOR.

4.3.2.9 Raise Track #5

This improvement would raise Track #5 by 7 inches (through additional ballast and tamping) in order to remove the potential conflict between raising the platforms to 15 inches above TOR and the adjacent freight traffic on Track #5; the maximum height of a platform adjacent to a freight track is 8 inches.

Two alternatives were evaluated:

- The No-Build option would leave track #5 15 inches below the raised platform, leaving a potential conflict with freight trains; and,
- The build option would raise Track #5 by 7 inches if platforms are raised by 15 inches.

4.3.2.10 Construct On-Site Yard Control

This improvement would employ a Yardmaster for Union Station in order to coordinate between BNSF and Union Pacific (UP) dispatchers directly, rather than coordination being routed through the Portland Terminal Railroad (PTRR). The Yardmaster would control switching within station limits via a locked control panel located on one of the platforms; this control panel would include phone and/or data lines to communicate with the appropriate dispatch.

The control would be provided via a locked console on the platform. This would be more desirable from a safety standpoint if the installation of the scissor crossovers was also implemented: the Yardmaster would be able to see each of the scissor switch points before switching, adding another layer of safety.

Two alternatives were evaluated:

- The No-Build option would leave the existing system in place requiring coordination through PTRR; and,
- The build option would implement on-site yard control.

4.3.2.11 Reconfigure Drip Pans

This improvement would replace the existing drip pan system to accommodate the future 2035 train berthing locations, install a new oil water separator for the additional lines, and replace the existing piping as needed to account for the removal of the storm water feeds from the existing platform canopies into the drip pan system.

Two alternatives were evaluated:

- The No-Build option would leave the existing pans in place with no modifications; and,
- The build option would replace the existing drip pan system and locate the pans to correspond to the berthing locations.

4.3.2.12 Provide 480V Locomotive Power

This improvement would replace the existing 480V power supply feeds for idling locomotives with new feeds in underground ducts, leading to power stanchions within the yard. Stanchions would be located at berthing locations coordinated with anticipated 2035 passenger train volumes, consists, and lengths. The conceptual design considers placement of electrical ducts beneath new, 15" high platforms.

Two alternatives were evaluated:

- The No-Build option would leave the existing system in place with no modifications; and,
- The build option would replace the entire 480V system.

4.3.2.13 Stormwater and Sewer Improvements

This improvement would rehabilitate and/or replace certain elements of the stormwater and sewer system identified as deficient in the Site Utilities Report (HDR, 2015). This analysis only considers improvements outside the envelope of the existing structures; improvements within the building are covered in the buildings evaluation section of this Alternatives Considered report.

Two alternatives were evaluated:

- The No-Build option would leave the existing system in place with no modifications, ongoing maintenance would be necessary; and,
- The build option would implement identified system improvements.

4.3.2.14 Water System Improvements

This improvement includes replacement, rehabilitation, and upgrades to the existing potable water delivery system within the yard and station area, as well as new sprinkler supply lines to the annex and main terminal buildings. This improvement does not consider any water or Fire / Life Safety improvements within either of the buildings on site (the main terminal or annex); however, it does consider service stubs to each building for sprinklers and water service.

Two alternatives were evaluated:

- The No-Build option would leave the existing system in place with no modifications; and,
- The build option would implement identified system improvements.

4.3.2.15 Electrical System Improvements

This improvement would replace the existing electrical vault on the north end of the terminal with a new line to a new electrical vault located north of the terminal. The existing line would be abandoned in place.

Two alternatives were evaluated:

- The No-Build option would leave the existing system in place with no modifications; and,
- The build option would replace the existing line and vault.

4.3.2.16 Telephone and Voice System Improvements

This improvement would install a new data and telecommunications line into the main terminal building from the existing vault on NW Irving Street. The design and estimate for this improvement do not consider any improvements within either the main terminal building or the annex.

Two alternatives were evaluated:

- The No-Build option would leave the existing system in place with no modifications; and,
- The build option would construct the proposed data and telecommunications improvements.

4.3.2.17 Compressed Air System Improvements

This improvement would reconfigure the compressed air system within the yard to accommodate the 2035 passenger train schedule, and resulting berthing locations for the trains. The new compressed air piping is assumed to run within a utility ductbank in the new, 15-inch high platforms. Replacement of the platforms is not required for the installation of the new air system; the piping could be run within the yard.

Two alternatives were evaluated:

- The No-Build option would leave the existing system in place with no modifications; and,
- The build option would implement identified air system improvements.

4.4. Alternatives Considered but Eliminated from Further Consideration

During early alternatives development, two options were initially considered and then were eliminated. The two options and the reasons they were eliminated from further consideration are described below.

4.4.1. Off-Site Inspections and Maintenance

The first option would relocate the required brake inspections and related train maintenance to an off-site location. Modifications to bring the platforms into ADA compliance for level boarding requires the platforms to be raised to a height 15 inches above top of rail (TOR) limiting access to the platform side of the train cars and locomotives for the required visual brake inspections. This impacts trains berthing on Tracks 2 through 5.

The option to move these inspections to an off-site location required finding a suitable site close to Union Station. Due to Union Station's location within Portland's heavily developed urban core, no site within a reasonable radius was available. Expansion beyond the Union Station site boundary is limited by privately owned adjacent properties, existing and proposed development, the Willamette River, slow train speeds across the Steel Bridge to the south, existing transportation infrastructure and potential conflicts with freight and other passenger trains on the two mainlines to the north and south of the station. In addition, additional Amtrak crews and time would be required to move trains from the station to an off-site location for the inspections and maintenance. Additional crews and required time is inconsistent with Amtrak's goals of improving operational efficiencies.

4.4.2. Preserve Existing Platform Canopies and High Shed

The other option that was eliminated during early concept development was the reuse of the refurbished existing canopies mounted on new 11-foot tall pedestals to bring them into compliance with Amtrak's and freight clearance requirements for overhead structures.

- The structural/seismic evaluation of the platform canopies revealed significant seismic deficiencies with the steel structural elements and foundations. Significant modification, replacement of existing steel members, and new foundations would be required to address these issues and also accommodate new loads due to lighting, service equipment, wayfinding, and drainage.
- The Union Station Conditions Assessment (DOWA/IBI Group, 2015) revealed substantial corrosion, damage, and deformity of structural members and materials resulting from more than 100 years of continuous use.
- The structural evaluation also determined that seismic retrofit of the High Shed would be infeasible due to its geometry, train clearance requirements, and current condition. Seismic isolation of the High Shed from the main building was another challenge in retaining the existing structure. Therefore this element of the platform canopy system would need to be replaced, leaving only the umbrella canopies to be preserved.
- The triangular edge of the Track 4 side of the Track 4/5 platform canopy was removed in the 1990s to accommodate freight train clearances. This missing segment damaged a large number of steel framing members along the length of the canopies that would have to be replaced. The missing corner of the triangular cross section could not be reinstated without violating minimum horizontal train clearances.

- Meeting current Amtrak and freight rail clearance standards would require raising the platform canopy structures from the existing approximately 11-foot clearance above TOR to 22 feet above TOR. This would require a new column system that would further compromise the appearance of the existing platform canopies.
- The current platform canopies do not provide adequate weather protection, because the dripline of the canopies is located over the platform in front of the train boarding doors. Best practices suggest extending the platform canopies to the centerline of the track to provide improved weather protection for passengers and train crew, and to reduce the risk of slippery boarding ramps and stairs. Raising the platform canopies to accommodate current train clearance requirements would further exacerbate the existing weather protection deficiencies.
- Necessary modifications and upgrades could fundamentally compromise the canopies' historic integrity, and create substantial constructability and implementation risks related to the ability to successfully remove, deconstruct, repair, reconstruct, and reinstall the platform canopies.

5. Buildings Improvements Considered

5.1. Main Building Vertical Circulation and Access Alternatives

This improvement addresses code, accessibility, emergency egress, and deterioration issues associated with the existing stairs and elevators as identified in the Conditions Assessment.

The following alternatives were evaluated:

- The No-Build Alternative would make no changes to the existing stairways or elevator.
- Alternative A: The Two Elevators - Enclosed Stair to 2nd and 3rd Floors alternative replaces and relocates the existing elevator and reconfigures stairways to address access and emergency egress requirements.
- Alternative B: The Two Elevators - Open Internal Stair to 2nd Floor alternative also replaces and relocates the existing elevator and reconfigures stairways to address access and emergency egress requirements, but arranges these elements differently.
- Alternative C: The Second Floor Connector Bridge alternative provides a new pedestrian bridge through the Main Concourse that restores the connection between the two halves of the second floor that existed prior to the 1930 remodel.

The results of the evaluation of the four alternatives are summarized in Table 5.1-1.

5.1.1. Design Requirements and Objectives

The key design requirements for vertical circulation and access identified through the conditions assessment and stakeholder discussions include:

- Upgrading vertical circulation (stairs and elevators) to current code requirements
- Provide ADA accessibility to all areas on all floors (currently lacking today).
- Address emergency egress path code issues, including fire escapes, areas of refuge, dead-end hallways, etc.
- Supporting access needs of future building uses, including directness of connections and access control.

5.1.2. Vertical Circulation and Access Build Alternatives

There are three build concepts for vertical circulation in the northwest and southeast wings of the main building with the main concourse as the dividing organization element. These alternative vertical circulation concepts allow for reorganization of the internal spaces for the overall building concept, improving upon circulation, security, operations, safety, and customer improvements.

5.1.2.1 Vertical Circulation No-Build Alternative

The No-Build Alternative would leave the vertical circulation as it is today. Numerous deficiencies were identified during the assessment of conditions and the No-Build Alternative was determined to be infeasible due to the current condition and configuration of vertical circulation and egress paths in the building. Some of the identified deficiencies include:

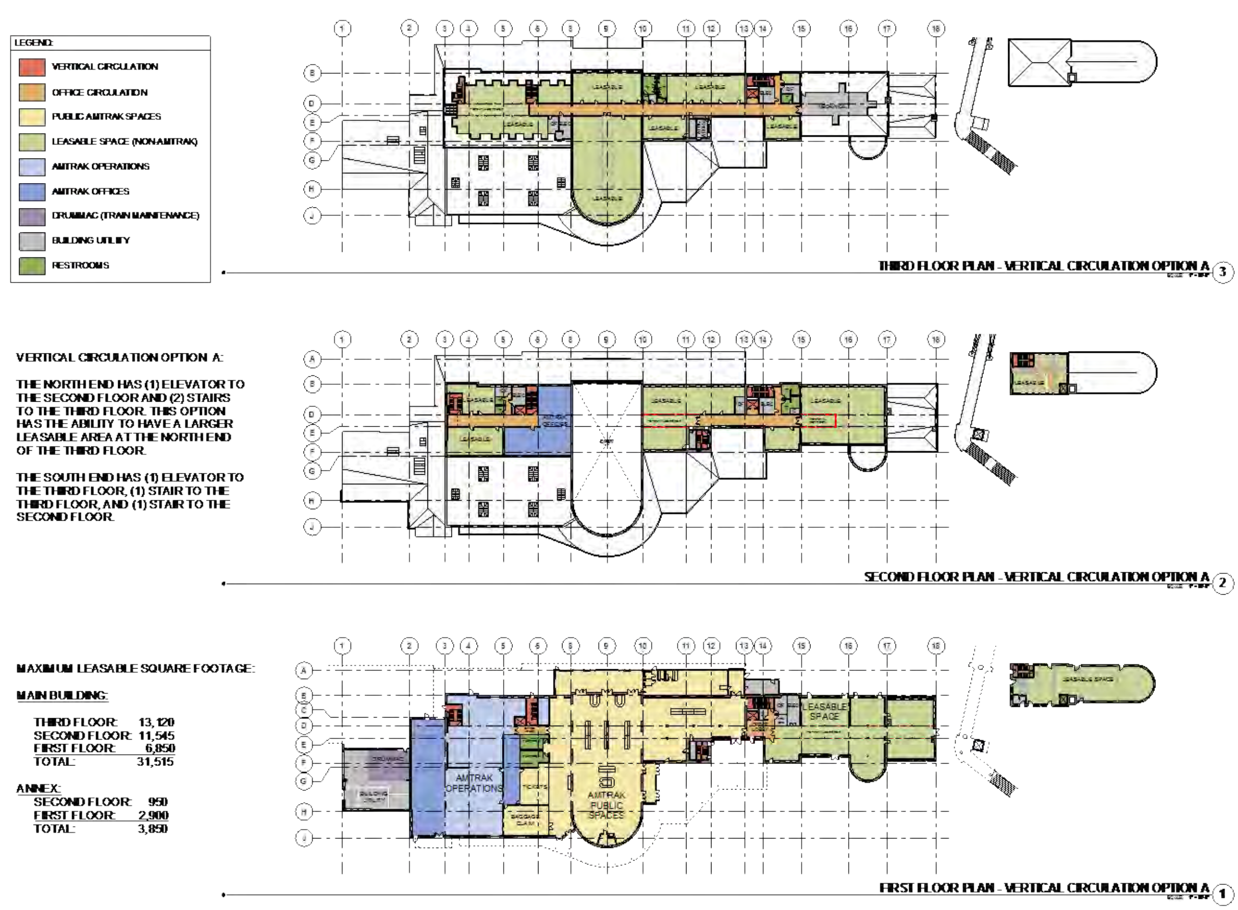
- Large portions of the facility, notably the south end of the second floor, lack elevator access.
- No portion of the building has ADA-compliant elevator access.
- The physical condition of the existing elevator is poor and requires replacement.
- The existing geometry and location of the stairwells does not meet current code requirements for design or emergency egress.
- Emergency exits rely on exterior fire escapes and ramps that do not comply with current code requirements.

For these reasons, the No-Build Alternative has been eliminated from further consideration.

5.1.2.2 Alternative A: Two Elevators; Enclosed Stair to 2nd and 3rd Floors

This alternative would replace and relocate the existing elevator serving the north side of the second floor as well as the third floor (Figure 5.1-1). And, a second elevator would be added south of the main concourse. This elevator would provide new elevator service to the south end of the second floor, and also would provide additional, primary tenant access to the third floor from the south hallway. This location would provide an opportunity for a more distinctive and secure tenant lobby that does not conflict with rail operations and passenger movements of the main concourse. The stairwells would also be relocated and reconfigured to meet egress and code requirements.

Figure 5.1-1. Vertical Circulation and Access Alternative A – Two Elevators, Enclosed Stairs



Source: IBI Group. 2016.

5.1.2.3 Alternative B: Two Elevators; Open Internal Stair to 2nd Floor

This alternative is very similar to Alternative A, with two elevators in a comparable configuration (Figure 5.1-2). The primary difference is the configuration of the north stairway, which is an open internal stair between the first and second floors only. This configuration would provide the same circulation functions, but it would create more challenging space configurations on the second and third floors. It would require a hallway to the full north end of the third floor in order to access the egress stairs, which would reduce the potential to create larger and more flexible floorplates for future tenants.

Figure 5.1-2. Vertical Circulation and Access Alternative B – Two Elevators, Open Stair

Source: IBI Group. 2016.

5.1.2.4 Alternative C: 2nd Floor Connector Bridge

This alternative would provide a new mezzanine connector bridge connecting the two halves of the second floor through the main concourse (Figure 5.1-3). This bridge would replicate a former connector hallway (with accompanying offices) that originally connected the north and south portions of the second floor; this connection was removed in the 1930 remodel. The new bridge is envisioned as an open bridge structure of metal and glass construction, suspended from structural supports within the main concourse ceiling. Care in the design and orientation of this bridge would be necessary because of the historic integrity and public prominence of the main concourse as a character-defining feature of Union Station. One benefit of the bridge connector is the ability to travel between the north and south portions of the second floor without needing to pass through the main concourse or the continuous third floor hallway over the main concourse. However, this benefit is perceived to be of limited value, because strong interaction between second floor tenant spaces on the north and south sides of the building is not anticipated. Amtrak is anticipated to lease a majority of the north second floor for District Office functions (e.g. training rooms), while tenants on the south side will be unrelated third-party tenants.

Figure 5.1-3. Vertical Circulation and Access Alternative C – 2nd Floor Connector Bridge

Source: IBI Group. 2016.

Figure 5.1-4. Vertical Circulation and Access Alternative C – 2nd Floor Connector Bridge Concept

Source: IBI Group. 2016.

5.1.3. Recommendation: Vertical Circulation and Access

The project team recommends implementing Alternative B with the two-elevator configuration with an enclosed stair to the second and third floors (Figure 5.1-2). The two-elevator approach avoids the potential historic impact of the mezzanine connector bridge on the main concourse. The stairway and elevator configuration would be the most compatible with proposed main floor and upper floor improvements in Amtrak and other leasable spaces.

Table 5.1-1. Evaluation of Vertical Circulation and Access Alternatives

Evaluation Criteria		No-Build	A	Two-Elevators; Enclosed Stair to 2nd and 3rd Floors	B	Two Elevators; Open Internal Stair to 2nd Floor	C	Second Floor Connector Bridge
A: Ability to Meet Project Goals								
A.1. Accommodate Future Capacity and Operational Needs of Passenger and Freight Rail	◆	Amtrak second floor levels will continue to lack ADA accessibility.	●	Improves connections between first and second floor Amtrak spaces	●	Improves connections between first and second floor Amtrak spaces	●	Improves connections between first and second floor Amtrak spaces
A.2. Preserve and Protect the Historic Character of Union Station	◆	Existing stairways and elevators will continue to exist in degraded condition.	●	Vertical circulation improvements do not substantially impact key historic elements of the building.	●	Vertical circulation improvements do not substantially impact key historic elements of the building.	●	Vertical circulation improvements do not substantially impact key historic elements of the building.
A.3. Improve Economic and Social Vitality	◆	The upper floors will continue to lack accessibility, hampering leasing ability and financial return.	●	All leasable areas of the building will have improved access and ADA accessibility	●	All leasable areas of the building will have improved access and ADA accessibility	●	All leasable areas of the building will have improved access and ADA accessibility
A.4. Improve Environmental Sustainability	◆	Older, less energy efficient elevator will continue to operate	●	Upgraded elevator equipment and lighting systems will use up to date energy efficiency technology	●	Upgraded elevator equipment and lighting systems will use up to date energy efficiency technology	●	Upgraded elevator equipment and lighting systems will use up to date energy efficiency technology
B. Cost and Financing								
B.1. Estimated Capital Cost	◆	Capital costs deferred but likely to be higher in the future	□	Costs for option A and B are similar with two elevators	□	Costs for option A and B are similar with two elevators	◆	Higher costs anticipated as compared to two elevator alternatives
B.2. Lifecycle Cost Impacts	◆	Increased operating and maintenance costs from continued used of older elevator equipment.	●	Reduced operating and repair costs for upgraded elevators	●	Reduced operating and repair costs for upgraded elevators	●	Reduced operating and repair costs for upgraded elevator
B.3. Cost Risk	◆	Risk of unanticipated failures to aging	□	No unusual factors anticipated	□	No unusual factors anticipated	◆	Design and materials requirements to ensure

Evaluation Criteria		No-Build	A	Two-Elevators; Enclosed Stair to 2nd and 3rd Floors	B	Two Elevators; Open Internal Stair to 2nd Floor	C	Second Floor Connector Bridge
		elevator equipment increases O&M cost risk.						compatibility with historic main concourse increase cost uncertainty
B.4. Financial Leverage	◆	More difficult to finance improvements as a stand-alone project	●	Increased funding potential as part of a multifaceted renovation project.	●	Increased funding potential as part of a multifaceted renovation project.	●	Increased funding potential as part of a multifaceted renovation project.
C. Implementability and Constructability								
C.1. Technical Complexity and Constructability	□	N/A – No capital improvement project	□	New floor openings and structural framing will be required to insert the new stairs and elevators, coordinated with structural/seismic retrofit and systems design.	□	New floor openings and structural framing will be required to insert the new stairs and elevators, coordinated with structural/seismic retrofit and systems design.	◆	Bridge structure design requires careful coordination of architectural and structural design as well as historic preservation and SHPO consultation.
C.2. Schedule and Schedule Risk	□	N/A – No capital improvement project	□	No unusual factors anticipated	□	No unusual factors anticipated	◆	Complexity increases schedule risk for design, approvals, and construction
C.3. Construction Impact on Passenger and Freight Rail Operations	□	N/A – No capital improvement project	□	All vertical circulation improvements will temporarily impact upper floor Amtrak operations.	□	All vertical circulation improvements will temporarily impact upper floor Amtrak operations.	◆	Increased complexity, and potential duration, of impacts on main concourse and passenger operations.
C.4. Construction Impact on Union Station Tenants	□	N/A – No capital improvement project	□	All vertical circulation improvements will temporarily impact upper floor tenants.	□	All vertical circulation improvements will temporarily impact upper floor tenants.	□	All vertical circulation improvements will temporarily impact upper floor tenants.
C.5. Phasing and Project Segmentation	□	N/A – No capital improvement project	□	No unusual factors anticipated	□	No unusual factors anticipated	◆	Requires closer coordination of vertical circulation and main concourse work.
C.6. Risks, Assumptions and Unknowns	□	N/A – No capital improvement project	□	No unusual factors anticipated	□	No unusual factors anticipated	◆	Larger impact to historic features of building and the concourse space

Evaluation Criteria		No-Build	A	Two-Elevators; Enclosed Stair to 2nd and 3rd Floors	B	Two Elevators; Open Internal Stair to 2nd Floor	C	Second Floor Connector Bridge
D. Environmental Impacts and Approvals								
D.1. Environmental Impacts and Project Classification	◆	Continued degradation of historic elements will continue; may lead to eventual loss of resources	□	Comparable among build alternatives	□	Comparable among build alternatives	□	Comparable among build alternatives
D.2. Historic Impacts and Approvals	◆	Historic spaces and materials will continue to degrade over time.	●	Minimal impact on high profile historic spaces	●	Minimal impact on high profile historic spaces	◆	Increased impact on primary historic spaces will likely require additional consultation and prolongs approvals process.
D.3. Decision Making and Approvals	◆	Project approvals and permitting may be hampered if code-mandated upgrades are not implemented	□	No unusual factors anticipated	□	No unusual factors anticipated	◆	Increased impact on primary historic spaces will likely require additional consultation and prolongs approvals process.

Source: IBI Group. 2016.

5.2. Amtrak Operations and Passenger Concourses

This improvement would provide improvements to rail passenger and rail operations spaces to accommodate the needs of future intercity rail, accommodate evolving passenger requirements (e.g. assisted boarding), improve accessibility, and preserve historic materials and finishes in Union Station's most prominent interior public spaces. It would also address the security and deteriorated conditions of the passenger restrooms.

The following alternatives were evaluated:

- The No-Build Alternative would preserve existing passenger and rail operations as-is.
- The Existing Boarding Gates alternative preserves the configuration of the existing passenger boarding gates, so that all passenger boarding and alighting activity occurs through the main concourse at existing capacity levels.
- The north foyer hallway -Configuration 1 alternative creates a new hallway connection and arriving passenger gate along with reconfigured restrooms and customer services.
- The north foyer hallway -Configuration 2 alternative is similar to the above alternative, with variations in the configuration of restrooms, customer services, and Amtrak operations spaces.

The results of the evaluation of the four alternatives are summarized in Table 5.2-1.

5.2.1. Design Requirements and Objectives

The key design requirements for Amtrak Operations and the Passenger Concourses (main concourse and south concourse) identified through the conditions assessment and stakeholder discussions include:

- Accommodating current and future Amtrak operational and business needs for safe, secure, and efficient railroad operations.
- Improving comfort, security, accessibility, and amenities for rail passengers and Union Station visitors.
- Consolidating the ticketing/baggage areas into a single location to better support Amtrak operations best practices, and to provide ADA accessibility to the customer service counters.
- Accommodating projected growth in passenger demand through the 2035 long-range planning horizon for the Cascades Corridor.
- Combine/consolidating Amtrak spaces into the main building, and optimizing sizing and relationships of passenger amenities, rail support, and office spaces.
- Improving overall security in the public and operations areas, particularly the Amtrak customer restrooms on the main floor.

5.2.2. Amtrak Operations and Passenger Concourses Alternatives

5.2.2.1 No-Build Alternative

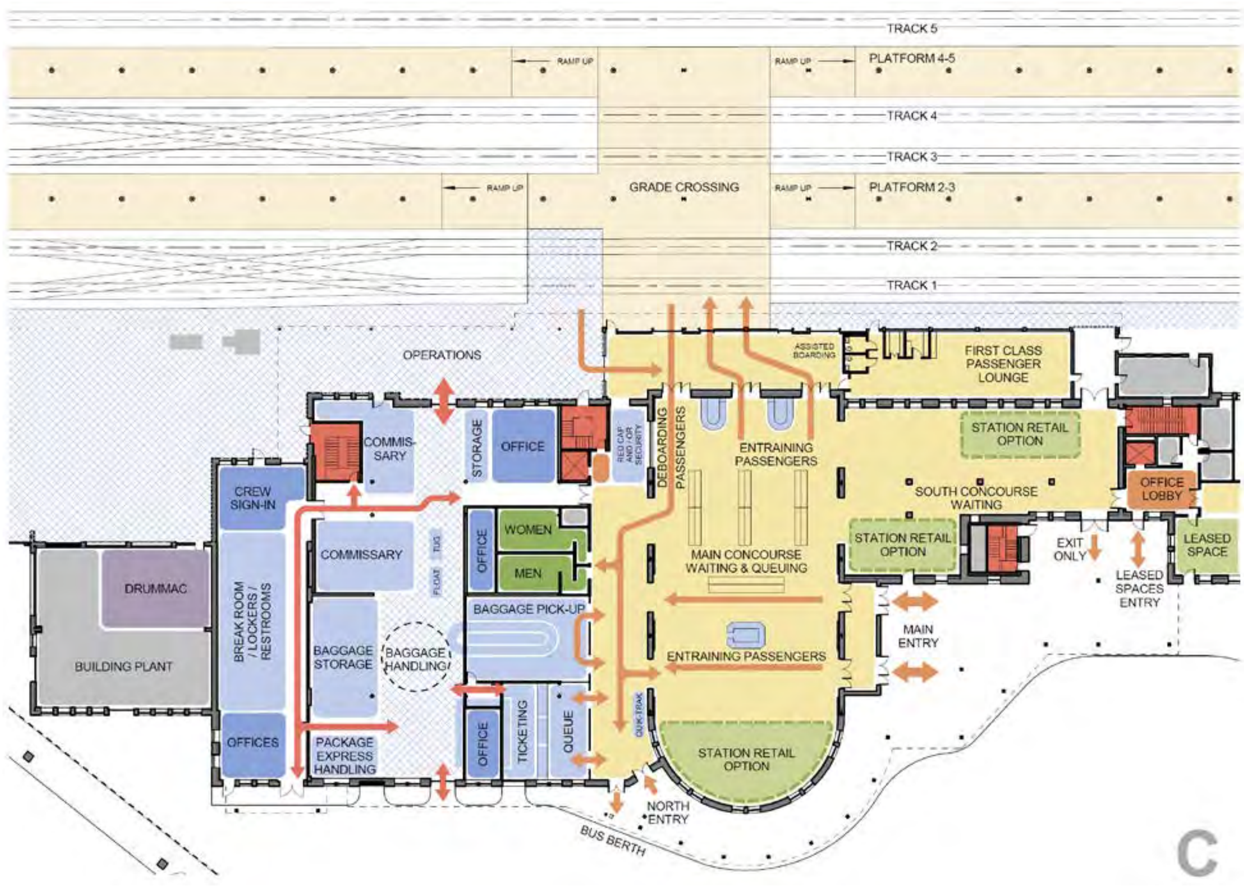
The current configuration of Amtrak ticketing, baggage, maintenance, crew space, office, and security facilities has not been substantially modified since the 1930s or before. There are substantial differences between rail and passenger operations needs of that era with the current and future needs of Amtrak. The current location of the main floor restrooms is particularly problematic given the lack of security surveillance and the history of illegal and unauthorized activities in these areas.

Many of these deficiencies negatively impact the rail passenger and visitor experience, including those with disabilities. This erodes the quality of the passenger rail experience and undermines Union Station's effectiveness as a multi-modal transportation hub, and the project goals to support future rail passenger needs and revitalization of the facility.

5.2.2.2 Alternative A: Existing Boarding Gates

This alternative would preserve the configuration of the existing passenger boarding gates, so that all passenger boarding and alighting activity occurs through the main concourse. Ticketing and baggage operations would be consolidated into a new ticketing / baggage customer service counter located off of the existing north foyer. Restrooms would also be relocated to this area from the south concourse, closer to staffed Amtrak positions and the main concourse waiting area, to improve passenger convenience and improve security surveillance. A new baggage claim belt would be implemented and would replace the existing counter.

Figure 5.2-1. Amtrak Operations and Passenger Concourse Alternative A – Existing Boarding Gates

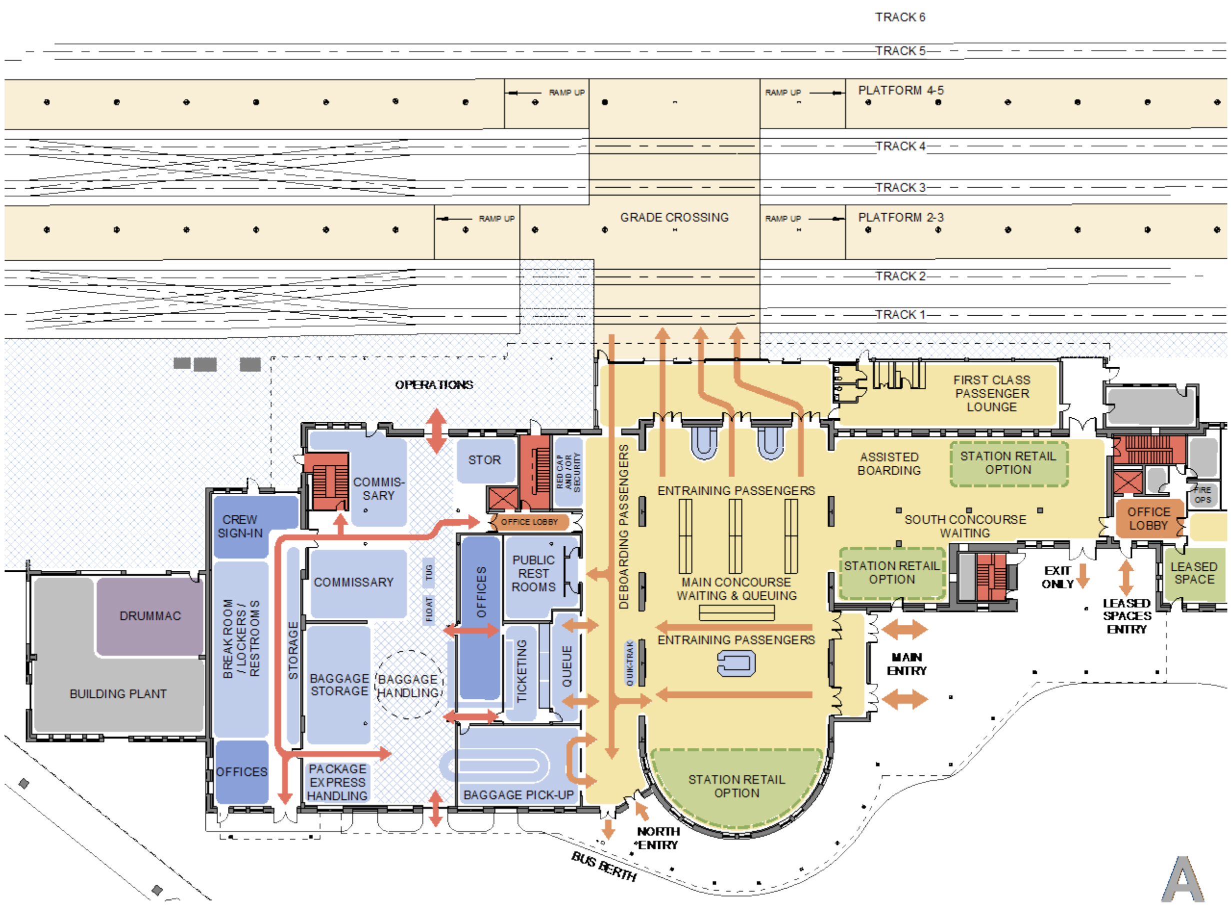


Source: IBI Group. 2016.

5.2.2.3 Alternative B: North Foyer Hallway (Configuration 1)

This alternative would extend the north foyer to create a north foyer hallway in the area currently occupied by the existing elevator and north stairway. This north foyer hallway would include a new exterior entrance for arriving passengers that would provide direct access to future restrooms, redcap services, customer service counters, and a new baggage claim belt. The north foyer would provide direct access to connecting thruway bus services as well as other amenities and transportation via the entrances to the adjacent main concourse.

Figure 5.2-2. Amtrak Operations and Passenger Concourse Alternative B – North Foyer Hallway (Configuration 1)

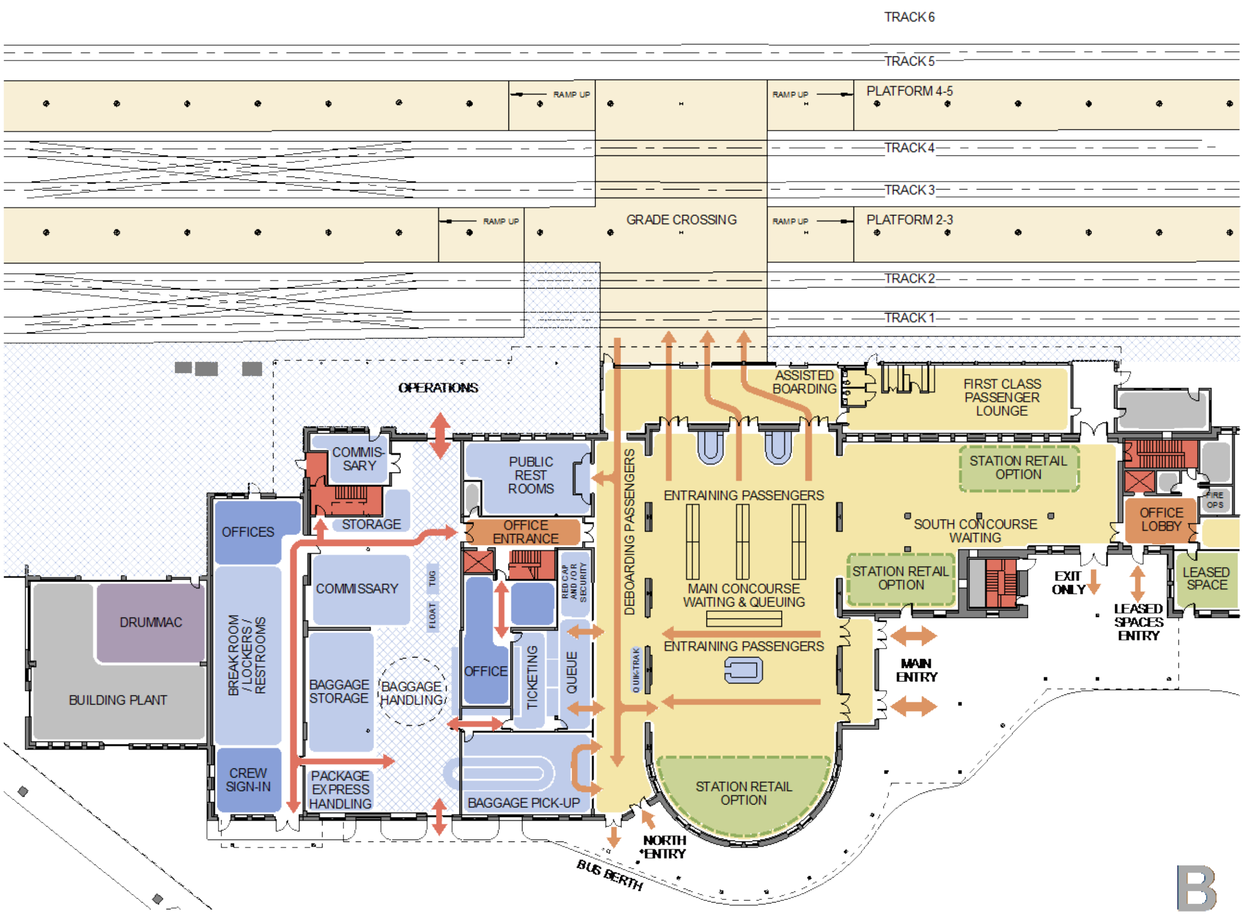


Source: IBI Group. 2016.

5.2.2.4 Alternative C: North Foyer Hallway (Configuration 2)

This alternative is very similar to Alternative B, except that the layout of Amtrak operations spaces would be adjusted to reflect the location of Vertical Circulation and Access Alternative B. The configuration of customer service amenities along the north foyer hallway is identical to Alternative A. As discussed previously, Alternative B with two elevators and the open internal stairs is not the preferred vertical circulation and access alternative.

Figure 5.2-3. Amtrak Operations and Passenger Concourse Alternative C – North Foyer Hallway (Configuration 2)



Source: IBI Group. 2016.

5.2.3. Recommendation: Amtrak Operations and Passenger Concourse

The project team recommends implementing Alternative B, the North Foyer Hallway – Configuration 1 (Figure 5.2-2). Creation of a new north foyer hallway would increase train boarding gate capacity for growth in future passenger rail service, and would minimize circulation and quieting conflicts between arriving and departing passenger flows and queues within the main concourse. The configuration of ticketing, baggage, and restrooms in this alternative would meet Amtrak operational and business objectives, and the orientation of passenger services would be the most conducive for arriving and departing passengers. Consolidation of ticketing / baggage functions would increase Amtrak operational efficiency and passenger convenience and would create opportunities to implement accessibility improvements to the customer service counter.

Table 5.2-1. Evaluation of Amtrak Operations and Passenger Concourse Alternatives

Evaluation Criteria		No-Build	A	Existing Boarding Gates	B	North Foyer Hallway – Configuration 1	C	North Foyer Hallway – Configuration 2
A: Ability to Meet Project Goals								
A.1. Accommodate Future Capacity and Operational Needs of Passenger and Freight Rail	◆	Existing deficiencies will continue to affect the passenger experience and rail operations	◆	Does not increase boarding gate capacity to accommodate increases in future demand and existing boarding gate congestion/conflicts.	●	Increases boarding gate capacity and reduces conflicts between arrive and departing passenger flows. Provides additional space to accommodate assisted boarding needs.	●	Increases boarding gate capacity and reduces conflicts between arrive and departing passenger flows. Provides additional space to accommodate assisted boarding needs.
A.2. Preserve and Protect the Historic Character of Union Station	◆	Historic characteristics of the building will continue to degrade over time.	●	Preserves historic features and materials while increasing station vitality.	●	Preserves historic features and materials while increasing station vitality.	●	Preserves historic features and materials while increasing station vitality.
A.3. Improve Economic and Social Vitality	◆	Missed opportunities to increase activation and vitality of the historic station	●	Allows for increased activation of the concourse through improved passenger amenities and concessions.	●	Allows for increased activation of the concourse through improved passenger amenities and concessions.	●	Allows for increased activation of the concourse through improved passenger amenities and concessions.
A.4. Improve Environmental Sustainability	◆	Old and inefficient building systems will remain in place.	●	Building systems and sustainability features will be upgraded to meet or exceed City standards	●	Building systems and sustainability features will be upgraded to meet or exceed City standards	●	Building systems and sustainability features will be upgraded to meet or exceed City standards
B. Cost and Financing								
B.1. Estimated Capital Cost	◆	Capital costs deferred but likely to be higher in the future	□	Similar capital costs for all build alternatives	□	Similar capital costs for all build alternatives	□	Similar capital costs for all build alternatives
B.2. Lifecycle Cost Impacts	◆	Old and inefficient building systems will remain in place.	□	Similar life cycle cost improvements (building and rail operations) for all build alternatives	□	Similar life cycle cost improvements (building and rail operations) for all build alternatives	□	Similar life cycle cost improvements (building and rail operations) for all build alternatives

Evaluation Criteria		No-Build	A	Existing Boarding Gates	B	North Foyer Hallway – Configuration 1	C	North Foyer Hallway – Configuration 2
B.3. Cost Risk	◆	Facilities O&M costs likely to remain higher and less predictable with older facilities and systems in place.	☐	Similar risk levels for all build alternatives	☐	Similar risk levels for all build alternatives	☐	Similar risk levels for all build alternatives
B.4. Financial Leverage	◆	Funding improvements is likely to be more difficult as a future stand-alone project	●	Increased funding potential as part of a multifaceted renovation project.	●	Increased funding potential as part of a multifaceted renovation project.	●	Increased funding potential as part of a multifaceted renovation project.
C. Implementability and Constructability								
C.1. Technical Complexity and Constructability	☐	N/A – No capital improvement project	☐	Similar scale of impacts for all build alternatives	☐	Similar scale of impacts for all build alternatives	☐	Similar scale of impacts for all build alternatives
C.2. Schedule and Schedule Risk	☐	N/A – No capital improvement project	☐	Similar scale of impacts for all build alternatives	☐	Similar scale of impacts for all build alternatives	☐	Similar scale of impacts for all build alternatives
C.3. Construction Impact on Passenger and Freight Rail Operations	☐	N/A – No capital improvement project	◆	Substantial disruption to passenger and rail operations will require temporary relocation of facilities and potential reduction in capacity during construction.	◆	Substantial disruption to passenger and rail operations will require temporary relocation of facilities and potential reduction in capacity during construction.	◆	Substantial disruption to passenger and rail operations will require temporary relocation of facilities and potential reduction in capacity during construction.
C.4. Construction Impact on Union Station Tenants	☐	N/A – No capital improvement project	◆	Potential impact to non-rail tenants during construction, including possible temporary use of non-rail tenant spaces for rail operations functions.	◆	Potential impact to non-rail tenants during construction, including possible temporary use of non-rail tenant spaces for rail operations functions.	◆	Potential impact to non-rail tenants during construction, including possible temporary use of non-rail tenant spaces for rail operations functions.
C.5. Phasing and Project Segmentation	☐	N/A – No capital improvement project	☐	Similar scale of impacts for all build alternatives	☐	Similar scale of impacts for all build alternatives	☐	Similar scale of impacts for all build alternatives
C.6. Risks, Assumptions and Unknowns	☐	N/A – No capital improvement project	☐	Similar risks and unknowns for all build alternatives	☐	Similar risks and unknowns for all build alternatives	☐	Similar risks and unknowns for all build alternatives

Evaluation Criteria		No-Build	A	Existing Boarding Gates	B	North Foyer Hallway – Configuration 1	C	North Foyer Hallway – Configuration 2
D. Environmental Impacts and Approvals								
D.1. Environmental Impacts and Project Classification	◆	Continued degradation of historic elements will continue; may lead to eventual loss of resources	☐	No unusual factors anticipated	☐	No unusual factors anticipated	☐	No unusual factors anticipated
D.2. Historic Impacts and Approvals	◆	Historic spaces and materials will continue to degrade over time.	◆	Impacts on historically sensitive areas, including the main concourse, will require design consultation and approvals.	◆	Impacts on historically sensitive areas, including the main concourse, will require design consultation and approvals.	◆	Impacts on historically sensitive areas, including the main concourse, will require design consultation and approvals. Changes to north foyer hallway with new external egress will potentially involve more historic discussion items.
D.3. Decision Making and Approvals	◆	Project approvals and permitting may be hampered if code-mandated upgrades are not implemented	☐	No unusual factors anticipated	☐	No unusual factors anticipated	☐	No unusual factors anticipated

5.3. Ticket Counter

This improvement repurposes the existing ticket counter area as a new rail passenger amenity. The ticket counter is anticipated to be vacated due to the proposed consolidation of the Amtrak ticketing function is combined with the baggage counter in the north foyer, in accordance with Amtrak's stated business requirements.

5.3.1. Design Requirements and Objectives

The key design requirements for the ticket counter identified through the conditions assessment and stakeholder discussions include:

- Repurpose the ticket counter when vacated by Amtrak due to consolidation of ticketing and baggage functions.
- Improve passenger amenities and waiting areas to improve the attractiveness, convenience, and comfort of the rail passenger experience.
- Provide amenities that benefit other Amtrak tenants and visitors.
- Accommodate mutually beneficial uses that enhance rail travel and also complement the overall revitalization of the Broadway Corridor.
- Maximize potential return on leasable spaces to improve the financial sustainability of Union Station in the future.

5.3.2. Ticket Counter Alternatives

The following alternatives were evaluated:

- The No-Build Alternative would maintain Amtrak ticketing function in the existing location.
- The Café/Retain Existing Ticket Counter alternative repurposes the ticket counter as a retail concession. (This alternative assumes consolidation of the Amtrak ticketing function is combined with the baggage counter in the north foyer.)
- The Passenger Seating/Retain Existing Ticket Counter alternative repurposes the ticket counter as an additional passenger waiting area. (This alternative assumes consolidation of the Amtrak ticketing function is combined with the baggage counter in the north foyer.)
- The Remove Existing Ticket Counter alternative removes the ticket counter and replaces it with an open, contiguous passenger waiting area, potentially with a freestanding retail or display kiosk. (This alternative assumes consolidation of the Amtrak ticketing function is combined with the baggage counter in the north foyer.)

The results of the evaluation of the four alternatives are summarized in Table 5.3-1.

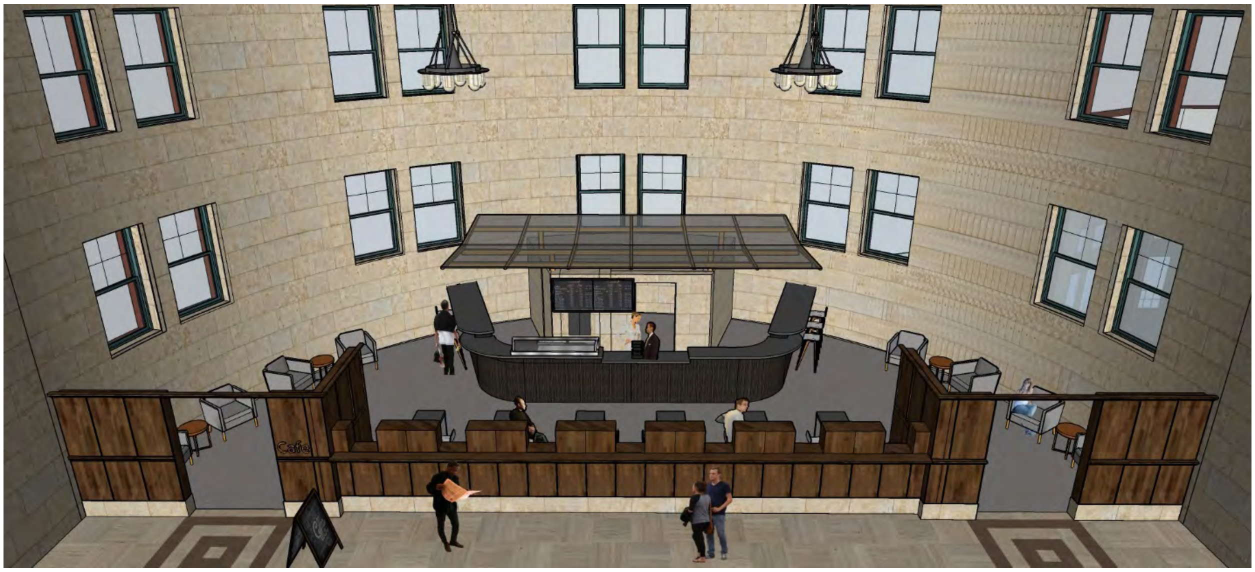
5.3.2.1 Ticket Counter No-Build Alternative

The No-Build Alternative would retain the existing Amtrak passenger ticketing function at its existing location in the 1903s era ticket counter. The desired consolidation of Amtrak ticketing and baggage functions into a single location to support customer convenience and business practices would not be accommodated. The ticket counter would continue to lack ADA accessibility features such as a reduced height counter. Amtrak back office accounting functions located behind the counter would remain as-is, without improvements to facilities or security.

5.3.2.1.1. Alternative A: Café/Retain Existing Ticket Counter

This option would preserve the existing, historic walnut ticketing counter to incorporate it as a feature into a new retail concession such as a café (Figure 5.3-1). The counter itself, following preservation work, could be incorporated into the concession as a service counter or seating area. This re-use would preserve the feel of the existing Ticket Counter in the main concourse, and would lend a distinctive character and rail there to any concession. Areas behind the main counter would likely be modified to accommodate the needs of the future concession, with care taken to preserve historic materials and features (such as marble paneling or a vault).

Figure 5.3-1. Ticket Counter Alternative A - Café/Retain Existing Ticket Counter

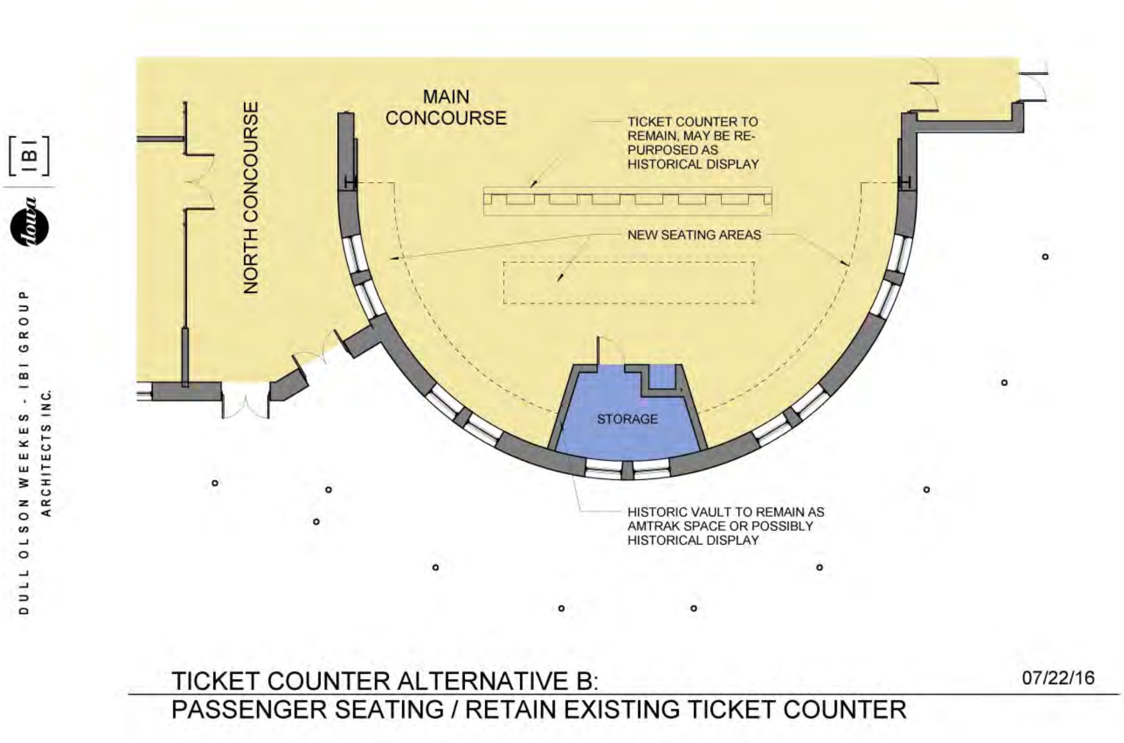


Source: IBI Group. 2016.

5.3.2.1.2. Alternative B: Passenger Seating/Retain Existing Ticket Counter

This option is similar to Alterative A in that it would preserve the existing historic walnut ticketing counter. However rather than housing a leasable space, the area behind the ticket counter would be repurposed for additional passenger seating and waiting area (Figure 5.3-2). The ticket counter itself could be preserved as a unique seating area for patrons, providing table and work space with a view of the historic main concourse and train activities. There is a wide variety of potential variation in the design of this space, including incorporation of historic artifacts, exhibits, or art.

Figure 5.3-2. Ticket Counter Alternative B - Passenger Seating/Retain Existing Ticket Counter



Source: IBI Group. 2016.

5.3.2.1.3. Alternative C: Remove Existing Ticket Counter

This alternative would remove the existing ticket counter entirely, creating a larger, contiguous waiting area within the main concourse (Figure 5.3-3). The vacated area could contain a retail kiosk, additional searing area, or both. Care would need to be taken to preserve existing historic materials while introducing new design materials if necessary, for example, to patch flooring within the footprint of the removed ticket counter.

Figure 5.3-3. Ticket Counter Alternative C - Remove Existing Ticket Counter

Source: IBI Group. 2016.

5.3.2.1.4. Recommendation: Ticket Counter

The project team recommends preserving the existing, historic walnut ticketing counter to incorporate it as a feature into a new retail concession such as a café (Figure 5.3-1). A café alternative would provide a new passenger amenity and creates a high-quality amenity in a prominent main concourse location. Preservation of the existing walnut ticket counter and other features would honor the historic use of this area and would add interest and character to the space.

Table 5.3-1. Evaluation of Ticket Counter Alternatives

Evaluation Criteria		No-Build	A	Café/Retain Existing Ticket Counter	B	Passenger Seating / Retain Existing Ticket Counter	C	Remove Existing Ticket Counter
A: Ability to Meet Project Goals								
A.1. Accommodate Future Capacity and Operational Needs of Passenger and Freight Rail	◆	Amtrak customer service options continue to be divided into separate portions of the station. Facilities are not ADA accessible.	●	Assumes relocation and consolidation of new, ADA accessible customer service functions to the north foyer. Adds an additional passenger amenity/seating capacity to the main concourse.	●	Assumes relocation and consolidation of new, ADA accessible customer service functions to the north foyer. Adds an additional passenger amenity/seating capacity to the main concourse.	●	Assumes relocation and consolidation of new, ADA accessible customer service functions to the north foyer. Adds an additional passenger amenity/seating capacity to the main concourse.
A.2. Preserve and Protect the Historic Character of Union Station	◆	Historic characteristics of the building will continue to degrade over time. Risk of abandonment of Ticket Counter as a functioning element as it becomes increasing obsolete.	●	Repurposes the ticket counter as a functional passenger amenity	●	Repurposes the ticket counter as a functional passenger amenity	◆	Results in removal of the historic ticket counter
A.3. Improve Economic and Social Vitality	◆	Missed opportunity to create new amenities and vitality in Union Station	●	Creates additional passenger amenity and vitality in Union Station's public areas. Increased revenue potential from new leasable space.	☐	Increases seating capacity.	☐	Increases seating capacity
A.4. Improve Environmental Sustainability	◆	Old and inefficient building systems will remain in place.	●	Building systems and sustainability features will be upgraded to meet or exceed City standards	●	Building systems and sustainability features will be upgraded to meet or exceed City standards	●	Building systems and sustainability features will be upgraded to meet or exceed City standards
B. Cost and Financing								
B.1. Estimated Capital Cost	◆	Capital costs deferred but likely to be higher in the future	☐	Similar capital costs for all build alternatives	☐	Similar capital costs for all build alternatives	☐	Similar capital costs for all build alternatives
B.2. Lifecycle Cost Impacts	◆	Higher rail operating costs for Amtrak. Old	●	Reduced rail and building operating costs due to	●	Reduced rail and building operating costs due to	●	Reduced rail and building operating costs due to

Evaluation Criteria		No-Build	A	Café/Retain Existing Ticket Counter	B	Passenger Seating / Retain Existing Ticket Counter	C	Remove Existing Ticket Counter
		and inefficient building systems will remain in place.		facilities consolidation and improvement.		facilities consolidation and improvement.		facilities consolidation and improvement.
B.3. Cost Risk	◆	Facilities O&M costs likely to remain higher and less predictable with older facilities and systems in place.	□	Similar risk levels for all build alternatives	□	Similar risk levels for all build alternatives	□	Similar risk levels for all build alternatives
B.4. Financial Leverage	◆	Funding improvements is likely to be more difficult as a future stand-alone project	●	Potential for new lease revenue generation/concessionaire financing to factor into project financing.	●	Increased funding potential as part of a multifaceted renovation project.	●	Increased funding potential as part of a multifaceted renovation project.
C. Implementability and Constructability								
C.1. Technical Complexity and Constructability	□	N/A – No capital improvement project	□	Similar scale of impacts for all build alternatives	□	Similar scale of impacts for all build alternatives	□	Similar scale of impacts for all build alternatives
C.2. Schedule and Schedule Risk	□	N/A – No capital improvement project	□	Similar scale of impacts for all build alternatives	□	Similar scale of impacts for all build alternatives	□	Similar scale of impacts for all build alternatives
C.3. Construction Impact on Passenger and Freight Rail Operations	□	N/A – No capital improvement project	□	Minimal impacts - work could be accomplished during major main concourse Renovations and is limited to ticketing area.	□	Minimal impacts - work could be accomplished during major main concourse Renovations and is limited to ticketing area.	□	Minimal impacts - work could be accomplished during major main concourse Renovations and is limited to ticketing area.
C.4. Construction Impact on Union Station Tenants	□	N/A – No capital improvement project	□	Minimal impact on existing tenants	□	Minimal impact on existing tenants	□	Minimal impact on existing tenants
C.5. Phasing and Project Segmentation	□	N/A – No capital improvement project	□	Tenant improvements can be phased after major improvements are completed	□	Similar scale of impacts for all build alternatives	□	Similar scale of impacts for all build alternatives
C.6. Risks, Assumptions and Unknowns	□	N/A – No capital improvement project	□	Similar risks and unknowns for all build alternatives	□	Similar risks and unknowns for all build alternatives	□	Similar risks and unknowns for all build alternatives
D. Environmental Impacts and Approvals								

Evaluation Criteria		No-Build	A	Café/Retain Existing Ticket Counter	B	Passenger Seating / Retain Existing Ticket Counter	C	Remove Existing Ticket Counter
D.1. Environmental Impacts and Project Classification	◆	Continued degradation of historic elements will continue; may lead to eventual loss of resources	●	Historic resource remains active and vital part of train station	●	Historic resource remains active and vital part of train station	◆	Loss of historic resource
D.2. Historic Impacts and Approvals	◆	Historic spaces and materials will continue to degrade over time.	◆	Ticket Counter preservation and adaptation will require historic consultations and approvals.	◆	Highest impact in historic resources	◆	Highest impact in historic resources
D.3. Decision Making and Approvals	◆	Project approvals and permitting may be hampered if code-mandated upgrades are not implemented	◆	Ticket Counter preservation and adaptation will require historic consultations and approvals.	◆	Highest impact in historic resources	◆	Highest impact in historic resources

Source: IBI Group. 2016.

5.4. South Concourse

This improvement would improve passenger waiting areas and amenities of south concourse through reconfiguration of seating, retail amenities, and potential changes to the seating area. These improvements would support re-activation of the main floor was well as improving the quality of rail passenger facilities.

The following alternatives were evaluated:

- The No-Build Alternative preserves the south concourse leasable spaces in the current configuration.
- The Expanded Retail Concessions With Shared Use Seating alternative activates the south concourse by introducing additional retail concessions in the south concourse, and created a shared-use seating area for both retail and rail passengers.
- The Passenger Waiting Area with Existing Concession alternative retains the existing concession area along with improve passenger and concession seating in the south concourse.
- The Dedicated Rail Passenger Seating alternative removes the existing concession area and refurbishes the south concourse as an expanded seating area dedicated to rail passengers.

The results of the evaluation of the four alternatives are summarized in Table 5.4-1.

5.4.1. Design Requirements and Objectives

The key design requirements for the south concourse identified through the conditions assessment and stakeholder discussions include:

- Improve passenger amenities and waiting areas to improve the attractiveness, convenience, and comfort of the rail passenger experience.
- Provide amenities that benefit other Amtrak tenants and visitors.
- Accommodate mutually beneficial uses that enhance rail travel and also complement the overall revitalization of the Broadway Corridor.
- Maximize potential return on leasable spaces to improve the financial sustainability of Union Station in the future.

5.4.2. South Concourse Alternatives

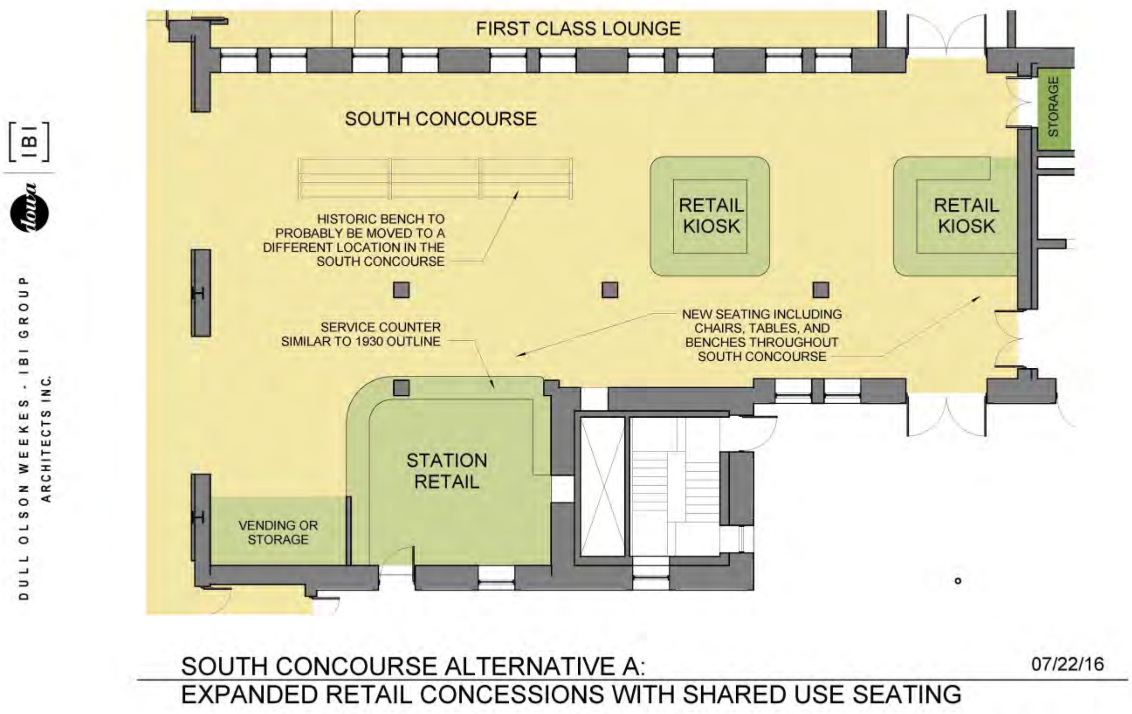
5.4.2.1 South Concourse No-Build Alternative

The No-Build Alternative would retain the existing configuration of the south concourse as a passenger seating area with one retail concession equipped with storage and kitchen space. Existing, bench-type seating in the south concourse would be retained.

5.4.2.2 Alternative A: Expanded Retail Concessions with Shared Use Seating

This alternative would activate the south concourse by increasing the amount of leasable retail/concession activity in the south concourse (Figure 5.4-1). Concessions could use the existing Trackside Café space and other kiosk/counter locations in or around the south concourse. These concessions, which would be anticipated to include food service uses, would use a shared seating area with new chairs, benches, or tables for both concession patrons as well as Amtrak passengers. This would increase the variety of seating and amenity options for passengers waiting for trains, and would also serve the needs of building tenants and patrons from the surrounding neighborhoods. During peak periods, the shared seating area could help to absorb the seating demand for rail passengers; at other times, it may be dominated by restaurant or café patrons. This alternative applies a concept that can be observed in rail and air transportation terminals around the world, where blending of concession and transportation waiting areas provides a richer experience for travelers and reduces the need for dedicated seating for both uses. In this case, the existing south concourse café could be repurposed for seating, business/work area, a children's amenity, exhibit space, etc.

Figure 5.4-1. South Concourse Alternative A – Expanded Retail Concessions with Shared Use Seating

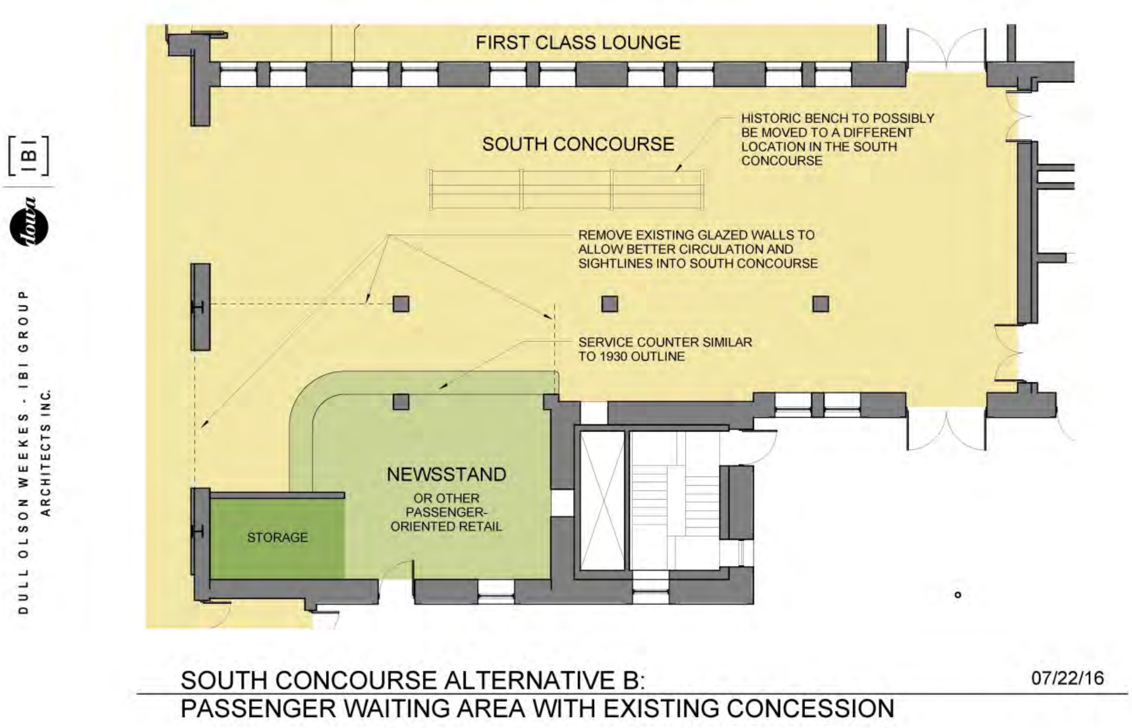


Source: IBI Group. 2016.

5.4.2.3 Alternative B: Passenger Waiting Area with Existing Concession

This alternative would retain the existing balance of retail and seating space in the south concourse area (Figure 5.4-2). The current café/retail space would continue to be occupied by a similar concession, and the south concourse itself would be dedicated primarily to waiting rail passengers. Seating could be re-configured to provide additional seating and seating variety. Exhibit spaces or art could also be incorporated into the final concept.

Figure 5.4-2. South Concourse Alternative B – Passenger Waiting Area with Existing Concession

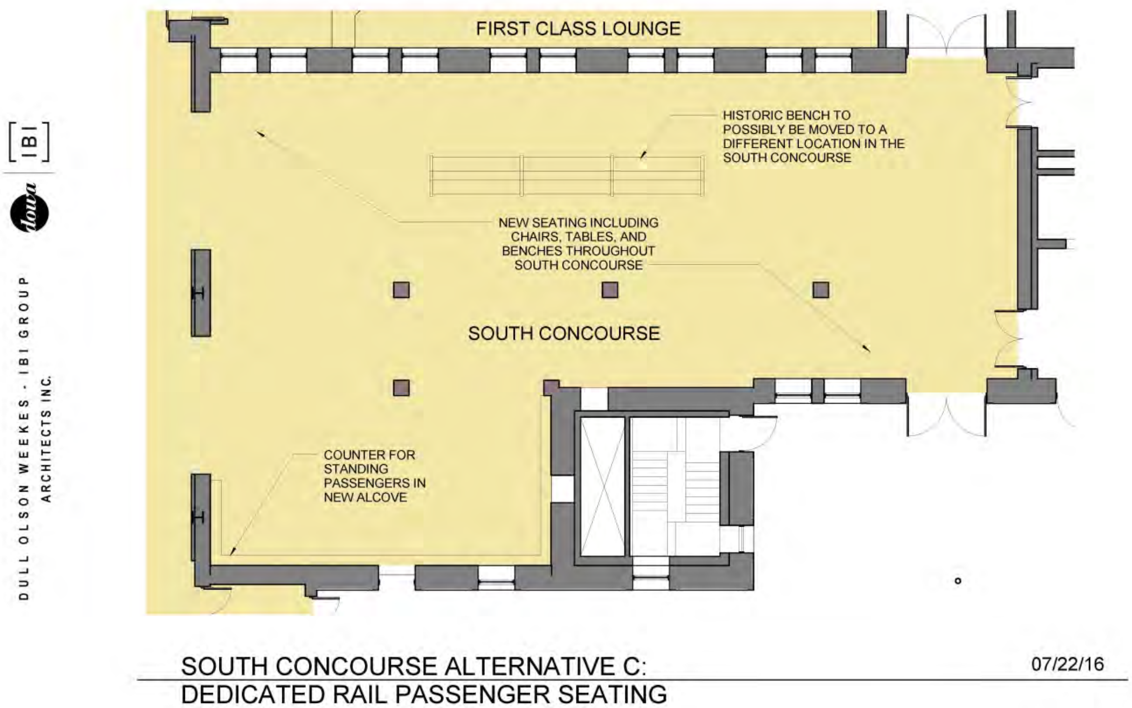


Source: IBI Group. 2016.

5.4.2.4 Alternative C: Dedicated Rail Passenger Seating

This alternative would dedicate the entire south concourse to rail passenger seating (Figure 5.3-6). While a retail concession for rail passengers is a desirable feature, this alternative could occur if the existing retail concession in the south concourse was relocated to the area of the former ticket counter (Ticket Counter Re-Use Alternative A). As with other alternatives, the seating could be re-configured to provide additional seating and seating variety. Exhibit spaces or art could also be incorporated into the final concept. This configuration may also accommodate specialized passenger waiting facility needs – for example, roll-aboard bike storage for Amtrak Cascades passengers or an assisted boarding area.

Figure 5.4-3. South Concourse Alternative C – Dedicated Rail Passenger Seating



Source: IBI Group. 2016.

5.4.3. Recommendation: South Concourse Alternative:

The project team recommends implementing Alternative A, which would expand retail concessions and have shared use seating (Figure 5.4-1). This alternative would improve and enhance the south concourse as an amenity for rail passengers, building tenants, and visitors alike. This alternative envisions flexible seating that can be used both by concession patrons and waiting rail passengers, providing flexible capacity during peak periods. Introduction of new retail concessions activates this area is compatible with providing exhibit space as part of the final space configuration.

Table 5.4-1. Evaluation of South Concourse Alternatives

Evaluation Criteria		No-Build	A	Expanded Retail Concessions with Shared Use Seating	B	Passenger Waiting Area with Existing Concessions	C	Dedicated Rail Passenger Seating
A: Ability to Meet Project Goals								
A.1. Accommodate Future Capacity and Operational Needs of Passenger and Freight Rail	◆	Does not increase vitality for rail passengers	●	Creates additional passenger amenity and shared passenger/retail seating.	●	Includes improved and expanded rail passenger seating area.	●	Includes improved and expanded rail passenger seating area.
A.2. Preserve and Protect the Historic Character of Union Station	◆	Historic characteristics of the building will continue to degrade over time.	□	Comparable among build alternatives	□	Comparable among build alternatives	□	Comparable among build alternatives
A.3. Improve Economic and Social Vitality	◆	Missed opportunity to create new amenities and vitality in Union Station	●	Creates additional passenger amenity and vitality in Union Station's public areas. Increased revenue potential from new leasable space.	●	Retains passenger amenity and revenue potential from existing leasable space.	◆	Reduces passenger amenities, vitality, and lease revenue potential.
A.4. Improve Environmental Sustainability	◆	Old and inefficient building systems will remain in place.	●	Building systems and sustainability features will be upgraded to meet or exceed City standards	●	Building systems and sustainability features will be upgraded to meet or exceed City standards	●	Building systems and sustainability features will be upgraded to meet or exceed City standards
B. Cost and Financing								
B.1. Estimated Capital Cost	◆	Capital costs deferred but likely to be higher in the future	□	Similar capital costs for all build alternatives (excluding tenant improvements)	□	Similar capital costs for all build alternatives	□	Similar capital costs for all build alternatives
B.2. Lifecycle Cost Impacts	◆	Existing, potentially diminishing, long term lease revenues from existing concession	●	Potential new lease revenue to offset building operating costs. Improvement in building operational efficiency.	●	Improvement in building operational efficiency	●	Improvement in building operational efficiency
B.3. Cost Risk	◆	Costs likely to be higher in the future with deferred	□	Comparable among build alternatives	□	Comparable among build alternatives	□	Comparable among build alternatives

Evaluation Criteria		No-Build	A	Expanded Retail Concessions with Shared Use Seating	B	Passenger Waiting Area with Existing Concessions	C	Dedicated Rail Passenger Seating
		investment						
B.4. Financial Leverage	◆	Funding improvements is likely to be more difficult as a future stand-alone project	●	Potential for new lease revenue generation/concessionaire financing to factor into project financing.	●	Potential for new lease revenue generation/concessionaire financing to factor into project financing.	●	Potential for new lease revenue generation/concessionaire financing to factor into project financing.
C. Implementability and Constructability								
C.1. Technical Complexity and Constructability	□	N/A – No capital improvement project	□	Similar scale of impacts for all build alternatives	□	Similar scale of impacts for all build alternatives	□	Similar scale of impacts for all build alternatives
C.2. Schedule and Schedule Risk	□	N/A – No capital improvement project	□	Similar scale of impacts for all build alternatives	□	Similar scale of impacts for all build alternatives	□	Similar scale of impacts for all build alternatives
C.3. Construction Impact on Passenger and Freight Rail Operations	□	N/A – No capital improvement project	□	Minimal impacts - work could be coordinated with major main concourse or south main building renovations and is limited in scope.	□	Minimal impacts - work could be coordinated with major main concourse or south main building renovations and is limited in scope.	□	Minimal impacts - work could be coordinated with major main concourse or south main building renovations and is limited in scope.
C.4. Construction Impact on Union Station Tenants	□	N/A – No capital improvement project	□	Minimal impact on existing tenants except existing south concourse concessionaire.	□	Minimal impact on existing tenants except existing south concourse concessionaire.	□	Minimal impact on existing tenants except existing south concourse concessionaire.
C.5. Phasing and Project Segmentation	□	N/A – No capital improvement project	□	Tenant improvements can be phased after major improvements are completed	□	Similar scale of impacts for all build alternatives	□	Similar scale of impacts for all build alternatives
C.6. Risks, Assumptions and Unknowns	□	N/A – No capital improvement project	□	Similar risks and unknowns for all build alternatives	□	Similar risks and unknowns for all build alternatives	□	Similar risks and unknowns for all build alternatives
D. Environmental Impacts and Approvals								
D.1. Environmental Impacts and Project Classification	◆	Continued degradation of historic elements will continue; may lead to eventual loss of resources	●	Historic portion of station remains vital part of passenger experience	●	Historic portion of station remains vital part of passenger experience	●	Historic portion of station remains vital part of passenger experience

Evaluation Criteria		No-Build	A	Expanded Retail Concessions with Shared Use Seating	B	Passenger Waiting Area with Existing Concessions	C	Dedicated Rail Passenger Seating
D.2. Historic Impacts and Approvals	◆	Historic spaces and materials will continue to degrade over time.	◆	Changes and preservation of south concourse will require historic consultations and approvals.	◆	Changes and preservation of south concourse will require historic consultations and approvals.	◆	Changes and preservation of south concourse will require historic consultations and approvals.
D.3. Decision Making and Approvals	◆	Project approvals and permitting may be hampered if code-mandated upgrades are not implemented	◆	Changes and preservation of south concourse will require historic consultations and approvals.	◆	Changes and preservation of south concourse will require historic consultations and approvals.	◆	Changes and preservation of south concourse will require historic consultations and approvals.

Source: IBI Group. 2016.

5.5. First Class Lounge

This improvement considers upgrades and potential re-use of the existing Amtrak First Class Lounge located off of the south concourse.

The following alternatives were evaluated:

- The No-Build Alternative preserves the existing first class lounge as-is.
- The Retain Amtrak First Class Lounge alternative retains the lounge function but completes upgrades and reconfigurations per Amtrak requirements.
- The Repurpose First Class Lounge alternative would reprogram the space as a retail concession or restaurant space, creating an additional amenity for rail passengers and increased vitality along the south concourse, should Amtrak's business decision to retain the First Class Lounge change in the future.

The results of the evaluation of the three alternatives are summarized in Table 5.5-1.

5.5.1. First Class Lounge Alternatives

5.5.1.1.1. First Class Lounge No-Build Alternative

The No-Build Alternative would retain the existing Amtrak first class passenger lounge as is, without changes or improvements to the space. No modifications to existing bathrooms, doors, seating areas, or fixtures would be implemented. Existing ADA accessibility barriers would remain.

5.5.1.1.2. Alternative A: Retain Amtrak First Class Lounge

This option would retain the Amtrak first class lounge in its current location and configurations (Figure 5.5-1). Modifications necessary to complete the building renovation and upgrades would be implemented, potentially along with other remodeling improvements by Amtrak as the leasing tenant. The area closest to the passenger boarding vestibule could be modified to accommodate a new assisted boarding location with direct access to the platforms.

Figure 5.5-1. First Class Lounge Alternative A – Retain Amtrak First Class Lounge

Source: IBI Group. 2016.

5.5.1.1.3. Alternative B: Repurpose First Class Lounge

This alternative would repurpose the Amtrak First Class Lounge space. If the Amtrak First Class Lounge space was vacated, this area could be used for a retail concession or restaurant space, creating an additional amenity for rail passengers and increased vitality along the south concourse (Figure 5.5-2). In this scenario, the Amtrak First Class Lounge could potentially be relocated, though there are few alternative locations on the Main floor that provide similar direct access to the trackside (for First Class and Sleeping Car passengers) without potentially interfering with baggage and train servicing operations. The existing masonry wall with windows separating the First Class Passenger Lounge could be made more "porous" by creating opening (e.g. a serving window) to an extended foodservice or counter space on the south concourse side of this wall. Similarly, a tenant in the First Class Lounge space could use possibly use shared seating in the south concourse for patrons, providing additional activation of the south concourse.

Figure 5.5-2. First Class Lounge Alternative B – Repurpose First Class Lounge

Source: IBI Group. 2016.

5.5.2. Recommendation: First Class Lounge

Amtrak has requested that the First Class Passenger Lounge be retained because of its value to its premium customer base such as sleeper car passengers and business class passengers; therefore, the project team recommends implementing Alterative A (Figure 5.5-1). Should Amtrak direction change, the space could be repurposed to accommodate a tenant or amenity as described in Alternative B.

Table 5.5-1. Evaluation of First Class Lounge Alternatives

Evaluation Criteria		No-Build	A	Retain Amtrak First Class Passenger Lounge	B	Repurpose First Class Passenger Lounge
A: Ability to Meet Project Goals						
A.1. Accommodate Future Capacity and Operational Needs of Passenger and Freight Rail	☐	Retains amenity, though with existing deficiencies and ingoing degradation	●	Provides a key amenity for Amtrak Cascades Business Class and long-distance sleeper car passengers. Provides direct loading door for these passengers to platforms.	●	Provides a new amenity accessible for all rail passengers and building visitors.
A.2. Preserve and Protect the Historic Character of Union Station	◆	Historic characteristics of the building will continue to degrade over time.	●	Preserves historic features and materials while increasing station vitality.	●	Preserves historic features and materials while increasing station vitality.
A.3. Improve Economic and Social Vitality	◆	Leasability and occupancy of the station are anticipated to decline with increased deterioration of leasable spaces.	●	Improves existing passenger amenity	●	Provides a new passenger/visitor amenity to activate the south Concourse.
A.4. Improve Environmental Sustainability	◆	Old and inefficient building systems will remain in place.	●	Building systems and sustainability features will be upgraded to meet or exceed City standards	●	Building systems and sustainability features will be upgraded to meet or exceed City standards
B. Cost and Financing						
B.1. Estimated Capital Cost	☐	Capital costs deferred but likely to be higher in the future	☐	Similar capital costs for all build alternatives	☐	Similar capital costs for all build alternatives (excluding tenant improvements)
B.2. Lifecycle Cost Impacts	◆	Higher building O&M costs due to continued operation with older and less efficient systems	●	Improvement in building operational efficiency	●	Improvement in building operational efficiency
B.3. Cost Risk	☐	Higher risk of unanticipated repair costs due to continued operation with older and less efficient systems	☐	No unusual factors anticipated	☐	No unusual factors anticipated
B.4. Financial Leverage	☐	Funding improvements is likely to be more difficult as a future stand-alone project	●	Potential for new lease revenue generation/concessionaire financing to factor into project financing.	●	Potential for Amtrak lease revenue generation/rail funding to factor into project financing.

Evaluation Criteria		No-Build	A	Retain Amtrak First Class Passenger Lounge	B	Repurpose First Class Passenger Lounge
C. Implementability and Constructability						
C.1. Technical Complexity and Constructability	☐	N/A – No capital improvement project	☐	Comparable among build alternatives	☐	Comparable among build alternatives
C.2. Schedule and Schedule Risk	☐	N/A – No capital improvement project	☐	Comparable among build alternatives	☐	Comparable among build alternatives
C.3. Construction Impact on Passenger and Freight Rail Operations	☐	N/A – No capital improvement project	☐	Temporary impact to first class passengers when facility is closed.	☐	Temporary impact to first class passengers when facility is closed.
C.4. Construction Impact on Union Station Tenants	☐	N/A – No capital improvement project	☐	Limited to Amtrak leased space.	☐	Limited to Amtrak leased space.
C.5. Phasing and Project Segmentation	☐	N/A – No capital improvement project	☐	Potential to stage with Main/south concourse work for minimal impact	☐	Potential to stage with Main/south concourse work for minimal impact
C.6. Risks, Assumptions and Unknowns	☐	N/A – No capital improvement project	☐	Comparable among build alternatives	☐	Comparable among build alternatives
D. Environmental Impacts and Approvals						
D.1. Environmental Impacts and Project Classification	☐	Continued degradation of historic elements will continue; may lead to eventual loss of resources	☐	Historic portion of station remains vital part of passenger experience	☐	Historic portion of station remains vital part of passenger experience
D.2. Historic Impacts and Approvals	☐	Historic spaces and materials will continue to degrade over time.	☐	Minimal changes to historic spaces anticipated.	◆	Changes and preservation of south concourse will require historic consultations and approvals.
D.3. Decision Making and Approvals	☐	Project approvals and permitting may be hampered if code-mandated upgrades are not implemented	☐	No unusual factors anticipated	◆	Changes and preservation of south concourse will require historic consultations and approvals.

Source: IBI Group. 2016.

5.6. South Main Floor Leasable Spaces

This improvement would provide additional amenities that would enhance the experience for passengers and visitors, support the revitalization of the surrounding neighborhood, and improve the financial sustainability of the building. The following alternatives were considered:

- The No-Build Alternative preserves the existing restaurant use and south hallways as is, without structural, systems, or accessibility upgrades.
- The Core and Shell Only alternative upgrades the south main floor Leasable Spaces to core and shell conditions following major structural, seismic, and systems work, with programing and tenanting decision deferred until a future phase of design.
- The Restaurant alternative retains the existing use of the space as a full-service restaurant, with necessary changes to accommodate seismic, systems, accessibility, and life safety upgrades.
- The Single Tenant Space would create a contiguous floorplate to house an office-type, shared work, studio, or similar tenant, much like the current and proposed tenants on the upper floors.
- The Market Hall alternative creates and active space consisting of multiple retail and food service tenant stalls, and would serve as supplemental waiting areas for rail passengers while also providing a gathering spot and amenity for the surrounding, revitalizing Broadway Corridor.

The results of the evaluation of the five alternatives are summarized in Table 5.6-1.

5.6.1. Design Requirements and Objectives

The key design requirements for the South Floor Leasable Spaces identified through the conditions assessment and stakeholder discussions include:

- Accommodate mutually beneficial uses that enhance rail travel and also complement the overall revitalization of the Broadway Corridor.
- Accommodate retail tenants with a draw beyond the convenience needs of train passengers.
- Reactivate the south hallway, currently used for storage and restroom access, with more active, public-facing uses.
- Maximize return on south Main floor leasable spaces to improve the long-term financial sustainability of Union Station.
- Improve access and security of this area as a lobby space for accessing upper floor leasable spaces.
- Provide a space that can be potentially used as an interim passenger waiting area, Amtrak operations support space, and/or temporary upper floor tenant accommodation during renovations of other portions Union Station.

5.6.2. South Main Floor Leasable Spaces Alternatives

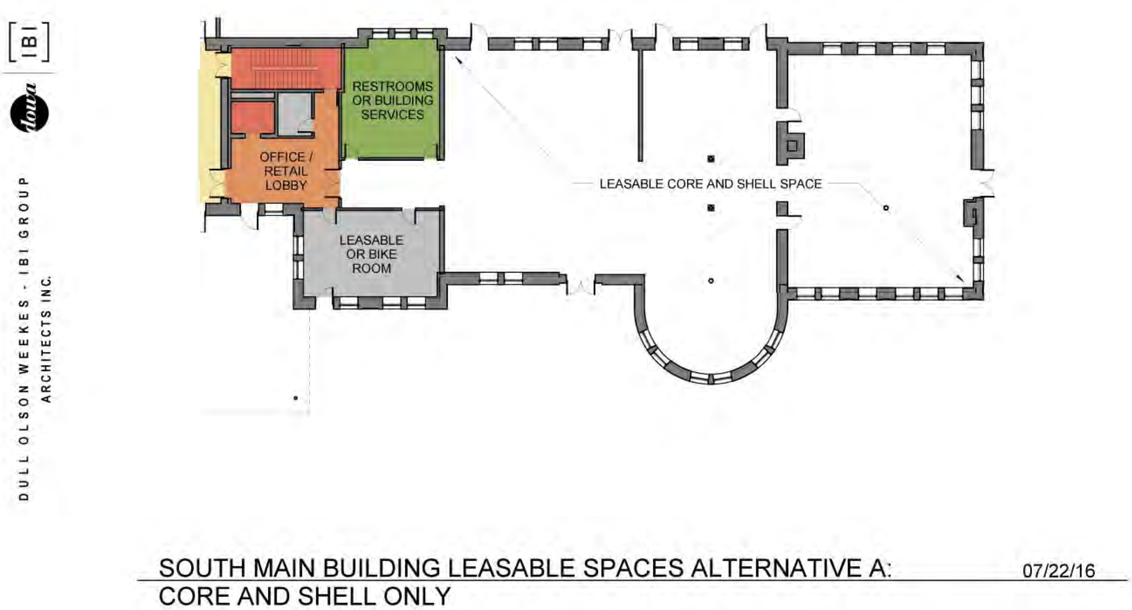
5.6.2.1 South Main Floor Leasable Spaces No-Build Alternative

Under the No-Build Alternative, the south main floor would remain in its current condition with regular maintenance but no capital investment. The south end of Union Station requires extensive structural/seismic retrofit and systems replacement. The south end of the main floor includes original wood flooring from the 1890s, as it was not replaced in the 1930s remodel like the majority of the north end main floor. A number of structural efficiencies and failures were identified in this area during the conditions assessment, from the foundations to the floors to the unreinforced concrete masonry building. Under the No-Build Alternative, there is no opportunity to restore the historic vitality of the south end hallway, which is currently closed off to the public. Repairing these deficiencies would require removal and replacement of the existing floors, finishes, and systems.

5.6.2.2 Alternative A: Core and Shell Only

This alternative would upgrade the south main floor leasable spaces to core and shell conditions following major structural, seismic, and systems work (Figure 5.6-1). Future tenant fit-out and configuration would be determined in the future, closer to the date of tenant occupancy. This retains the most flexibility for future use and changing market conditions, as well as providing a space for temporary use during construction.

Figure 5.6-1. South Main Floor Leasable Spaces Alternative A – Core and Shell Only

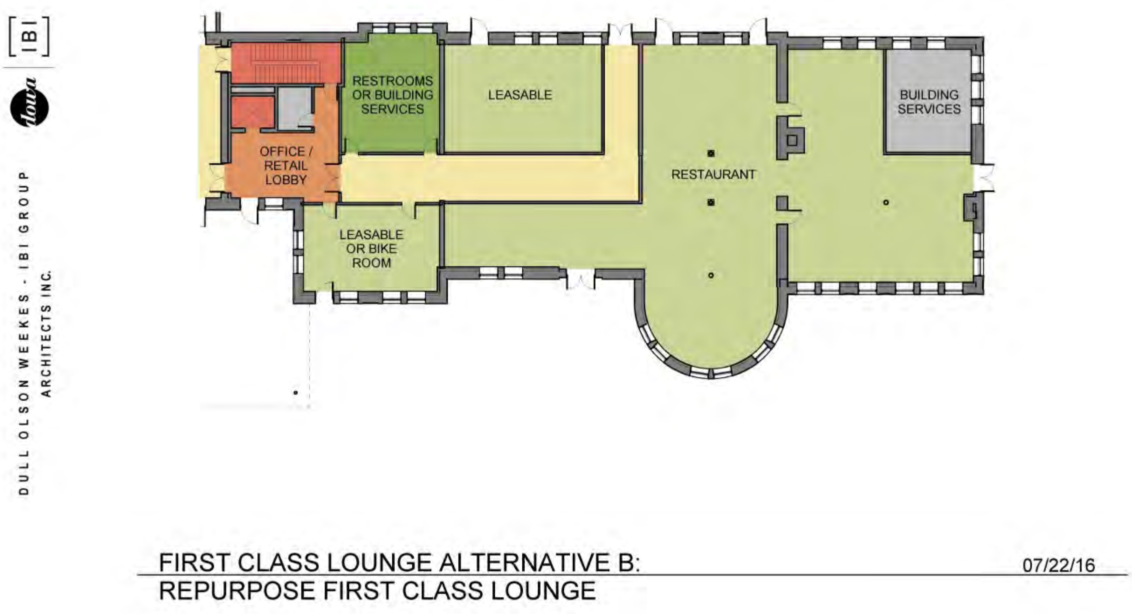


Source: IBI Group. 2016.

5.6.2.3 Alternative B: Restaurant

This alternative would re-create a restaurant space similar to the current use (Figure 5.6-2). The layout of the restaurant could be similar, but not identical, to the current layout, given the need to accommodate building upgrades, egress, accessibility, etc. It may be possible to re-create the entrance to the restaurant from the south hallway, recreating the manner in which the historic dining room was connected to the station prior to 1930. Existing historic finish materials in the current restaurant could potentially be preserved, repurposed, or relocated following the implementation of major building upgrades.

Figure 5.6-2. South Main Floor Leasable Spaces Alternative B - Restaurant

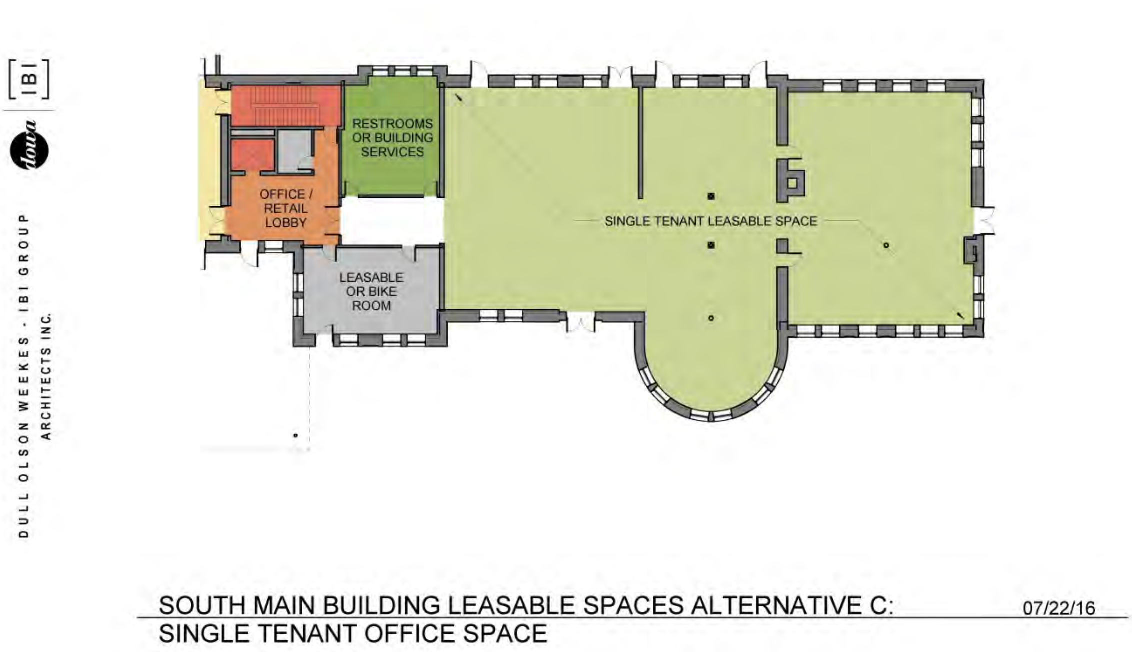


Source: IBI Group. 2016.

5.6.2.4 Alternative C: Single Tenant Office Space

This alternative would create a single floorplate to accommodate a single office tenant space on the main floor (Figure 5.6-3). Depending on the future tenant, this use may or may not provide benefit to rail passengers as a service or amenity. It would create a far larger contiguous leasable office space than currently exists on the upper floors of Union Station.

Figure 5.6-3. South Main Floor Leasable Spaces Alternative C – Single Tenant Office Space

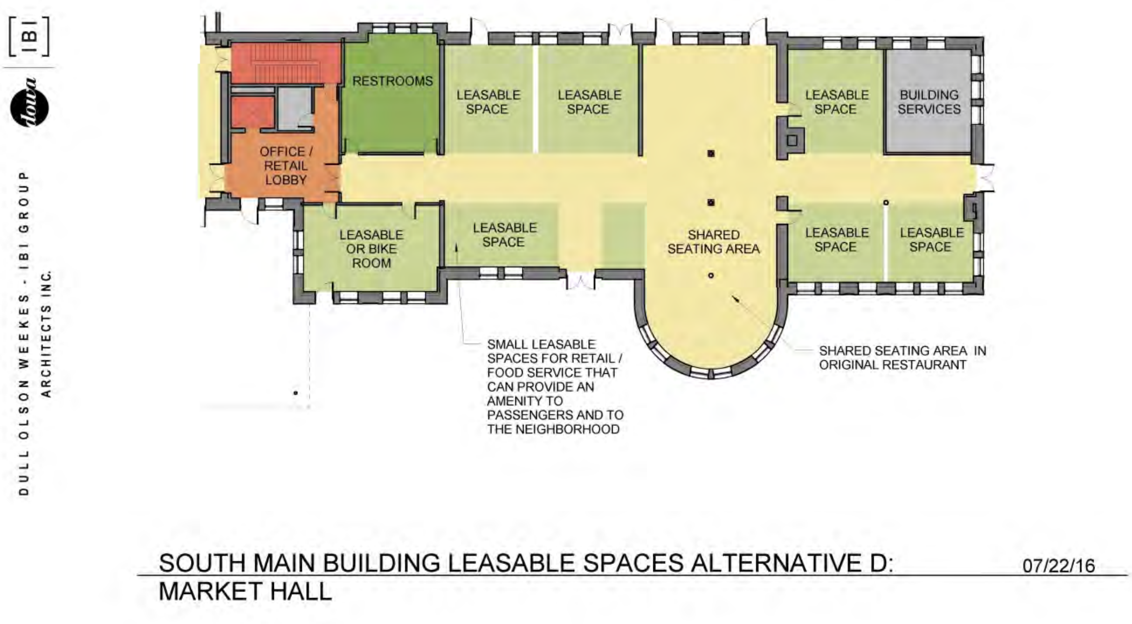


Source: IBI Group. 2016.

5.6.2.5 Alternative D: Market Hall

This alternative would create a "Market Hall" consisting of multiple retail and food service tenant stalls to create the feel of an active market (Figure 5.6-4). The Market Hall would include dining seating areas that could serve as supplemental waiting areas for rail passengers, while also providing a gathering spot and amenity for the surrounding, revitalizing Broadway Corridor. The Market Hall would be aligned along the footprint of the existing south hallway, which would continue as an open corridor through to the south end of the building. There is an opportunity to provide a new exterior egress to a future Annex Plaza at the south end. Access control to the Market Hall could be provided to limit access to the public outside of business hours by using doors or partitions near the proposed upper floor tenant lobby space. However, the overall design objective would be to provide an inviting, continuous corridor from the south concourse to encourage interaction between the Market Hall and the passenger concourses. This could include an extension of Market Hall style amenities into the south concourse area. The economic vitality of a Market Hall use would likely require substantial foot traffic from the adjacent neighborhood in addition to rail passengers, tenants, and visitors.

Figure 5.6-4. South Main Floor Leasable Spaces Alternative D – Market Hall



Source: IBI Group. 2016.

5.6.3. Recommendation: South Main Floor Leasable Spaces

The project team recommends implementing the core and shell only option (Alternative A) (Figure 5.6-1).The decision about the highest and best use of this space will depend on future market conditions closer to the completion of construction, which is anticipated to be up to five or more years into the future. During this time, market conditions are expected to evolve significantly in the Broadway Corridor, particularly with the potential redevelopment of the nearby U.S. Post Office site and other parcels in the immediate vicinity.

The core and shell improvement (Alternative A) would accommodate any of the three re-use scenarios presented in Alternatives B through D. Restaurant and/or retail is the preferred re-use option, consistent with the historic uses of the south end of the building as a restaurant and dining hall, and the historical presence of other public services along the south hallway (e.g. barber shop). The refurbishments of this area of the building would require replacement of the floor structure, potential modifications to the ceiling structure, and seismic retrofits of the interior and exterior walls. Code and accessibility requirements would likely result in modification to the existing configuration of interior spaces. The re-designed south floor leasable spaces would incorporate elements of the historic corridor to the extent practical.

Table 5.6-1. Evaluation of South Main Floor Leasable Spaces Alternatives

Evaluation Criteria		No-Build	A	Core and Shell Only	B	Restaurant	C	Single Tenant: Business Incubator	D	Market Hall
A: Ability to Meet Project Goals										
A.1. Accommodate Future Capacity and Operational Needs of Passenger and Freight Rail	◆	Lost opportunity to provide improved amenities to enhance rail passenger experience.	●	Preserves opportunity to incorporate future passenger amenities.	●	Preserves restaurant function as an existing amenity	◆	Note likely to be a tenant that provides benefit to rail passengers	●	Provides expanded retail and food service options and seating as rail passenger amenities
A.2. Preserve and Protect the Historic Character of Union Station	◆	Historic characteristics of the building will continue to degrade over time. Severe structural issues in south end of the building remain unaddressed.	□	Future fit out of space will be determined in the future.	●	Consistent with historic restaurant/dining hall function	◆	Does not reflect historic passenger-facing uses of this part of the building	◆	Changes the historic use and footprint of the south end of the building.
A.3. Improve Economic and Social Vitality	◆	Leasability and occupancy of the station are anticipated to decline with increased deterioration of leasable spaces.	□	Future fit out of space will be determined in the future.	□	Vitality benefit from a single tenant would depend largely on the tenant. Likely little change from current activity levels.	◆	Not as supportive to neighborhood revitalization and Annex activation	●	Increased tenant variety with potentially greater integration with the surrounding neighborhood.
A.4. Improve Environmental Sustainability	◆	Old and inefficient building systems will remain in place.	●	Building systems and sustainability features will be upgraded to meet or exceed City standards	●	Building systems and sustainability features will be upgraded to meet or exceed City standards	●	Building systems and sustainability features will be upgraded to meet or exceed City standards	●	Building systems and sustainability features will be upgraded to meet or exceed City standards
B. Cost and Financing										
B.1. Estimated Capital Cost	◆	Capital costs deferred but likely to be higher in the future	□	Similar capital costs for all build alternatives (excluding tenant	□	Similar capital costs for all build alternatives (excluding tenant	□	Similar capital costs for all build alternatives (excluding tenant	□	Similar capital costs for all build alternatives (excluding tenant

Evaluation Criteria		No-Build	A	Core and Shell Only	B	Restaurant	C	Single Tenant: Business Incubator	D	Market Hall
				improvements)		improvements)		improvements)		improvements)
B.2. Lifecycle Cost Impacts	◆	Higher building O&M costs due to continued operation with older and less efficient systems	●	Potential new lease revenue to offset building operating costs. Improvement in building operational efficiency.	●	Potential new lease revenue to offset building operating costs. Improvement in building operational efficiency.	●	Potential new lease revenue to offset building operating costs. Improvement in building operational efficiency.	●	Potential new lease revenue to offset building operating costs. Improvement in building operational efficiency.
B.3. Cost Risk	◆	Higher risk of unanticipated repair costs due to continued operation with older and less efficient systems	□	Risks shared by future tenant	□	Risks shared by future tenant	□	Risks shared by future tenant	□	Risks shared by future tenant
B.4. Financial Leverage	◆	Funding improvements is likely to be more difficult as a future stand-alone project	●	Potential for new lease revenue generation/concessionaire financing to factor into project financing.	●	Potential for new lease revenue generation/concessionaire financing to factor into project financing.	●	Potential for new lease revenue generation/concessionaire financing to factor into project financing.	●	Potential for new lease revenue generation/concessionaire financing to factor into project financing.
C. Implementability and Constructability										
C.1. Technical Complexity and Constructability	□	N/A – No capital improvement project	●	Owner provides shell and core.	●	Owner provides shell and core.	●	Owner provides shell and core.	●	Owner provides shell and core.
C.2. Schedule and Schedule Risk	□	N/A – No capital improvement project	□	No unusual factors anticipated	□	No unusual factors anticipated	□	No unusual factors anticipated	□	
C.3. Construction Impact on Passenger and Freight Rail Operations	□	N/A – No capital improvement project	●	Potential use of south end of the building as a temporary passenger facility or rail operations area during construction.	●	Potential use of south end of the building as a temporary passenger facility or rail operations area during construction.	●	Potential use of south end of the building as a temporary passenger facility or rail operations area during construction.	●	Potential use of south end of the building as a temporary passenger facility or rail operations area during construction.
C.4. Construction Impact on Union	□	N/A – No capital improvement	◆	Negative impact on existing tenants	◆	Negative impact on existing tenants	◆	Negative impact on existing tenants	◆	Negative impact on existing tenants

Evaluation Criteria		No-Build	A	Core and Shell Only	B	Restaurant	C	Single Tenant: Business Incubator	D	Market Hall
Station Tenants		project		during substantial structural/seismic retrofit		during substantial structural/seismic retrofit		during substantial structural/seismic retrofit		during substantial structural/seismic retrofit
C.5. Phasing and Project Segmentation	☐	N/A – No capital improvement project	●	Fit-out of space can be delayed until after major renovations, based on market conditions	◆	Involves earlier commitment to tenant type, based on unknown future market conditions.	◆	Involves earlier commitment to tenant type, based on unknown future market conditions.	◆	Involves earlier commitment to tenant type, based on unknown future market conditions.
C.6. Risks, Assumptions and Unknowns	☐	N/A – No capital improvement project	◆	Existing structural condition of the building in this area poses risks to cost, scope, and schedule.	◆	Existing structural condition of the building in this area poses risks to cost, scope, and schedule.	◆	Existing structural condition of the building in this area poses risks to cost, scope, and schedule.	◆	Existing structural condition of the building in this area poses risks to cost, scope, and schedule.
D. Environmental Impacts and Approvals										
D.1. Environmental Impacts and Project Classification	◆	Continued degradation of historic elements will continue; may lead to eventual loss of resources	●	Historic portion of station remains vital part of passenger experience	●	Historic portion of station remains vital part of passenger experience consistent with historic use for food service	☐	Area repurposed/ reactivated but not part of rail passenger experience	●	Historic portion of station remains vital part of passenger experience consistent with historic use for food service
D.2. Historic Impacts and Approvals	◆	Historic spaces and materials will continue to degrade over time.	◆	Changes and preservation of south concourse will require historic consultations and approvals.	◆	Changes and preservation of south concourse will require historic consultations and approvals.	◆	Potentially most significant historic impacts that will need to be evaluated.	◆	Potentially most significant historic impacts that will need to be evaluated.
D.3. Decision Making and Approvals	◆	Project approvals and permitting may be hampered if code-mandated upgrades are not implemented	◆	Changes and preservation of south concourse will require historic consultations and approvals.	◆	Changes and preservation of south concourse will require historic consultations and approvals.	◆	Potentially most significant historic impacts that will need to be evaluated.	◆	Potentially most significant historic impacts that will need to be evaluated.

Source: IBI Group. 2016.

5.7. Upper Floor Leasable Spaces

This improvement would address the need to upgrade upper floor leasable spaces and supporting infrastructure due to deterioration and deficiencies that compromise the quality and leasability of upper floors. These improvements are intended to enhance the tenant/visitor experience, increase the quality and marketability of the second and third floor leasable spaces while respecting the historic character of the building.

The following alternatives were evaluated:

- The No-Build Alternative would leave upper floor leasable spaces as-is, without improvements.
- The Retain Existing Configuration and Floorplates of Leasable Spaces alternative would upgrade and refurbish upper floor leasable spaces, while keeping the floorplates of the existing rooms and hallways essentially intact.
- The Reconfigure Leasable Spaces to Create Larger Leasable Floorplates alternative creates larger floorplates for future tenants (core and shell) to accommodate a more diverse range of future office, creative, or other suitable tenants.

The results of the evaluation of the three alternatives are summarized in Table 5.7-1.

5.7.1. Design Requirements and Objectives

The key design requirements for the south floor leasable spaces identified through the conditions assessment and stakeholder discussions include:

- Addressing existing circulation, egress, and accessibility issues as stipulated by code requirements.
- Accommodating Amtrak regional office space needs, consolidated on the 2nd floor north and connected by vertical circulation to other Amtrak leasable spaces on the main floor directly below.
- Preserving and enhancing the integrity and character of the historic hallways.
- Addressing existing deficiencies in leasable tenant spaces (lighting, noise, vibration, HVAC, physical condition, etc.) that detract from the tenant experience and leasability of these spaces.
- Providing accessibility to all areas of the upper floors as required by current code.
- Creating larger footplates to attract larger and more diverse tenants.
- Maximizing return on upper floor leasable space to improve the long-term financial vitality of Union Station.
- Accommodate building support, mechanical, electrical, and telecommunications support spaces to improve building operational efficiency and to service future tenant needs.

5.7.2. Upper Floor Leasable Spaces Alternatives

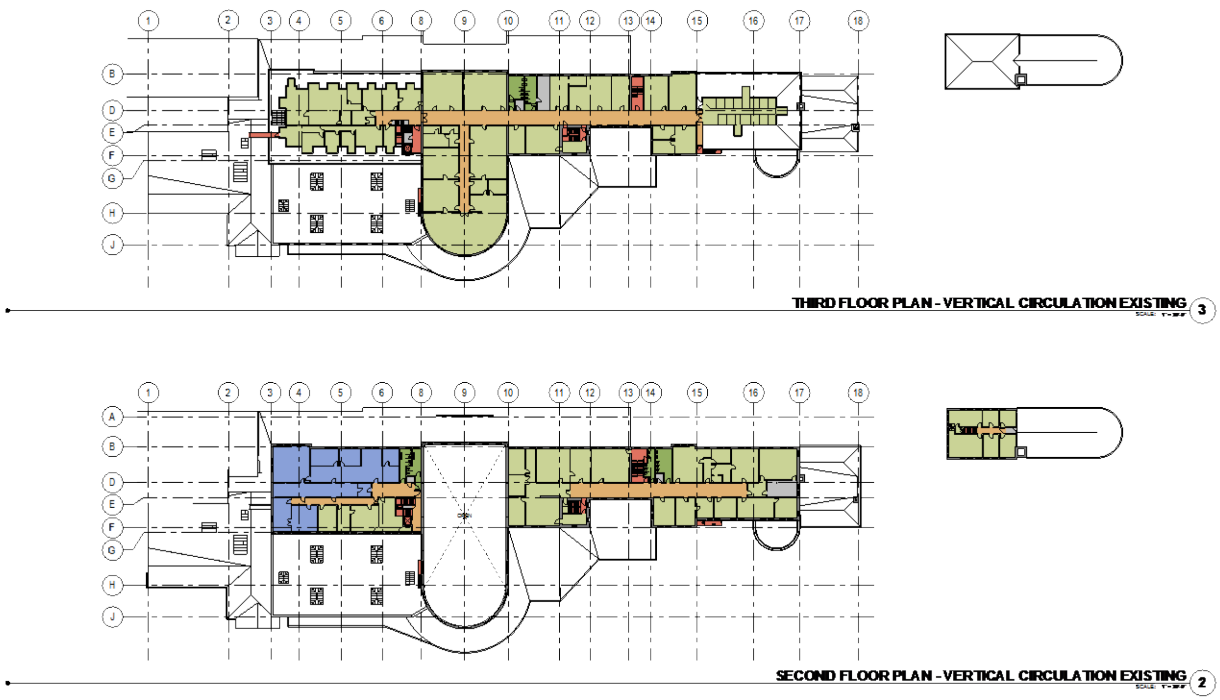
5.7.2.1 Upper Floor Leasable Spaces No-Build Alternative

Under the No-Build Alternative, the upper floor leasable spaces would remain in its current condition with regular maintenance but no capital investment. Like the main floor, the upper floors will require substantial intervention to address structural, seismic, code, accessibility, life safety, and mechanical/electrical/plumbing deficiencies identified in the conditions assessment. Some of these changes, including vertical circulation and egress, will require reconfiguration of building elements. Additionally, feedback from building tenants and operations personnel identified numerous existing deficiencies to leasable tenant spaces, including: noise/vibration from trains; inadequate power, lighting, and telecom; a lack of ventilation and climate control; obsolete restroom fixtures; a lack of accessibility; a lack of access control; and general degraded condition of materials and finishes. These challenges, as well as the small floorplate of existing offices, are causing increasing challenges for leasing spaces at market rates. The historic hallways have also been compromised by incremental changes over the years that degrade their character and appearance.

5.7.2.2 Alternative A: Retain Existing Configuration and Floorplates of Leasable Spaces

This alternative would maintain the existing footplate and tenant leasable spaces as is, following the implementation of core building (Figure 5.7-1). This new configuration would implemented by upgrading leasable areas to the core and shell stage following major structural, seismic, and mechanical improvements, with new partitions and tenant fit-out performed based on the needs of the future tenant. Historic finishes or casework within the tenant spaces themselves could potentially be preserved, reused, or relocated. In this alternative, the dead-end 'T' hallway on the second floor will likely need to be shortened to meet current code requirements.

Figure 5.5-1. Upper Floor Leasable Spaces Alternative A - Retain Existing Configuration and Floorplates of Leasable Spaces

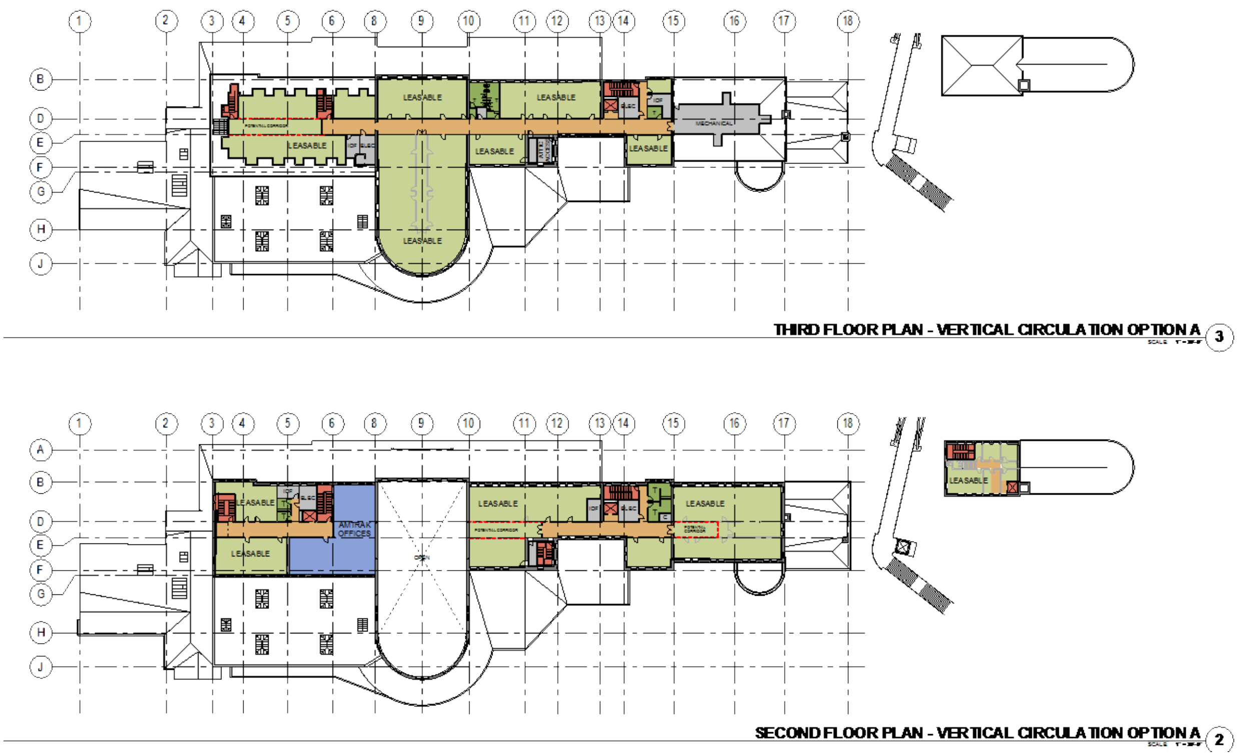


Source: IBI Group. 2016.

5.7.2.3 Alternative B: Reconfigure Leasable Spaces to Create Larger Leasable Floorplates

This alternative would create larger floorplates for future tenants (core and shell) to accommodate a more diverse range of future office, creative, or other suitable tenants (Figure 5.7-2). The objective is to improve overall vitality and marketability of these spaces. This new configuration would implemented by upgrading leasable areas to the core and shell stage following major structural, seismic, and mechanical improvements, with new partitions and tenant fit-out performed based on the needs of the future tenant. Care would be taken to preserve the finishes and door openings of the existing historic hallway, even if some doors become inoperable in the future. Also, historic finishes or casework within the tenant spaces themselves could potentially be preserved, reused, or relocated. As with Alternative A, the dead-end 'T' hallway on the second floor would likely need to be shortened to meet current code requirements, though it could also be eliminated entirely to create an even larger contiguous leasable footplate.

Figure 5.5-2. Upper Floor Leasable Spaces Alternative B - Reconfigure Leasable Spaces to Create Larger Leasable Floorplates



Source: IBI Group. 2016.

5.7.3. Recommendation: Upper Floor Leasable Spaces

The preferred alternative is to reconfigure leasable spaces to create larger floorplates (Alternative B) (Figure 5.7-2). With this alternative, PDC will preserve the existing character, footprint, and materials of the existing historic corridors, while creating larger footprint leasable spaces that are more financially viable. In the near term, it is expected that leasable spaces will be rehabilitated to a core and shell level following major structural, systems, and vertical circulation improvements. This will maintain flexibility for tenant fit-out in the future. On a case-by-case basis, historic materials and features of leasable areas (e.g. casework, finishes) will be preserved and/or relocated.

Table 5.7-1. Evaluation of Upper Floor Leasable Spaces Alternatives

Evaluation Criteria		No-Build	A	Retain Existing Configuration and Floorplates of Leasable Spaces	B	Reconfigure Leasable Spaces to Create Larger Leasable Floorplates
A: Ability to Meet Project Goals						
A.1. Accommodate Future Capacity and Operational Needs of Passenger and Freight Rail	◆	No improvements to Amtrak second floor office spaces	●	Improves Amtrak second floor office spaces to better meet current and future needs	●	Improves Amtrak second floor office spaces to better meet current and future needs
A.2. Preserve and Protect the Historic Character of Union Station	◆	Historic characteristics of the building will continue to degrade over time.	●	Preserves historic features and materials while increasing station vitality.	●	Preserves historic features and materials while increasing station vitality.
A.3. Improve Economic and Social Vitality	◆	Leasability and occupancy of the station are anticipated to decline with increased deterioration of leasable spaces.	●	Improves reactivation opportunities and long term financial sustainability of the station	●	Maximizes reactivation opportunities and long term financial sustainability of the station
A.4. Improve Environmental Sustainability	◆	Old and inefficient building systems will remain in place.	●	Building systems and sustainability features will be upgraded to meet or exceed City standards	●	Building systems and sustainability features will be upgraded to meet or exceed City standards
B. Cost and Financing						
B.1. Estimated Capital Cost	◆	Capital costs deferred but likely to be higher in the future	□	Comparable costs anticipated for major building upgrades irrespective of final footprint configuration.	□	Comparable costs anticipated for major building upgrades irrespective of final footprint configuration.
B.2. Lifecycle Cost Impacts	◆	Operating and maintenance costs of failing and obsolete building systems will remain.	●	Building systems will be upgraded, reducing lifecycle costs and unanticipated repairs.	●	Building systems will be upgraded, reducing lifecycle costs and unanticipated repairs.
B.3. Cost Risk	◆	Unanticipated system failures are a cost risk that is difficult to estimate and manage.	●	Building systems will be upgraded, reducing lifecycle costs and unanticipated repairs.	●	Building systems will be upgraded, reducing lifecycle costs and unanticipated repairs.
B.4. Financial Leverage	◆	Funding improvements is likely to be more difficult as a future stand-alone project	●	Increased funding potential as part of a multifaceted renovation project.	●	Increased funding potential as part of a multifaceted renovation project.
C. Implementability and Constructability						
C.1. Technical Complexity and	□	N/A – No capital improvement	□	No unusual factors anticipated	●	Greater flexibility in incorporating

Evaluation Criteria		No-Build	A	Retain Existing Configuration and Floorplates of Leasable Spaces	B	Reconfigure Leasable Spaces to Create Larger Leasable Floorplates
Constructability		project				core building improvements and programmatic changes if the leasable space footplates can be modified.
C.2. Schedule and Schedule Risk	☐	N/A – No capital improvement project	☐	No unusual factors anticipated	☐	No unusual factors anticipated
C.3. Construction Impact on Passenger and Freight Rail Operations	☐	N/A – No capital improvement project	☐	Temporary relocation of Amtrak upper floor offices required.	☐	Temporary relocation of Amtrak upper floor offices required.
C.4. Construction Impact on Union Station Tenants	☐	N/A – No capital improvement project	◆	All build options will have a detrimental near-term impact on tenants during the construction phase, requiring temporary relocation.	◆	All build options will have a detrimental near-term impact on tenants during the construction phase, requiring temporary relocation.
C.5. Phasing and Project Segmentation	☐	N/A – No capital improvement project	☐	Upgrades will occur after core building systems work (structural/seismic and building systems)	☐	Upgrades will occur after core building systems work (structural/seismic and building systems)
C.6. Risks, Assumptions and Unknowns	☐	N/A – No capital improvement project	☐	The ability to preserve and replace historic finishes following construction is anticipated, but represents a risk.	☐	The ability to preserve and replace historic finishes following construction is anticipated, but represents a risk.
D. Environmental Impacts and Approvals						
D.1. Environmental Impacts and Project Classification	◆	Continued degradation of historic elements will continue; may lead to eventual loss of resources	●	Historic materials and building features will be preserved and enhanced as part of the renovation.	●	Historic materials and building features will be preserved and enhanced as part of the renovation.
D.2. Historic Impacts and Approvals	◆	Historic spaces and materials will continue to degrade over time.	●	Historic materials and building features will be preserved and enhanced as part of the renovation.	●	Historic materials and building features will be preserved and enhanced as part of the renovation.
D.3. Decision Making and Approvals	◆	Project approvals and permitting may be hampered if code-mandated upgrades are not implemented	☐	Will require consultations to ensure that proposed changes are compatible with historic character of critical elements of the upper	●	Allows future decisions on programming of leasable spaces to be deferred to reflect market conditions closer to the completion

Evaluation Criteria	No-Build	A	Retain Existing Configuration and Floorplates of Leasable Spaces	B	Reconfigure Leasable Spaces to Create Larger Leasable Floorplates
			floors (e.g. hallways).		of construction. Will likely require additional consultations to ensure that proposed changes are compatible with historic character of critical elements of the upper floors (e.g. hallways).

Source: IBI Group. 2016.

5.8. Nursery

This improvement would address structural and deterioration issues in the 1940s nursery addition which, because of deterioration and deficiencies, is currently not occupied.

5.8.1. Design Requirements and Objectives

The key design requirements for the Nursery identified through the conditions assessment and stakeholder discussions include:

- Preserve, repurpose, or remove the nursery given its current non-habitable condition and degradation.
- Prevent damage to the main building through incursion of water or mold leaking through the nursery.

5.8.2. Nursery Alternatives

The following alternatives were evaluated:

- The No-Build Alternative would leave the nursery as-is, and it would continue to be left unoccupied in its current degraded condition.
- The Rehabilitate Nursery alternative would preserve the existing nursery building and complete necessary upgrades and refurbishments to restore it to a condition where it could be occupied.
- The Remove Nursery alternative would demolish the Nursery building (and restored the original building wall).
- The Replace Nursery Building would demolish and reconstruct the Nursery building as a new structure.

The results of the evaluation of the four alternatives are summarized in Table 5.8-1.

5.8.2.1 Nursery No-Build Alternative

Under the No-Build Alternative, the nursery would remain in its current condition and without regular maintenance or capital investment because of the health and safety risks associated with its current condition (Figure 5.8-1). The nursery is currently not occupied given its current condition and would continue to be unoccupied because of the health and safety risks. The nursery would continue to have seismic, structural, life safety, accessibility, and mechanical deficiencies, similar to the remainder of the building. Failure to remedy these conditions would result in continued deterioration and non-occupancy.

Figure 5.8-1. Existing Nursery

Source: IBI Group. 2016.

5.8.2.2 Alternative A: Rehabilitate Nursery

Under Alternative A, the nursery building would be repaired and seismically strengthened in line with current codes and requirements. The location of the structure on the trackside of the building suggests that a building/tenant support space or storage would be the most likely re-use of the space.

5.8.2.3 Alternative B: Remove Nursery

Under Alternative B, the nursery building would be removed and necessary repairs to the adjacent main building exterior wall would be made.

5.8.2.4 Alternative C: Replace Nursery Building

This alternative would replace the existing nursery building with a new structure of similar size and construction, consistent with modern code requirements and using new materials. As with the rehabilitation option, the location of the structure on the trackside of the building suggests that a building/tenant support space or storage would be the most likely re-use of the space.

5.8.3. Recommendation: Nursery

The project team recommends removing the nursery building (Alternative B). The nursery building is in poor physical and seismic condition, is currently unused, and cannot be occupied in its current state. Damage due to water and mold has compromised the structure, which risks damaging the main structure. The trackside location behind the Amtrak security control line limits the re-use options and potential future public access to any rehabilitated or reconstructed space. In order to preserve the legacy of the WWII era nursery, an interpretive display of the history of Union Station during WWII in a more public area of Union Station could be considered.

Table 5.8-1. Evaluation of Nursery Alternatives

Evaluation Criteria		No-Build	A	Rehabilitate Nursery	B	Replace Nursery Building	C	Remove Nursery Building
A: Ability to Meet Project Goals								
A.1. Accommodate Future Capacity and Operational Needs of Passenger and Freight Rail	□	Nursery not use for rail operations	□	Nursery not use for rail operations	□	Nursery not use for rail operations	□	Nursery not use for rail operations
A.2. Preserve and Protect the Historic Character of Union Station	◆	Historic characteristics of the building will continue to degrade over time	●	Preserves historic nursery and restores it to a state that can be occupied	●	Incorporates a facsimile of the historic nursery that can be occupied	◆	Removes historic resource
A.3. Improve Economic and Social Vitality	◆	Leasability and occupancy of the station are anticipated to decline with increased deterioration of leasable spaces	□	Future beneficial use of the Nursery has not been determined - potential storage or rail/operations support space is likely	□	Future beneficial use of the Nursery has not been determined - potential storage or rail/operations support space is likely	◆	Does not contribute to building or neighborhood revitalization
A.4. Improve Environmental Sustainability	◆	Old and inefficient building systems will remain in place	●	Building systems and sustainability features will be upgraded to meet or exceed City standards	●	Building systems and sustainability features will be upgraded to meet or exceed City standards	□	Neutral impact
B. Cost and Financing								
B.1. Estimated Capital Cost	◆	Capital costs deferred but likely to be higher in the future	□	Comparable among build alternatives	□	Comparable among build alternatives	□	Minimal costs for demolition and main building restoration.
B.2. Lifecycle Cost Impacts	◆	Likely need for future emergency repairs to prevent further degradation and damage to the main building; overhead cost without potential for lease revenue.	●	Eliminates emergency maintenance repair liability and upgrades systems to high efficiency. Nursery becomes potential leasable space.	●	Eliminates emergency maintenance repair liability and upgrades systems to high efficiency. Nursery becomes potential leasable space.	●	Eliminates future O&M costs
B.3. Cost Risk	◆	Likely need for future emergency repairs to	●	Eliminates emergency maintenance repair	●	Eliminates emergency maintenance repair liability	●	Eliminates future O&M costs

Evaluation Criteria		No-Build	A	Rehabilitate Nursery	B	Replace Nursery Building	C	Remove Nursery Building
		prevent further degradation and damage to the main building.		liability and upgrades systems to high efficiency. Nursery becomes potential leasable space.		and upgrades systems to high efficiency. Nursery becomes potential leasable space.		
B.4. Financial Leverage	◆	Funding improvements is likely to be more difficult as a future stand-alone project	●	Increased funding potential as part of a multifaceted renovation project.	●	Increased funding potential as part of a multifaceted renovation project.	●	Increased funding potential as part of a multifaceted renovation project.
C. Implementability and Constructability								
C.1. Technical Complexity and Constructability	□	N/A – No capital improvement project	□	Minimal scope and complexity of work in an very limited area of the project site	□	Minimal scope and complexity of work in an very limited area of the project site	□	Minimal scope and complexity of work in an very limited area of the project site
C.2. Schedule and Schedule Risk	□	N/A – No capital improvement project	□	No unusual factors anticipated	□	No unusual factors anticipated	□	No unusual factors anticipated
C.3. Construction Impact on Passenger and Freight Rail Operations	□	N/A – No capital improvement project	□	Minimal impact given localized area	□	Minimal impact given localized area	□	Minimal impact given localized area
C.4. Construction Impact on Union Station Tenants	□	N/A – No capital improvement project	□	Minimal impact given localized area	□	Minimal impact given localized area	□	Minimal impact given localized area
C.5. Phasing and Project Segmentation	□	N/A – No capital improvement project	□	No unusual factors anticipated	□	No unusual factors anticipated	□	No unusual factors anticipated
C.6. Risks, Assumptions and Unknowns	□	N/A – No capital improvement project	□	No unusual factors anticipated	□	No unusual factors anticipated	□	No unusual factors anticipated
D. Environmental Impacts and Approvals								
D.1. Environmental Impacts and Project Classification	◆	Continued degradation of historic elements will continue; may lead to eventual loss of resources	●	Retains historic resource	◆	Involves permanent loss of historic resource but retains a replacement structure	◆	Involves permanent loss of historic resource
D.2. Historic Impacts and Approvals	◆	Historic spaces and materials will continue to degrade	□	Rehabilitation will require historic consultations and	□	New design will require historic consultations and	◆	Highest potential historical impact. Potential to incorporate interpretive

Evaluation Criteria		No-Build	A	Rehabilitate Nursery	B	Replace Nursery Building	C	Remove Nursery Building
		over time.		approval		approval		exhibits as a mitigating measure.
D.3. Decision Making and Approvals	◆	Project approvals and permitting may be hampered if code-mandated upgrades are not implemented	□	Rehabilitation will require historic consultations and approval	□	New design will require historic consultations and approval	◆	Highest potential historical impact. Potential to incorporate interpretive exhibits as a mitigating measure.

Source: IBI Group. 2016.

5.9. Structural/Seismic Improvements

The core building improvements address a number of issues including structural/seismic deficiencies that were identified through the conditions assessment. Mandatory seismic improvements are triggered by the City of Portland code based on project construction value.

5.9.1. Structural/Seismic Alternatives

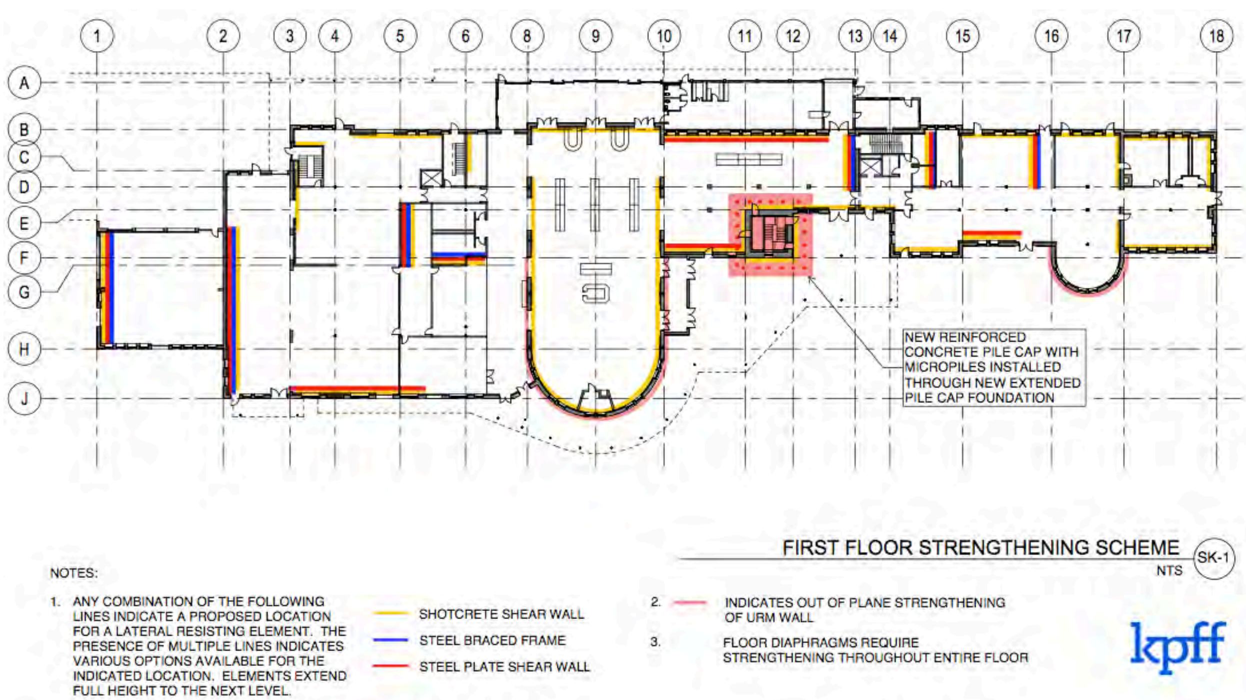
The structural alternatives are presented in the following discussion by sub-element:

- Main Building Seismic Strengthening Alternatives
- Diaphragm Alternatives
- Out-of-Plane Strengthening Alternatives
- Tower URM Strengthening Alternatives
- Tower Overturning Resistance Alternatives
- Main Building Chimneys

The complete package of structural/seismic improvements is illustrated in Figures 5.9-1 through 5.9-3. The recommended improvements discussed in the sections below represent a hybrid of strategies based on specific architectural and structural engineering considerations for each element of the building. For lateral elements of the building (walls), the range of feasible technical approaches are illustrated for each wall section. In most locations, a preferred option is feasible (reinforced concrete (shotcrete) shear walls), but there are exceptions and options that need to be evaluated in preliminary design on a case-by-case basis.

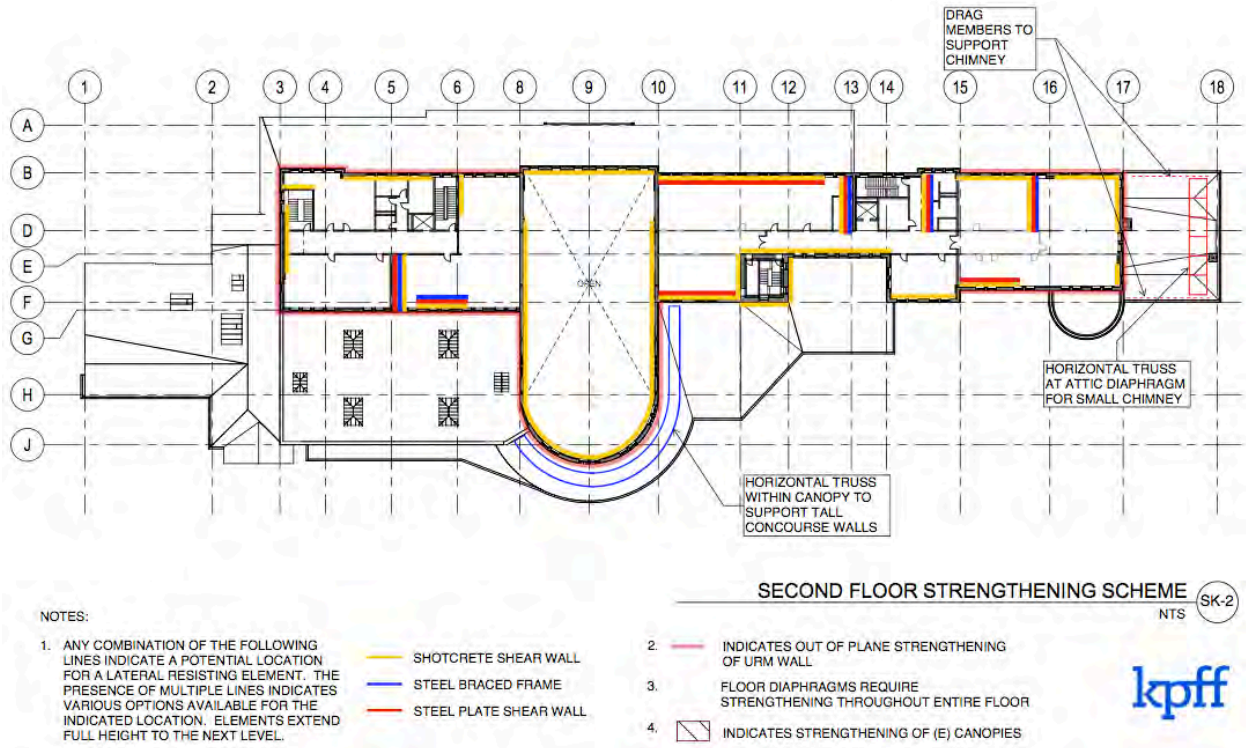
Design decisions on related components (e.g., location and framing of vertical circulation elements) may ultimately influence the preferred structural/seismic approach.

Figure 5.9-1. Structural / Seismic Alternatives 1st Floor



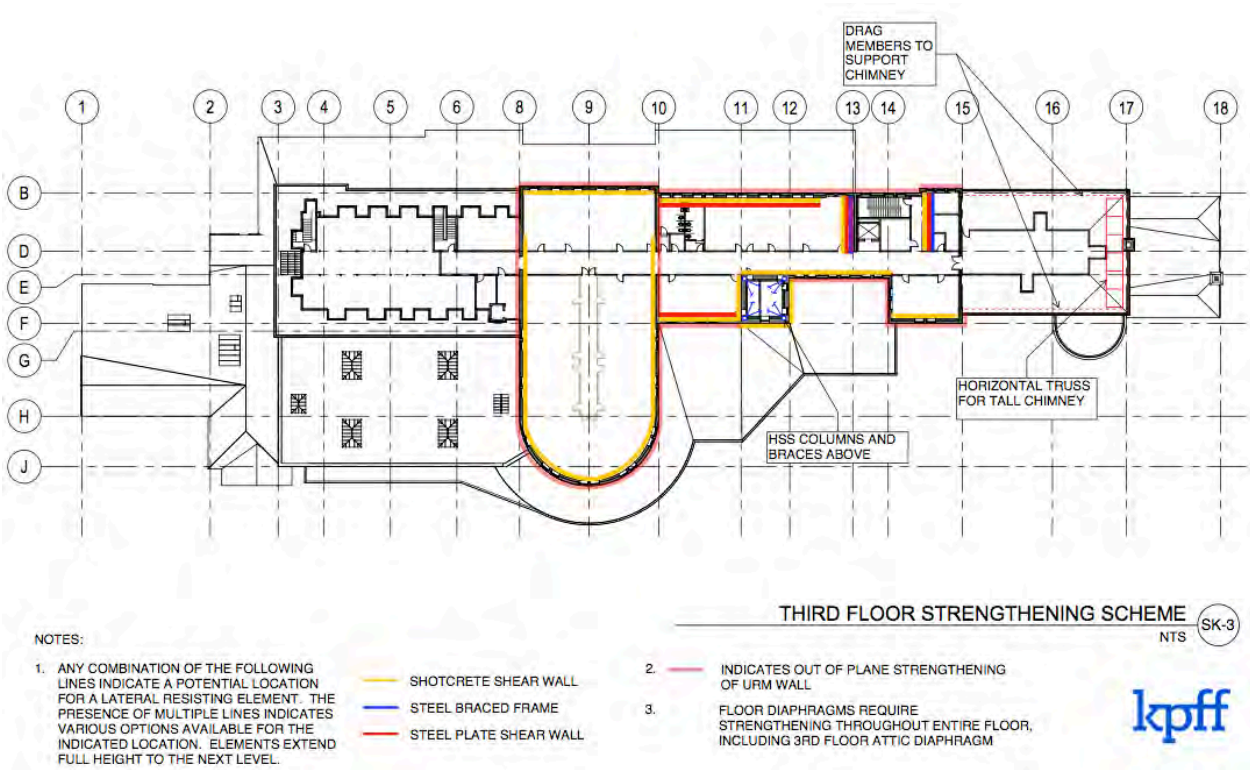
Source: KPFF. 2016.

Figure 5.9-2. Structural / Seismic Alternatives 2nd Floor



Source: KPFF. 2016.

Figure 5.9-3. Structural / Seismic Alternatives 3rd Floor



Source: KPFF. 2016.

5.9.2. Structural/Seismic No-Build Alternative

Under the No-Build Alternative, the Union Station building would remain in its current structural and seismic condition with regular maintenance but no capital investment. Existing structural elements are in a degraded state and were designed well before current seismic hazards were identified. A major seismic event could result in a catastrophic failure of the existing unreinforced masonry structure, with significant risk of loss of life. Deterioration of the structure due to age is evident in cracked foundations, sloping floors, and concrete slabs where the underlying fill has been scoured away. Furthermore, current code requires certain structural/seismic upgrades to accommodate a change in occupancy. Failure to implement these changes would restrict the alternatives for re-use and revitalization of leasable areas of the station.

5.9.3. Main Building Seismic Strengthening Improvements

The following alternatives were evaluated:

- The No-Build Alternative retains the unreinforced building diaphragm as-is, without improvement to the seismic condition or reduction in safety hazard to building occupants due to seismic forces (see Section 5.9.2).
- The Reinforced Concrete Shear Walls alternative affixes a layer of reinforced concrete to the interior side of unreinforced masonry walls to provide necessary seismic reinforcement.
- The Steel Braced Frames alternative uses structural steel in truss configurations located to the inside of unreinforced masonry walls to provide necessary seismic reinforcement.
- The Steel Plate Shear Walls alternative inserts steel plates against unreinforced masonry walls in the main building to provide necessary seismic reinforcement.

The results of the evaluation of the four alternatives are summarized in Table 5.9-1.

5.9.3.1 Design Requirements and Objectives

The key design requirements for the main building strengthening alternatives identified through the conditions assessment and stakeholder discussions include:

- Strengthen unreinforced masonry interior and exterior walls in the main building to meet current seismic codes.
- Address structural degradation identified in the conditions assessment.
- Minimize permanent visual impact of structural retrofits on historic spaces and materials.

5.9.3.2 Main Building Seismic Strengthening Alternatives

5.9.3.2.1. Alternative A: Reinforced Concrete Shear Walls

Under Alternative A reinforced concrete shear walls would be added to the existing structure to provide adequate lateral resistance to the structure and stiffness to resist deformations that would prevent damage to the existing structure. A portion of the new shear walls would be added adjacent to the existing brick walls of the structure while others can be positioned around the new programming of the station and hidden within new walls (around stair/elevator shafts for example). These walls would be very simple and quick to construct and can easily be concealed within architectural features. Where the new walls are added adjacent to existing brick walls, the walls would get thicker. This added thickness can be hidden within architectural features to disguise the increased thickness.

5.9.3.2.2. Alternative B: Steel Braced Frames

Under Alternative B steel braced frames would be used and would require more strengthening locations than the reinforced concrete walls. Braced frames have less stiffness than reinforced concrete walls and as a result more locations would need to be used to prevent damage to the existing structure. Additionally, braced frames work well on the interior of the station, but do not fit well within the configuration of the exterior walls of the station. If braced frames are used along the exterior walls of the station, the braces would likely block some of the windows. Construction of the steel braced frames would be more difficult than the reinforced concrete shear walls. The new lateral elements have to be continuous from the top of the structure all the way to the ground. Aligning columns up the height of the structure while working around the existing floor would be difficult and would not be as flexible as reinforced concrete shear walls.

5.9.3.2.3. Alternative C: Steel Plate Shear Walls

Under Alternative C steel plate shear walls would be used to strengthen the structure. The current programming of Union Station would not allow for steel plate shear walls to be used in their optimum configuration. Steel plate shear walls would be an option for interior locations that could work around the new programming, but the exterior walls of the structure have a lot of windows which would be blocked by the use of steel plate shear walls. Steel plate shear walls also require a large amount of welding which is difficult within the station due to the large amount of existing wood construction.

5.9.3.3 Recommendation: Main Building Seismic Strengthening

The project team recommends implementing reinforced concrete shear walls (Alternative A) because, overall, it would be the most efficient option for strengthening the existing station. Reinforced concrete shear walls would provide the most flexibility in layout and would be the easiest to enclose in architectural features so as to avoid a significant impact on the overall appearance of the station. Reinforced concrete walls also provide the greatest amount of stiffness and would limit the amount of work to brace architectural features. There are some locations in the interior of the building near new stair/elevator cores where the recommended option between a braced frame and a concrete shear wall would be determined during the design process. This decision would consider cost, constructability and space planning based on the final stair/elevator core locations.

Table 5.9-1. Evaluation of Main Building Seismic Strengthening Alternatives

Evaluation Criteria		No-Build	A	Reinforced Concrete Shear Walls	B	Steel Braced Frames	C	Steel Plate Shear Walls
A: Ability to Meet Project Goals								
A.1. Accommodate Future Capacity and Operational Needs of Passenger and Freight Rail	◆	Existing structural deficiencies and seismic hazards will persist.	●	Addresses existing deficiencies and life safety risks	●	Addresses existing deficiencies and life safety risks	●	Addresses existing deficiencies and life safety risks
A.2. Preserve and Protect the Historic Character of Union Station	◆	Degraded structural condition and risk of seismic failure will persist.	●	Reinforced concrete shear walls can fit around existing windows and doorways allowing the majority of the station to remain intact. Reinforced walls will be thicker than the original URM walls, but this option will have the smallest increase in thickness after applying finishes.	◆	Braced frames used at the exterior of the structure will block some window openings. Additionally, furring required to cover the braced frames will increase the overall thickness of existing walls.	◆	In their most efficient configuration, steel plate shear walls will have a significant impact on the current configuration of the station. Large columns and beams are required for steel plate shear walls and the furring to conceal the frames will have a significant impact on the station.
A.3. Improve Economic and Social Vitality	◆	Lack of structural/seismic upgrades limits the ability to reactivate and change occupancies due to code requirements.	●	Addresses existing deficiencies and life safety risks to support revitalization	●	Addresses existing deficiencies and life safety risks to support revitalization	●	Addresses existing deficiencies and life safety risks to support revitalization
A.4. Improve Environmental Sustainability	☐	Minimal impact	☐	Minimal impact anticipated	☐	Minimal impact anticipated	☐	Minimal impact anticipated
B. Cost and Financing								
B.1. Estimated Capital Cost	◆	Likely to be higher in future with deferred action	☐	Comparable among build alternatives	☐	Comparable among build alternatives	☐	Comparable among build alternatives
B.2. Lifecycle Cost Impacts	◆	Likely to increase due to emergency repairs and failures	☐	Comparable among build alternatives	☐	Comparable among build alternatives	☐	Comparable among build alternatives
B.3. Cost Risk	◆	There is a greater risk of unanticipated costs due to	☐	Comparable among build alternatives	☐	Comparable among build alternatives	☐	Comparable among build alternatives

Evaluation Criteria		No-Build	A	Reinforced Concrete Shear Walls	B	Steel Braced Frames	C	Steel Plate Shear Walls
		emergency repairs, failures, or seismic events						
B.4. Financial Leverage	◆	Funding structural/seismic upgrades is likely to be more difficult as a future stand-alone project	●	Increased funding potential as part of a multifaceted renovation project.	●	Increased funding potential as part of a multifaceted renovation project.	●	Increased funding potential as part of a multifaceted renovation project.
C. Implementability and Constructability								
C.1. Technical Complexity and Constructability	☐	N/A – No capital improvement project	●	Reinforced concrete shear walls are the simplest to construct of the three alternatives and minimizes overall construction by also bracing the URM walls out of plane.	●	Construction difficulty is similar to reinforced concrete shear walls but cannot be used for out of plane wall bracing.	◆	Steel plate shear walls require more specialized construction and are not effective for bracing the URM walls out of plane.
C.2. Schedule and Schedule Risk	☐	N/A – No capital improvement project	☐	Comparable among build alternatives	☐	Comparable among build alternatives	☐	Comparable among build alternatives
C.3. Construction Impact on Passenger and Freight Rail Operations	☐	N/A – No capital improvement project	●	Allows for phasing of construction with minimal impact on operations.	●	Allows for phasing of construction with minimal impact on operations.	●	Allows for phasing of construction with minimal impact on operations.
C.4. Construction Impact on Union Station Tenants	☐	N/A – No capital improvement project	●	Construction of reinforced concrete walls is the fastest of the three options and will have the smallest impact on tenants.	◆	Installation of columns, beams and braces can be difficult and may require re-design after demolition begins to accommodate unknown conditions. Welding will be required and will require a longer duration than typical welded construction due to wood diaphragms and other flammable materials in the station.	◆	Installation of columns and beams can be difficult and may require re-design after demolition begins to accommodate unknown conditions. A large amount of welding will be required and will require a longer duration than typical welded construction due to wood diaphragms and other flammable materials in the station.
C.5. Phasing and Project Segmentation	☐	N/A – No capital improvement project	●	Allows for phasing of construction with minimal impact on operations.	●	Allows for phasing of construction with minimal impact on operations.	●	Allows for phasing of construction with minimal impact on operations.
C.6. Risks, Assumptions	☐	N/A – No capital	●	Concrete shear walls allow	◆	Columns have much less	◆	The beams and columns of

Evaluation Criteria		No-Build	A	Reinforced Concrete Shear Walls	B	Steel Braced Frames	C	Steel Plate Shear Walls
and Unknowns		improvement project		for much more adaptability to unknown conditions. Alignment requirements are much less strict than the other systems.		tolerance in position than reinforced concrete walls. Placement of the columns, beams and braces are specific and it can be difficult to adapt to unforeseen conditions.		the steel plate shear walls have specific alignment requirements and have less adaptability to unknown conditions.
D. Environmental Impacts and Approvals								
D.1. Environmental Impacts and Project Classification	◆	Continued degradation of historic elements will continue; may lead to eventual loss of resources	●	Reduces life safety risk to building occupants	●	Reduces life safety risk to building occupants	●	Reduces life safety risk to building occupants
D.2. Historic Impacts and Approvals	◆	Historic spaces and materials will continue to degrade over time.	☐	Locations where the walls will be reinforced with concrete will require the walls increase in thickness, but will have a limited impact on the overall structure.	◆	Braced frames are not an option in the main concourse without a major impact on the marble paneling.	☐	Locations where the walls will be contain steel plate shear walls will require the walls to increase in thickness, but will have a limited impact on the overall structure.
D.3. Decision Making and Approvals	◆	Project approvals and permitting may be hampered if code-mandated upgrades are not implemented	☐	No unusual factors anticipated	☐	No unusual factors anticipated	☐	No unusual factors anticipated

Source: IBI Group. 2016.

5.9.4. Diaphragm Improvements

This improvement provides resistance to seismic forces in the horizontal diaphragms of the main building, addressing a deficiency identified in the conditions assessment.

The following alternatives were evaluated:

- The No-Build Alternative retains the unreinforced building diaphragm as-is, without improvement to the seismic condition or reduction in safety hazard to building occupants due to seismic forces (see Section 5.9.2).
- The Plywood Sheathing alternative uses a plywood layer inserted above or below the existing framing members to provide the necessary seismic resistance.
- The Horizontal Steel Truss alternative inserts structural steel framing at floor/ceiling levels to provide the necessary seismic resistance.

The results of the evaluation of the three alternatives are summarized in Table 5.9-2.

5.9.4.1 Design Requirements and Objectives

The key design requirements for the Diaphragm improvement alternatives identified through the conditions assessment and stakeholder discussions include:

- Strengthen unreinforced masonry interior and exterior walls in the horizontal building diagram to meet current seismic codes.
- Address floor sloping and other structural deficiencies identified in the conditions assessment.
- Minimize permanent visual impact of structural retrofits on historic spaces and materials.

5.9.4.2 Diaphragm Alternatives

5.9.4.2.1. Alternative A: Plywood Sheathing Above/Below Existing Wood Floor Framing

Under Alternative A plywood sheathing would be added above or below the existing diaphragm, which would provide a lot of flexibility for strengthening the diaphragm of the station. In areas where the existing floor finish cannot be disturbed, the plywood sheathing can be added beneath the floor. When the ceiling finish needs to be preserved, the sheathing can be placed on top of the existing floor.

5.9.4.2.2. Alternative B: Horizontal Steel Truss

Under Alternative B the horizontal steel truss floor diaphragm system would be added beneath the existing floor diaphragm and would require the existing ceiling to get significantly lower to accommodate the new structure. All of the existing flooring would be able to be preserved by adding the horizontal truss. Additionally, the vertical lateral elements (reinforced concrete walls, steel plate shear walls or braced frames) could be placed further apart.

5.9.4.3 Recommendation: Diaphragm

The project team recommends adding plywood sheathing above or below the existing floor diaphragm (Alternative A). A horizontal truss would reduce the amount of shear walls to be added to the structure, but would be have a significant impact on the ceiling of the station. The horizontal truss would have to be located below the existing floor diaphragm and is not an option in areas where the ceiling is to be preserved. Additionally, reducing the number of shear walls would increase the load to each shear wall and as a result could require a large amount of foundation work.

Table 5.9-2. Evaluation of Diaphragm Alternatives

Evaluation Criteria		No-Build	A	Plywood Sheathing Above/Below Existing Wood Floor Framing	B	Horizontal Steel Truss
A: Ability to Meet Project Goals						
A.1. Accommodate Future Capacity and Operational Needs of Passenger and Freight Rail	◆	Existing structural deficiencies and seismic hazards will persist.	●	Addresses existing deficiencies and life safety risks	●	Addresses existing deficiencies and life safety risks
A.2. Preserve and Protect the Historic Character of Union Station	◆	Degraded structural condition and risk of seismic failure will persist.	●	Both options could be hidden above ceiling. The plywood sheathing will be easier to also hide under the flooring.	□	Both options could be hidden above ceiling.
A.3. Improve Economic and Social Vitality	◆	Lack of structural/seismic upgrades limits the ability to reactivate and change occupancies due to code requirements.	●	Addresses existing deficiencies and life safety risks to support revitalization	●	Addresses existing deficiencies and life safety risks to support revitalization
A.4. Improve Environmental Sustainability	□	Minimal impact anticipated	□	Minimal impact anticipated	□	Minimal impact anticipated
B. Cost and Financing						
B.1. Estimated Capital Cost	◆	Likely to be higher in future with deferred action	●	Materials/labor will cost less for plywood sheathing than a steel horizontal truss with welded connections.	◆	More complex steel system with welding.
B.2. Lifecycle Cost Impacts	◆	Likely to increase due to emergency repairs and failures	□	Minimal impact anticipated	□	Minimal impact anticipated
B.3. Cost Risk	◆	There is a greater risk of unanticipated costs due to emergency repairs, failures, or seismic events	□	Comparable among build alternatives	□	Comparable among build alternatives
B.4. Financial Leverage	◆	Funding structural/seismic upgrades is likely to be more difficult as a future stand-alone project	□	Comparable among build alternatives	□	Comparable among build alternatives
C. Implementability and Constructability						
C.1. Technical Complexity and Constructability	□	N/A – No capital improvement project	●	Plywood is easy to work with and customize.	◆	Pre-fabrication is difficult in an existing building.

Evaluation Criteria		No-Build	A	Plywood Sheathing Above/Below Existing Wood Floor Framing	B	Horizontal Steel Truss
C.2. Schedule and Schedule Risk	☐	N/A – No capital improvement project	☐	No unusual schedule risks	◆	Pre-fabrication based on as-built dimensions could take time.
C.3. Construction Impact on Passenger and Freight Rail Operations	☐	N/A – No capital improvement project	☐	Comparable among build alternatives	☐	Comparable among build alternatives
C.4. Construction Impact on Union Station Tenants	☐	N/A – No capital improvement project	☐	Comparable among build alternatives	☐	Comparable among build alternatives
C.5. Phasing and Project Segmentation	☐	N/A – No capital improvement project	☐	Comparable among build alternatives	☐	Comparable among build alternatives
C.6. Risks, Assumptions and Unknowns	☐	N/A – No capital improvement project	☐	Unknowns about existing structural condition of floors and walls pose risks	☐	Unknowns about existing structural condition of walls and walls pose risks
D. Environmental Impacts and Approvals						
D.1. Environmental Impacts and Project Classification	◆	Continued degradation of historic elements will continue; may lead to eventual loss of resources	●	- Reduces life safety risk to building occupants	●	- Reduces life safety risk to building occupants
D.2. Historic Impacts and Approvals	◆	Historic spaces and materials will continue to degrade over time.	☐	Comparable among build alternatives	☐	Comparable among build alternatives
D.3. Decision Making and Approvals	◆	Project approvals and permitting may be hampered if code-mandated upgrades are not implemented	☐	Comparable among build alternatives	☐	Comparable among build alternatives

Source: IBI Group. 2016.

5.9.5. Out-of-Plane Strengthening

This improvement addresses existing seismic deficiencies of the unreinforced masonry walls throughout Union Station that lack resistance to out of plane seismic forces.

The following alternatives were evaluated:

- The No-Build Alternative retains the unreinforced masonry walls as-is, without improvement to the seismic condition or reduction in safety hazard to building occupants due to out of plane forces (see Section 5.9.2).
- The Reinforced Concrete Shear Walls alternative attaches a layer of reinforced concrete to the interior side of URM walls.
- The Steel Tube Strongback System uses a tubular steel system to provide the necessary out of plane strengthening.
- The Vertical Core Drilling alternative provides strengthening by drilling vertically from the roof level to the ground and grouting in reinforcing bars inside the URM walls.

The results of the evaluation of the four alternatives are summarized in Table 5.9-3.

5.9.5.1 Design Requirements and Objectives

The key design requirements for the Out of Plane Strengthening alternatives identified through the conditions assessment and stakeholder discussions include:

- Strengthen unreinforced masonry interior and exterior walls in the horizontal building diagram to meet current seismic codes.
- Address structural degradation identified in the conditions assessment.
- Minimize permanent visual impact of structural retrofits on historic spaces and materials.

5.9.5.2 Out-of-Plane Strengthening Alternatives

5.9.5.2.1. Alternative A: Reinforced Concrete Shear Walls

Under Alternative A reinforced concrete shear walls would likely be used as part of the lateral system for the structure and as such, the walls can be used for two purposes (both in-plane and out-of-plane). Reinforced concrete shear walls would also provide a simple method for attaching to the existing brick walls.

5.9.5.2.2. Alternative B: Steel Tube Strongback System

Under Alternative B the steel tube strongback system has a thinner profile than the reinforced concrete system and would take up slightly less floor space. Additionally, the steel tube option would be the least expensive to install.

5.9.5.2.3. Alternative C: Vertical Core Drilling

Under Alternative C vertical core drilling would change the aesthetic the least of the three options. By drilling vertically from the roof level to the ground and grouting in reinforcing bars, the out of plane capacity of the existing walls can be increased without disturbing the finishes on the inside or outside of the station. Vertical core drilling can be implemented without disturbing the historic finishes on the inside or outside of the station; however vertical core drilling would be the most expensive option and the most difficult to construct, and may not meet all needs for in-plane and out-of-plane strengthening.

5.9.5.3 Recommendation: Out-of-Plane Strengthening

The project team recommends implementing the reinforced concrete shear walls (Alternative A). Reinforced concrete shear walls would be relatively simple to attach to the existing URM brick walls. As part of the lateral system for the structure and as such, concrete shear walls can be used for both in-plane and out-of-plane strengthening.

Where historic finishes and materials exist (such as the walls of the main concourse), the concrete shear wall reinforcement can be implemented behind the historic material by temporarily removing the marble panels, replacing existing hollow clay tile with a shotcrete shear wall, and replacing the marble panels. This process may result in minor changes to finish room dimensions due to the slight increase in wall thickness, but the restored structural reinforcement will be hidden from view behind the restored marble panels with relatively small permanent dimensional changes anticipated. In less historic locations, such as the baggage room or leasable tenant spaces, the introduction of concrete shear walls on the inside of the existing URM wall would result in an increase in the overall wall thickness. However unlike braced framing, there is no risk of steel structural members blocking existing historic windows.

The use of concrete shear walls would also create opportunities to introduce new building insulation, acoustic window treatments, and mechanical/electrical conduit within new the wall system. These opportunities would be explored in preliminary design.

In certain locations, the steel tube strongback system may be considered as an alternative base. Exceptions to the use of concrete shear walls would be further explored in preliminary design based on overall architectural and structural design considerations.

Table 5.9-3. Evaluation of Out-of-Plane Strengthening Alternatives

Evaluation Criteria		No-Build	A	Reinforced Concrete Shear Walls	B	Steel Tube Strongback System	C	Vertical Core Drilling
A: Ability to Meet Project Goals								
A.1. Accommodate Future Capacity and Operational Needs of Passenger and Freight Rail	◆	Existing structural deficiencies and seismic hazards will persist.	●	Addresses existing deficiencies and life safety risks	●	Addresses existing deficiencies and life safety risks	●	Addresses existing deficiencies and life safety risks
A.2. Preserve and Protect the Historic Character of Union Station	◆	Degraded structural condition and risk of seismic failure will persist.	□	Minimal visual impact	◆	Potential for higher visual impact based on design	●	No visual impact.
A.3. Improve Economic and Social Vitality	◆	Lack of structural/seismic upgrades limits the ability to reactivate and change occupancies due to code requirements.	●	Addresses existing deficiencies and life safety risks to support revitalization	●	Addresses existing deficiencies and life safety risks to support revitalization	●	Addresses existing deficiencies and life safety risks to support revitalization
A.4. Improve Environmental Sustainability	□	Minimal impact anticipated	□	Minimal impact anticipated	□	Minimal impact anticipated	□	Minimal impact anticipated
B. Cost and Financing								
B.1. Estimated Capital Cost	◆	Likely to be higher in future with deferred action	□	Shotcrete shear walls would be used over steel strongbacks if also needed for shear strengthening.	●	Steel strongbacks are the least expensive option.	◆	Vertical Core Drilling is the most expensive option.
B.2. Lifecycle Cost Impacts	◆	Likely to increase due to emergency repairs and failures	□	Comparable among build alternatives	□	Comparable among build alternatives	□	Comparable among build alternatives
B.3. Cost Risk	◆	There is a greater risk of unanticipated costs due to emergency repairs, failures, or seismic events	□	-No unusual cost risks	□	No unusual cost risks	◆	Vertical Core Drilling is the riskiest option due to unknowns within the existing brick wall.

Evaluation Criteria		No-Build	A	Reinforced Concrete Shear Walls	B	Steel Tube Strongback System	C	Vertical Core Drilling
B.4. Financial Leverage	◆	Funding structural/seismic upgrades is likely to be more difficult as a future stand-alone project	☐	Comparable among build alternatives	☐	Comparable among build alternatives	☐	Comparable among build alternatives
C. Implementability and Constructability								
C.1. Technical Complexity and Constructability	☐	N/A – No capital improvement project	☐	No unusual risks anticipated	☐	No unusual risks anticipated	◆	Most complex due to sensitivity to core drilling vertically down. Drill must be kept plumb and straight to avoid protruding out of the face of the wall.
C.2. Schedule and Schedule Risk	☐	N/A – No capital improvement project	☐	No unusual risks anticipated	☐	No unusual risks anticipated	◆	Schedule risk due to unknowns.
C.3. Construction Impact on Passenger and Freight Rail Operations	☐	N/A – No capital improvement project	☐	Comparable among build alternatives	☐	Comparable among build alternatives	☐	Comparable among build alternatives
C.4. Construction Impact on Union Station Tenants	☐	N/A – No capital improvement project	☐	Moderate impact	☐	-Moderate impact	●	This will be the least impactful since it is installed from the roof.
C.5. Phasing and Project Segmentation	☐	N/A – No capital improvement project	☐	Comparable among build alternatives	☐	Comparable among build alternatives	☐	Comparable among build alternatives
C.6. Risks, Assumptions and Unknowns	☐	N/A – No capital improvement project	☐	Unknowns about existing structural condition of walls and foundations pose risks	☐	Unknowns about existing structural condition of walls and foundations pose risks	◆	Vertical Core Drilling is the riskiest option due to unknowns within the existing brick wall.
D. Environmental Impacts and Approvals								
D.1. Environmental Impacts and Project	◆	Continued degradation of historic elements will continue; may lead to	●	Reduces life safety risk to building occupants	●	Reduces life safety risk to building	●	Reduces life safety risk to building

Evaluation Criteria		No-Build	A	Reinforced Concrete Shear Walls	B	Steel Tube Strongback System	C	Vertical Core Drilling
Classification		eventual loss of resources				occupants		occupants
D.2. Historic Impacts and Approvals	◆	Historic spaces and materials will continue to degrade over time.	●	Preserves structure with minimal permanent visual impact	●	Preserves structure with minimal permanent visual impact	●	Preserves structure with least permanent visual impact
D.3. Decision Making and Approvals	◆	Project approvals and permitting may be hampered if code-mandated upgrades are not implemented	□	Comparable among build alternatives	□	Comparable among build alternatives	□	Comparable among build alternatives

Source: IBI Group. 2016.

5.9.6. Tower URM Strengthening

This improvement provides seismic strengthening to the unreinforced masonry (URM) clock tower to address deficiencies identified in the conditions assessment.

The following alternatives were evaluated:

- The No-Build Alternative retains the clock tower as-is, without improvement to the seismic condition or reduction in safety hazard to building occupants (see Section 5.9.2).
- The Steel Braced Frames above Reinforced Concrete Shear Walls alternative uses a combination of reinforced concrete shear walls (lower level) and steel braced frames (upper level) to provide seismic strengthening.
- The Steel Braced Frames Full Height alternative provides an interior steel braced frame against the inside face of the clock tower walls for its full height.
- The Reinforced Concrete Shear Walls - Full Height alternative applies reinforced concrete shear walls cast against the inside face of the clock tower walls for its full height.

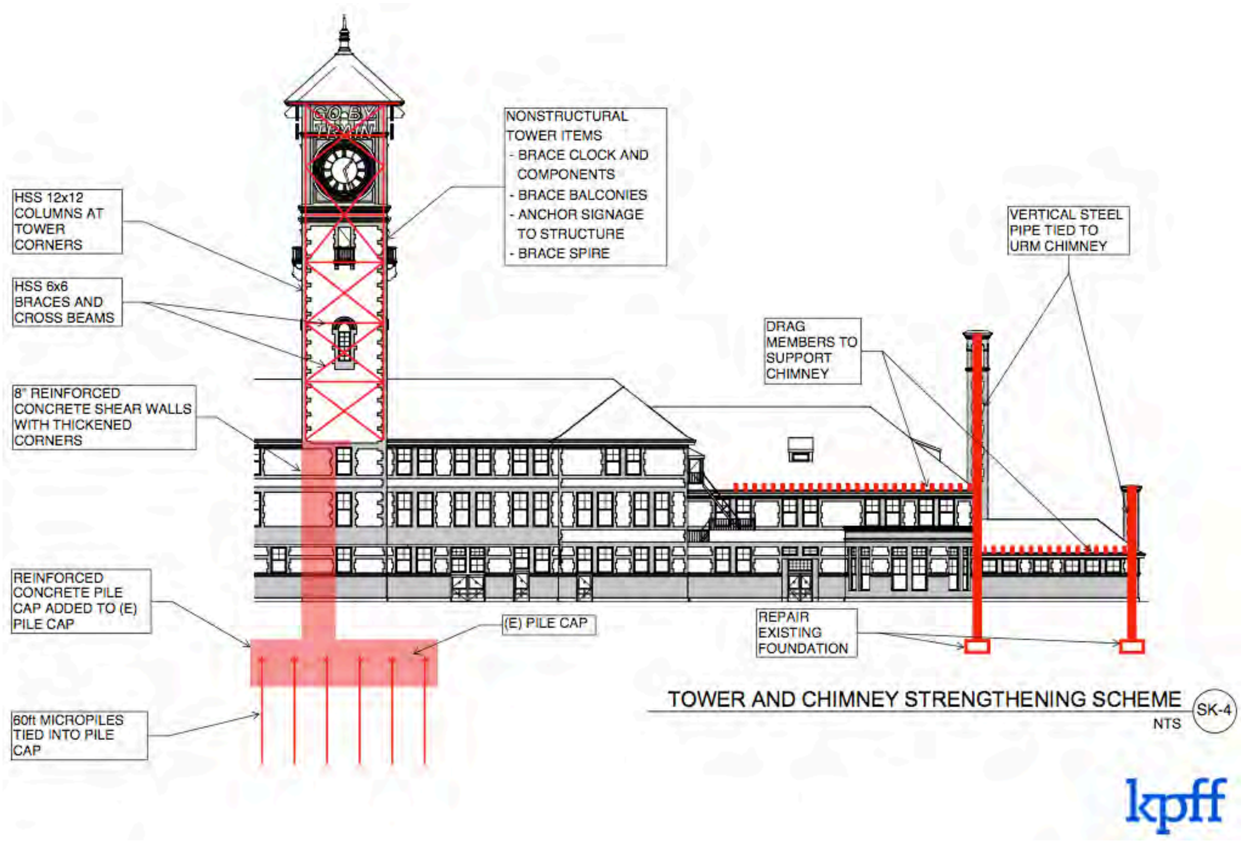
The results of the evaluation of the four alternatives are summarized in Table 5.9-4.

5.9.6.1 Design Requirements and Objectives

The key design requirements for the Tower URM Strengthening Alternatives identified through the conditions assessment and stakeholder discussions include:

- Strengthen unreinforced masonry of the clock tower to meet current seismic codes.
- Address structural degradation identified in the conditions assessment.
- Provide seismic reinforcement of non-structural tower elements such as the clock, balconies, and "Go by Train" sign.
- Minimize permanent visual impact of structural retrofits in the clock tower.

Figure 5.8-1. Tower and Chimney Strengthening Scheme



Source: KPFF. 2015.

5.9.6.2 Tower URM Strengthening Alternatives

5.9.6.2.1. *Alternative A: Steel Braced Frames above Reinforced Concrete Shear Walls*

Under Alternative A reinforced concrete shear walls would be added to the inside face of the tower walls from the base up to the attic level of the station then steel braced frames would be added for the remaining height of the tower. Braces in the upper portion of the tower would have minimal impact on the interior and exterior aesthetic of the tower. The light steel braced frame would add stiffness to the tower without adding a significant amount of weight which is proportional to the lateral load. Steel braced frame pieces are also light and can be broken up and spliced which makes construction in the tight tower easier than other systems. Steel braced frames for the upper levels of the tower can be worked around the majority of the windows leaving the exterior aesthetic of the tower essentially unchanged. Reinforced concrete shear walls installed up to the height of the attic allow for the main station to be braced back to the tower, reducing the amount of interior work on the station. Additionally, the reinforced concrete shear walls would distribute the bending moment at the base of the tower which would reduce the concentration of pin piles below the tower if that system is chosen for the foundation strengthening.

The steel braced frame above reinforced concrete shear walls is the most efficient method for strengthening the tower.

5.9.6.2.2. *Alternative B: Steel Braced Frames Full Height*

Under Alternative B would provide an interior steel braced frame against the inside face of the clock tower walls for its full height. The full height steel braced frame option is very light, and would add little additional weight and lateral load to the existing structure and would have the least impact on the interior aesthetic. The aspect ratio (height to width) of the tower is not ideal for a braced frame system to extend the full height of the tower. This means there would be heavier members at the base of the tower that would not be the most efficient use of a braced frame system. Discrete structural member size and adjustability make the steel braced frame the simplest system for construction. The steel braced frame system is likely not stiff enough or strong enough to support additional load from the main station thus adding to the amount of interior work in the main portion of the station. There would also be visual conflicts between the braces and exterior windows at the lower levels.

5.9.6.2.3. *Alternative C: Reinforced Concrete Shear Walls Full Height*

Under Alternative C improvements would include reinforced concrete shear walls cast against the inside face of the clock tower walls for its full height. Reinforced concrete shear walls can be cast against the inside face of the tower around the existing openings allowing the outside look of the tower to remain the same as today, however the inside face of the tower would be concrete rather than brick. Concrete shear walls also add a large amount of weight to the structure and increase the lateral demand on the walls and foundations. Using the new walls in the tower to brace the main station can still be done, but would likely require thicker walls than the option with braced frames above concrete shear walls. Due to the higher weight of the concrete walls in the tower, this option would require more foundation work than other options.

5.9.6.3 Recommendation: Tower URM Strengthening

The project team recommends implementing a combination of reinforced concrete shear walls in the lower levels and steel braced frames in the upper levels (Alternative A). The light weight of the braces in the upper levels would provide lateral resistance without adding a significant amount of mass. Reinforced concrete shear walls would anchor the braces from above and at the same time can be used to provide lateral support to the main station structure.

Table 5.9-4. Evaluation of Tower URM Strengthening Alternatives

Evaluation Criteria		No-Build	A	Steel Braced Frames Above Reinforced Concrete Shear Walls	B	Steel Braced Frames Full Height	C	Reinforced Concrete Shear Walls Full Height
A: Ability to Meet Project Goals								
A.1. Accommodate Future Capacity and Operational Needs of Passenger and Freight Rail	◆	Existing structural deficiencies and seismic hazards will persist.	●	- Reduces life safety risk to building occupants	●	- Reduces life safety risk to building occupants	●	- Reduces life safety risk to building occupants
A.2. Preserve and Protect the Historic Character of Union Station	◆	Degraded structural condition and risk of seismic failure will persist.	●	From the exterior, there will be little impact if any on the appearance of the tower.	◆	From the exterior, there will be an impact of braces crossing in front of windows on the lower floor levels.	◆	From the exterior, there will be little impact if any on the appearance of the tower but inside of tower will be reinforced concrete the entire height rather than a brick finish.
A.3. Improve Economic and Social Vitality	◆	Lack of structural/seismic upgrades limits the ability to reactivate and change occupancies due to code requirements.	●	Addresses existing deficiencies and life safety risks to support revitalization	●	Addresses existing deficiencies and life safety risks to support revitalization	●	Addresses existing deficiencies and life safety risks to support revitalization
A.4. Improve Environmental Sustainability	☐	Minimal impact anticipated	☐	Minimal impact anticipated	☐	Minimal impact anticipated	☐	Minimal impact anticipated
B. Cost and Financing								
B.1. Estimated Capital Cost	☐	N/A	☐	Costs for option B and C are similar.	☐	Costs for option B and C are similar.	◆	High cost for installation of concrete and reinforcing the full height of the tower. Larger foundation required due to heavier concrete structure.
B.2. Lifecycle Cost	◆	Likely to increase due to	☐	Little maintenance	☐	Little maintenance	☐	Little maintenance

Evaluation Criteria		No-Build	A	Steel Braced Frames Above Reinforced Concrete Shear Walls	B	Steel Braced Frames Full Height	C	Reinforced Concrete Shear Walls Full Height
Impacts		emergency repairs and failures.		required after installation.		required after installation.		required after installation.
B.3. Cost Risk	◆	There is a greater risk of unanticipated costs due to emergency repairs and failures.	☐	Comparable among build alternatives	☐	Comparable among build alternatives	☐	Comparable among build alternatives
B.4. Financial Leverage	◆	Funding structural/seismic upgrades is likely to be more difficult as a future stand-alone project.	●	Increased funding potential as part of a multifaceted renovation project.	●	Increased funding potential as part of a multifaceted renovation project.	●	Increased funding potential as part of a multifaceted renovation project.
C. Implementability and Constructability								
C.1. Technical Complexity and Constructability	☐	N/A – No capital improvement project	●	Limited impact to inside appearance of tower, works around existing clock face, braced frame pieces simpler to bring into tower, lower level shear walls can be used to brace the station as well.	☐	Limited impact to inside appearance of tower, works around existing clock face, braced frame pieces simpler to bring into tower.	◆	Shear walls can be worked around clock face and lower level windows, adds significant mass to structure, difficult to pump concrete to top of tower.
C.2. Schedule and Schedule Risk	☐	N/A – No capital improvement project	☐	Comparable among build alternatives	☐	Comparable among build alternatives	☐	Comparable among build alternatives
C.3. Construction Impact on Passenger and Freight Rail Operations	☐	N/A – No capital improvement project	☐	Comparable among build alternatives	☐	Comparable among build alternatives	☐	Comparable among build alternatives
C.4. Construction Impact on Union Station Tenants	☐	N/A – No capital improvement project	☐	Comparable among build alternatives	☐	Comparable among build alternatives	☐	Comparable among build alternatives
C.5. Phasing and Project Segmentation	☐	N/A – No capital improvement project	☐	Option B, C, or D needs to occur at the same time as a Tower Overturning Strengthening Option.	☐	Option B, C, or D needs to occur at the same time as a Tower Overturning Strengthening Option.	☐	Option B, C, or D needs to occur at the same time as a Tower Overturning Strengthening Option.
C.6. Risks, Assumptions and Unknowns	☐	N/A – No capital improvement project	☐	Unknowns about existing structural	☐	Unknowns about existing structural	☐	Unknowns about existing structural

Evaluation Criteria		No-Build	A	Steel Braced Frames Above Reinforced Concrete Shear Walls	B	Steel Braced Frames Full Height	C	Reinforced Concrete Shear Walls Full Height
				condition of walls and foundations pose risks		condition of walls and foundations pose risks		condition of walls and foundations pose risks
D. Environmental Impacts and Approvals								
D.1. Environmental Impacts and Project Classification	◆	Continued degradation of historic elements will continue; may lead to eventual loss of resources	●	Reduces life safety risk to building occupants	●	Reduces life safety risk to building occupants	●	Reduces life safety risk to building occupants
D.2. Historic Impacts and Approvals	◆	Historic spaces and materials will continue to degrade over time.	□	No significant impacts anticipated	◆	Larger impact to historic features of building with braces cutting in front of bottom 3 floors of windows.	□	No significant impacts anticipated
D.3. Decision Making and Approvals	◆	Project approvals and permitting may be hampered if code-mandated upgrades are not implemented	□	No significant impacts anticipated	◆	Visible steel framing may require additional review	□	No significant impacts anticipated

Source: IBI Group. 2016.

5.9.7. Tower Overturning Resistance

This improvement provides needed overturning resistance strength to withstand seismic forces on the clock tower.

The following alternatives were evaluated:

- The No-Build Alternative retains the clock tower as-is, without improvement to the seismic condition or reduction in safety hazard to building occupants (see Section 5.9.2).
- The Pile Foundations Improvement alternative adds new piles and a larger pile cap to the existing tower foundation underneath the clock tower.
- The Horizontal Trusses at Floor Levels alternative adds structural steel connections to each floor level to distribute the lateral load from the clock tower out to the rest of the main building.

The results of the evaluation of the three alternatives are summarized in Table 5.9-5.

5.9.7.1 Design Requirements and Objectives

The key design requirements for the Tower Overturning Resistance Alternatives identified through the conditions assessment and stakeholder discussions include:

- Reduce the life safety risk posed by overturning of the clock tower due to its current inability to resist seismic forces.
- Address foundation degradation identified in the conditions assessment.
- Minimize construction and permanent impact of subsurface/foundation retrofits on adjacent historic spaces and materials.

5.9.7.2 Tower Overturning Resistance Alternatives

5.9.7.2.1. Alternative A: Pile Foundations Improvement

Improvements under Alternative A would add piles and a larger pile cap to the existing tower foundation concentrates the work to a minimal area. The construction would require a portion of the exterior sidewalk to be removed and soil excavated from around the base to accommodate the drilling equipment, but impact on the final aesthetic of the station would be minimal. This option also allows for the lateral system of the tower to be used to support the main building.

5.9.7.2.2. Alternative B: Horizontal Trusses at Floor Levels

Under Alternative B a horizontal truss would be added at each floor level to distribute the lateral load from the tower out to the rest of the main building and eliminate foundation work at the base of the tower. However, the horizontal trusses would be extensive and have a significant impact on the ceiling finishes of the station. Additionally, while the foundation work below the tower would be eliminated, redistributing the forces to the main station may still result in some foundation work elsewhere.

5.9.7.3 Recommendation: Tower Overturning Resistance

The project team recommends implementing the addition of piles to the existing pile cap (Alternative A). Drilled pile foundations can be challenging to construct, but the work would be concentrated to a small area. Additionally, by adding the piles below the tower, the lateral elements of the tower can be used to support the main station. Without the addition of these piles, the loads from the tower would have to be redistributed to the rest of the station.

Table 5.9-5. Evaluation of Tower Overturning Resistance Alternatives

Evaluation Criteria		No-Build	A	Pile Foundations Improvement	B	Horizontal Trusses at Floor Levels
A: Ability to Meet Project Goals						
A.1. Accommodate Future Capacity and Operational Needs of Passenger and Freight Rail	◆	Existing structural deficiencies and seismic hazards will persist.	●	Reduces life safety risk to building occupants	●	Reduces life safety risk to building occupants
A.2. Preserve and Protect the Historic Character of Union Station	◆	Degraded structural condition and risk of seismic failure will persist.	□	Small impact to main floor finishes.	◆	Significant impact to each floor level, likely change to ceiling configuration in impacted areas to accommodate horizontal truss below existing floor gravity support.
A.3. Improve Economic and Social Vitality	◆	Lack of structural/seismic upgrades limits the ability to reactivate and change occupancies due to code requirements.	●	Addresses existing deficiencies and life safety risks to support revitalization	●	Addresses existing deficiencies and life safety risks to support revitalization
A.4. Improve Environmental Sustainability	□	Minimal impact anticipated	□	Minimal impact anticipated	□	Minimal impact anticipated
B. Cost and Financing						
B.1. Estimated Capital Cost	◆	Likely to be higher in future with deferred action	□	Localized high cost of new piles at existing foundation pile cap.	◆	High cost for installation of truss system at floor levels and additional lateral elements.
B.2. Lifecycle Cost Impacts	◆	Likely to increase due to emergency repairs and failures.	□	Little maintenance required after installation.	□	Little maintenance required after installation.
B.3. Cost Risk	◆	There is a greater risk of unanticipated costs due to emergency repairs and failures.	●	Pile foundations are concentrated to one area has less potential for construction conflicts.	◆	A horizontal truss creates much more construction than pile foundation strengthening and greater potential for construction conflicts.
B.4. Financial Leverage	◆	Funding structural/seismic upgrades is likely to be more difficult as a future	●	Increased funding leverage as part of a multi-faceted rehabilitation project	●	Increased funding leverage as part of a multi-faceted rehabilitation project

Evaluation Criteria		No-Build	A	Pile Foundations Improvement	B	Horizontal Trusses at Floor Levels
		stand-alone project.				
C. Implementability and Constructability						
C.1. Technical Complexity and Constructability	☐	N/A – No capital improvement project	●	Requires less construction and has limited impact to main portion of the station, requires below grade excavation.	◆	Requires no below grade foundation work, has significant impact of main floor levels of the station and will require additional distributed lateral elements to transfer loads.
C.2. Schedule and Schedule Risk	☐	N/A – No capital improvement project	●	Pile foundations are concentrated to one area has less potential for construction conflicts.	◆	A horizontal truss creates much more construction than pile foundation strengthening and greater potential for construction conflicts.
C.3. Construction Impact on Passenger and Freight Rail Operations	☐	N/A – No capital improvement project	●	Minimal tenant impacts anticipated	◆	The horizontal truss option has a larger impact on the station overall and is not just concentrated around the tower.
C.4. Construction Impact on Union Station Tenants	☐	N/A – No capital improvement project	☐	Tenants immediately adjacent to tower will have to be relocated or closed during foundation work.	◆	Horizontal trusses require extensive floor level work and will require additional closure time of occupied spaces.
C.5. Phasing and Project Segmentation	☐	N/A – No capital improvement project	●	Option B could be performed before a Tower URM Strengthening Option if phasing is important.	◆	Option C would need to occur at the same time as a Tower URM Strengthening Option since they work integrally together.
C.6. Risks, Assumptions and Unknowns	☐	N/A – No capital improvement project	◆	Risk/unknown conditions regarding new pile foundation system through existing pile foundation system.	◆	Risk/unknown conditions of as-built conditions over a large area of the building.
D. Environmental Impacts and Approvals						
D.1. Environmental Impacts and Project Classification	◆	Continued degradation of historic elements will continue; may lead to eventual loss of resources	●	- Reduces life safety risk to building occupants	●	- Reduces life safety risk to building occupants
D.2. Historic Impacts and	◆	Historic spaces and	●	-Improves condition with minimal	◆	Large impact to historic features

Evaluation Criteria		No-Build	A	Pile Foundations Improvement	B	Horizontal Trusses at Floor Levels
Approvals		materials will continue to degrade over time.		historic impact		over a larger area of the main building.
D.3. Decision Making and Approvals	◆	Project approvals and permitting may be hampered if code-mandated upgrades are not implemented	◆	If a decision is not made between Option B and C, this will impact how the rest of the main building's retrofit is designed. If Option C is chosen, this has a larger impact on the overall building design than Option B which is localized.	◆	If a decision is not made between Option B and C, this will impact how the rest of the main building's retrofit is designed. If Option C is chosen, this has a larger impact on the overall building design than Option B which is localized.

Source: IBI Group. 2016.

5.9.8. Main Building Chimney

This improvement addresses existing structural deterioration and seismic deficiency in the unreinforced masonry chimneys of the main building.

The following alternatives were evaluated:

- The No-Build Alternative retains the main building chimneys as-is, without improvement to the seismic condition or reduction in safety hazard to building occupants (see Section 5.9.2).
- The Steel Pipe Propped to Diaphragms alternative reinforces the chimney by inserting an interior steel tube that is tied to the building diaphragm.
- The Exterior Braces alternative uses steel reinforcement or banding on the exterior of the masonry chimneys, creating a permanent visual impact
- The Remove Chimneys alternative removes the main building chimneys entirely instead of seismically reinforcing them.

The results of the evaluation of the four alternatives are summarized in Table 5.9-6.

5.9.8.1 Design Requirements and Objectives

The key design requirements for the main building Chimney Alternatives identified through the conditions assessment and stakeholder discussions include:

- Preserve the non-functional main building chimneys as a historic character-defining feature of Union Station.
- Reduce the life safety risk posed by seismic failure of the chimneys
- Address structural degradation identified in the conditions assessment.
- Minimize permanent visual impact of the chimney seismic retrofit.

5.9.8.2 Main Building Chimney Alternatives

5.9.8.2.1. *Alternative A: Steel Pipe Propped to Diaphragms*

Improvements under Alternative A would reinforce the chimney by inserting an interior steel tube that is tied to the building diaphragm (Figure 5.8-1). Adding a steel pipe to the interior of the chimneys to support the chimney would have minimal impact on the historic appearance of the station. The steel pipe can be fully hidden inside the chimney and would not change the look of the chimney. This steel pipe would be braced back to the main building at the roof level. Foundation strengthening at the chimneys would also be required.

5.9.8.2.2. *Alternative B: Exterior Braces*

Improvements under Alternative B would use steel reinforcement or banding on the exterior of the masonry chimneys, creating a permanent visual impact. Exterior chimney braces would be easier to construct than the pipe placed inside the chimney, but would have a significant impact on the appearance of the chimneys and the historic character of the building.

5.9.8.2.3. *Alternative C: Remove Chimney*

Alternative C would remove the main building chimneys entirely instead of seismically reinforcing them. Removing the chimneys is the simplest of the alternatives. Additionally, removing the chimneys would decrease the overall lateral load thus reducing the amount of lateral strengthening required for the structure. However, this would have the most major impact on the appearance of the station and would negatively impact the historical character of the building.

5.9.8.3 Recommendation: Main Building Chimney

The project team recommends adding a pipe column inside the chimneys (Alternative A). This would have no permanent impact on the exterior appearance of the chimney structures. The chimneys are non-functional, and therefore the primary objective for a structural/seismic retrofit is to preserve their historic appearance and character.

Table 5.9-6. Evaluation of Main Building Chimney Alternatives

Evaluation Criteria		No-Build	A	Steel Pipe Propped to Diaphragms	B	Exterior Braces	C	Remove Chimney
A: Ability to Meet Project Goals								
A.1. Accommodate Future Capacity and Operational Needs of Passenger and Freight Rail	◆	Existing structural deficiencies and seismic hazards will persist.	●	- Reduces life safety risk to building occupants	●	- Reduces life safety risk to building occupants	●	- Reduces life safety risk to building occupants
A.2. Preserve and Protect the Historic Character of Union Station	◆	Degraded structural condition and risk of seismic failure will persist.	●	Small impact on historic character.	◆	Large change in historic character.	◆	Large change in historic character.
A.3. Improve Economic and Social Vitality	◆	Lack of structural/seismic upgrades limits the ability to reactivate and change occupancies due to code requirements.	●	Addresses existing deficiencies and life safety risks to support revitalization	●	Addresses existing deficiencies and life safety risks to support revitalization	●	Addresses existing deficiencies and life safety risks to support revitalization
A.4. Improve Environmental Sustainability	□	Minimal impact anticipated	□	Minimal impact anticipated	□	Minimal impact anticipated	□	Minimal impact anticipated
B. Cost and Financing								
B.1. Estimated Capital Cost	◆	Likely to be higher in future with deferred action	□	Comparable among build alternatives	□	Comparable among build alternatives	□	Comparable among build alternatives
B.2. Lifecycle Cost Impacts	◆	Likely to be higher in future with deferred action	□	Comparable among build alternatives	□	Comparable among build alternatives	□	Comparable among build alternatives
B.3. Cost Risk	◆	Costs likely to be higher as a future stand-alone project with ongoing degradation.	□	Comparable among build alternatives	□	Comparable among build alternatives	□	Comparable among build alternatives

Evaluation Criteria		No-Build	A	Steel Pipe Propped to Diaphragms	B	Exterior Braces	C	Remove Chimney
		Higher risk of future seismic damage repair costs.						
B.4. Financial Leverage	◆	Likely to be more difficult to finance as a future stand-alone project	☐	Comparable among build alternatives	☐	Comparable among build alternatives	☐	Comparable among build alternatives
C. Implementability and Constructability								
C.1. Technical Complexity and Constructability	☐	N/A – No capital improvement project	☐	Comparable among build alternatives	☐	Comparable among build alternatives	☐	Comparable among build alternatives
C.2. Schedule and Schedule Risk	☐	N/A – No capital improvement project	☐	Comparable among build alternatives	☐	Comparable among build alternatives	☐	Comparable among build alternatives
C.3. Construction Impact on Passenger and Freight Rail Operations	☐	N/A – No capital improvement project	☐	Comparable among build alternatives	☐	Comparable among build alternatives	☐	Comparable among build alternatives
C.4. Construction Impact on Union Station Tenants	☐	N/A – No capital improvement project	☐	Comparable among build alternatives	☐	Comparable among build alternatives	☐	Comparable among build alternatives
C.5. Phasing and Project Segmentation	☐	N/A – No capital improvement project	●	Allows for phasing of construction with minimal impact on operations.	●	Allows for phasing of construction with minimal impact on operations.	●	Allows for phasing of construction with minimal impact on operations.
C.6. Risks, Assumptions and Unknowns	☐	N/A – No capital improvement project	☐	Unknowns about existing structural condition of chimney brick and foundations pose risks	☐	Unknowns about existing structural condition of chimney brick and foundations pose risks	☐	Unknowns about existing structural condition of chimney brick and foundations pose risks
D. Environmental Impacts and Approvals								
D.1. Environmental Impacts and Project Classification	◆	Continued degradation of historic elements will continue; may lead to eventual	●	Reduces life safety risk to building occupants	●	Reduces life safety risk to building occupants	●	Reduces life safety risk to building occupants

Evaluation Criteria		No-Build	A	Steel Pipe Propped to Diaphragms	B	Exterior Braces	C	Remove Chimney
		loss of resources						
D.2. Historic Impacts and Approvals	◆	Historic spaces and materials will continue to degrade over time.	●	Minimum impact on historic appearance.	◆	Large change in historic character with exterior braces framing back to the roof.	◆	Significant change in historic appearance without the chimneys.
D.3. Decision Making and Approvals	◆	Project approvals and permitting may be hampered if code-mandated upgrades are not implemented	□	Comparable among build alternatives	□	Comparable among build alternatives	□	Comparable among build alternatives

Source: IBI Group. 2016.

5.10. Mechanical, Electrical, and Plumbing

The Mechanical, Electrical, and Plumbing alternatives cover building systems for both the main building and the Annex. Rail operations support systems such as 480v power, yard air, and potable water used to service trains are excluded from this discussion and are addressed in the rail alternatives section (Chapter 6) of this report.

5.10.1. Key Design Requirements

The key design requirements for Mechanical, Electrical, and Plumbing Alternatives identified through the conditions assessment and stakeholder discussions include:

- Replacing outdated mechanical, electrical, and plumbing systems nearing or beyond the end of their useful lives
- Reducing total lifecycle costs of building operations through improved efficiency
- Relocating mechanical systems from the Annex to allow for refurbishment and reuse of the Annex
- Relocating the existing electrical vault from current flood-susceptible basement location
- Increasing environmental sustainability of Union Station, such as through reduced energy and water consumption.

5.10.2. Mechanical, Electrical, and Plumbing Alternatives

This improvement would replace aging mechanical, electrical, plumbing and lighting systems that have reached or exceeded their useful lives. As part of this wok, the build alternatives would relocate and consolidate existing HVAC and electrical support equipment to the north end of the building, in the location of the existing City of Portland workshop. Existing systems would be decommissioned and removed, including surface-mounted wires, pipes, and conduits currently visible in historic portions of the building.

Four alternatives were evaluated:

- The No-Build option leaves the existing mechanical, electrical, plumbing and lighting systems with no modifications;
- The LEED Gold alternative upgrades systems to meet the City of Portland's minimum LEED Gold sustainability standards
- The LEED Platinum alternative would include further sustainability features to reach the LEED Platinum level; and,
- The New Zero alternative includes LEED Platinum sustainability features and also introduces a photovoltaic system for on-site electricity generation that meets or exceeds the power demand of Union Station ("net zero").

The results of the evaluation of the four alternatives are summarized in Table 5.10-1.

5.10.2.1 Mechanical, Electrical, and Plumbing No-Build Alternative

This alternative would maintain existing mechanical, electrical, and plumbing systems as-is in their current configuration. Most of the main building and Annex would lack ventilation systems consistent with current design standards. The Annex building would continue to house heaving equipment in the Boiler Room, precluding re-use and repurposing of this structure as a leasable space. Existing systems, many at or beyond the end of their useful life, would continue to be maintained in their current state, with emergency repairs anticipated from time to time due to systems failures. The quality of climate control, restrooms, illumination levels, data communications, and other tenant and passenger services that were determined to be deficient in the needs assessment would remain deficient with only minor incremental improvements over time.

5.10.2.2 Alternative A: Upgrade to LEED Gold Standard

This alternative would upgrade building systems to meet the minimum the City of Portland's LEED Gold standard. This may include upgraded, high efficiency lighting and energy reduction features such as occupancy sensors and/or photocells to automatically respond to ambient daylight. Based on building occupancy and historic significance, HVAC systems would be upgraded with new natural ventilation controls, mixed-mode systems, and/or provisions for future tenant systems fit-out.

5.10.2.3 Alternative B: Upgrade to LEED Platinum Standards

This alternative would incorporate the basic components of the LEED Gold alternative with additional sustainability features. This may include a groundsource bore field to act as a heat pump to reduce HVAC energy and fossil fuel consumption. Additionally sub-metering sensor technology and LED retrofit would help to improve electrical energy efficiency. Another option is the introduction of a rainwater retention cistern to allow for partial recycling and reuse of rainwater for building services.

5.10.2.4 Alternative C: Upgrade to Net Zero for Electricity Consumption

This alternative would build on the LEED Gold and Platinum alternatives, with the addition of a photovoltaic (PV) array on the reconstructed platform canopies. Preliminary analysis suggests that a PV array could generate sufficient electrical power to meet or exceed building electrical consumption needs.

5.10.3. Recommendation: Mechanical, Electrical, and Plumbing

Based on consideration of sustainability benefits and potential reduction in lifecycle cost, the project team recommends implementing Alternative C (Upgrade to Net Zero for Electricity Consumption). Refinement of this alternative is contingent upon energy modeling of existing and future Union Station electricity consumption as well as development of a feasible photovoltaic (PV) solar panel field as part of the preferred platform canopy alternative during preliminary engineering.

Table 5.10-1. Evaluation of Mechanical, Electrical, and Plumbing Alternatives

Evaluation Criteria		No-Build	A	LEED Gold Target (min standard per City of Portland)	B	LEED Platinum Target	C	Net Zero Target
A: Ability to Meet Project Goals								
A.1. Accommodate Future Capacity and Operational Needs of Passenger and Freight Rail	◆	Failing, obsolete, and inefficient systems will continue to detract from the passenger experience and will hamper current and future rail operations.	●	The upgraded lighting will enhance the visitors experience as well as increase the site and facilities security. HVAC systems will provide comfort as necessary.	●	The upgraded lighting will enhance the visitors experience as well as increase the site and facilities security. HVAC systems will provide comfort as necessary.	●	The upgraded lighting will enhance the visitors experience as well as increase the site and facilities security. HVAC systems will provide comfort as necessary.
A.2. Preserve and Protect the Historic Character of Union Station	◆	System retrofits and unused equipment installed over the years will continue to detract from the historic character of the building.	●	Upgrades historic lighting features to high-efficiency standards and removes exposed legacy plumbing, wiring, and conduit	●	The optional photovoltaics proposed for the platform canopies could be seen as a change to the historic character of the roofs. But the groundsource systems completely hide all HVAC.	□	The Photovoltaics proposed for the platform canopies could be seen as a change to the historic character of the roofs. But the groundsource systems completely hide all HVAC.
A.3. Improve Economic and Social Vitality	◆	The conditions of systems will continue to diminish the easing potential and vitality of the station	●	Upgraded LED lighting and controls should have a very positive impact on the quality of the tenant spaces.	●	The proposed sustainable features for the building should have a positive marketing impact for leased spaces. Upgraded LED lighting and controls should have a very positive impact on the quality of the tenant spaces.	●	The proposed sustainable features for the building should have a positive marketing impact for leased spaces. Upgraded LED lighting and controls should have a very positive impact on the quality of the tenant spaces.
A.4. Improve Environmental Sustainability	◆	Older and less efficient systems will continue to use more energy	□	This option provides a pretty standard LEED gold strategy, so there are some sustainable features such as LED lighting.	●	This option did not include rain water harvesting, so water consumption and stormwater management	●	The Net Zero option will satisfy all of the contributing factors listed under this category

Evaluation Criteria		No-Build	A	LEED Gold Target (min standard per City of Portland)	B	LEED Platinum Target	C	Net Zero Target
		and will have higher environmental impact.		Energy and water savings will be baseline compared to the other two options.		will not be as great as the net zero option. The PV array size is reduced in this option so the amount of energy consumed from the grid will be greater than the Net Zero option.		related to MEP.
B. Cost and Financing								
B.1. Estimated Capital Cost	□	N/A – No capital improvement project	□	Costs for the LEED Gold option should be comparable to average construction costs of a comparable building type/size/condition.	◆	The LEED Platinum option will have the second largest upfront cost of the options presented. (Order of Magnitude costs TBD)	◆	The Net Zero option will have the largest upfront cost. There should be incentives from ETO to help recapture some of this cost. (Order of Magnitude costs TBD)
B.2. Lifecycle Cost Impacts	◆	Costs of operation will be higher for older systems.	●	LED lighting will require less costs associated with relamping.	●	Overall decrease in lifecycle building costs anticipated due to high efficiency systems	●	Overall decrease in lifecycle building costs anticipated due to high efficiency systems
B.3. Cost Risk	◆	Costs of operation will be higher for older systems.	□	No unusual cost risks anticipated	◆	Potential costs risks associated with groundsource borefield excavation and more complex systems	◆	Potentially higher cost risk due to more sophisticated systems and integration of PVs with platform canopy system
B.4. Financial Leverage	◆	There is less cost sharing potential and financial leveraging potential if systems are upgraded as a stand-alone	●	ETO will incentivize the LED lighting upgrade and lighting controls upgrade.	●	ETO will incentivize the PV installation, LED lighting upgrade and lighting controls upgrade.	●	ETO will incentivize the PV installation, LED lighting upgrade and lighting controls upgrade.
C. Implementability and Constructability								

Evaluation Criteria		No-Build	A	LEED Gold Target (min standard per City of Portland)	B	LEED Platinum Target	C	Net Zero Target
C.1. Technical Complexity and Constructability	☐	N/A – No capital improvement project	☐	No unusual risk factors anticipated	☐	The groundsource system will have to be installed early in the schedule, sometimes creating additional complexity.	☐	The groundsource system will have to be installed early in the schedule, sometimes creating additional complexity.
C.2. Schedule and Schedule Risk	☐	N/A – No capital improvement project	☐	No unusual risk factors anticipated	☐	Potential for increased risk with increased complexity	☐	Potential for increased risk with increased complexity
C.3. Construction Impact on Passenger and Freight Rail Operations	☐	N/A – No capital improvement project	☐	Comparable among alternatives	☐	Comparable among alternatives	☐	Comparable among alternatives
C.4. Construction Impact on Union Station Tenants	☐	N/A – No capital improvement project	◆	All options will have an impact on tenants. Existing lighting and electrical infrastructure have reached an age where it needs to be replaced and the replacement will cause a disruption to the tenant if all spaces are to remain occupied.	◆	All options will have an impact on tenants. Existing lighting and electrical infrastructure have reached an age where it needs to be replaced and the replacement will cause a disruption to the tenant if all spaces are to remain occupied.	◆	All options will have an impact on tenants. Existing lighting and electrical infrastructure have reached an age where it needs to be replaced and the replacement will cause a disruption to the tenant if all spaces are to remain occupied.
C.5. Phasing and Project Segmentation	☐	N/A – No capital improvement project	☐	All options presented are compatible with a phased main building approach.	☐	All options presented are compatible with a phased main building approach.	☐	All options presented are compatible with a phased main building approach.
C.6. Risks, Assumptions and Unknowns	☐	N/A – No capital improvement project	☐	No unusual risk factors anticipated	☐	Potential for increased risk with increased complexity	☐	Potential for increased risk with increased complexity
D. Environmental Impacts and Approvals								
D.1. Environmental Impacts and Project Classification	◆	Continued visual impact of obsolete wiring, piping, and conduit on historic spaces	●	Reduced visual impact due to removal of obsolete wiring, piping, and conduit on historic spaces	●	Reduced visual impact due to removal of obsolete wiring, piping, and conduit on historic spaces	●	Reduced visual impact due to removal of obsolete wiring, piping, and conduit on historic spaces

Evaluation Criteria		No-Build	A	LEED Gold Target (min standard per City of Portland)	B	LEED Platinum Target	C	Net Zero Target
D.2. Historic Impacts and Approvals	◆	Continued visual impact of obsolete wiring, piping, and conduit on historic spaces	●	Reduced visual impact due to removal of obsolete wiring, piping, and conduit on historic spaces	●	Reduced visual impact due to removal of obsolete wiring, piping, and conduit on historic spaces	●	Reduced visual impact due to removal of obsolete wiring, piping, and conduit on historic spaces
D.3. Decision Making and Approvals	□	N/A - No capital improvement project	□	Comparable among build alternatives	□	Comparable among build alternatives	□	Comparable among build alternatives

Source: IBI Group. 2016.

5.11. Platform Canopies and High Shed

The platform canopy system consists of the umbrella canopies over the Track 2/3 and Track 4/5 platforms, as well as the perpendicular high shed covering the walkway and connecting the platforms to the main building.

5.11.1. Key Design Requirements

The key design requirements of the Platform Canopies and High Shed identified through the conditions assessment and stakeholder discussions include:

- Accommodating future capacity, operational, safety, and passenger comfort needs of passenger and freight rail.
- Addressing seismic/structural deficiencies of the Existing Platform Canopies and High Shed to meet current code and safety standards.
- Repairing/replacing failing and end-of-life mechanical, electrical, plumbing, and stormwater systems.
- Accommodating changes to track geometry to accommodate future rail capacity needs, e.g. Track 6 and/or reconfiguration of the passenger walkway.
- Compatibility with new platforms that are compliant with the FRA Level Boarding Final Rule.
- Upgrading rail support equipment, utilities, lighting, wayfinding, and security systems.
- Honoring the historic character of Union Station

5.11.2. Platform Canopies and High Shed Alternatives

This improvement addresses the operational, structural, and systems deficiencies of the existing platform canopies, as well as corrosion and deterioration of materials. The improvements to the rail side also include a replacement of the existing platform systems to current standards, including structural/foundations, systems, rail support equipment, and ADA accessibility.

The objective of the platform canopy conceptual design alternatives evaluation was to narrow the range of potential architectural styles and forms to a preliminary preferred alternative. After public review and selection of a preferred alternative, a number of future design decisions would be required in terms of architectural detailing, structural design, materials, finishes, colors, lighting, etc.

Therefore the designs presented for each alternative should be considered conceptual renderings for comparison purposes, and not necessarily reflective of the final design.

The conceptual design process considered four alternatives for platform canopy and high shed replacement. The four alternatives represent combinations of two architectural styles (Traditional/Contemporary) and forms (Umbrella Canopies with High Shed) (Figures 5.10-1 through 5.10-4):

The following alternatives were evaluated:

- The No-Build alternative would maintain the existing platform canopies as-is, without addressing operational or structural deficiencies.
- The Traditional Umbrella Canopies with High Shed alternative provides new umbrella canopies and a relocated High Shed structure constructed to current rail clearances using traditional styling and materials.
- The Contemporary Umbrella Canopies with High Shed alternative provides new umbrella canopies and a relocated High Shed structure constructed to current rail clearances using contemporary styling and materials.
- The Traditional Train Shed alternative provides a continuous train shed with a traditional design styling between the Broadway Bridge and the pedestrian bridge. North and south of these bridges, respectively, the canopies would continue as Umbrella Canopies also using a traditional styling

- The Contemporary Train Shed alternative provides a continuous train shed with a contemporary design styling between the Broadway Bridge and the pedestrian bridge. North and south of these bridges, respectively, the canopies would continue as Umbrella Canopies also using a contemporary styling

The results of the evaluation of the four alternatives are summarized in Table 5.11-1.

5.11.2.1 Platform Canopies and High Shed No-Build Alternative

If the Platform Canopies are not improved, the existing structures will continue to pose a significant seismic hazard and will continue to deteriorate over time. The condition of the structure detracts from the function and appearance of Union Station.

The existing canopies also provide inadequate operating conditions for passengers and train crews. The dripline of the platform canopy edges is over the platform surface, not the rail cars, resulting in precipitation cascading over the canopy edge between passengers and the boarding doors of trains. Insufficient lighting levels and outmoded rail support systems will continue to be a hindrance to the safe and efficient operations of the station.

During the conditions assessment phase, the Platform Canopies were identified to have numerous deficiencies in terms of function, train clearance, structural/seismic condition, drainage, lighting, and wayfinding. The Platform Canopies are also in a state of deterioration including corrosion of structural steel members, corroded and failed drainage pipes, and numerous decommissioned electrical, water, and yard air systems. The Track 4/5 platform has been modified by truncating the triangular roof truss on the track 4 side, to provide for wider clearances for freight trains operating on Track 4.

Vertical and horizontal clearance of the Platform Canopies is also a concern. Rehabilitating the truncated Track 4 edge of the Track 4/5 canopy would violate the horizontal clearance requirements of Amtrak and freight rail standards. Potential realignment of Track 5 due to the introduction of Track 6 could pose a similar constraint on the Track 5 side of this structure, which currently has sufficient clearance.

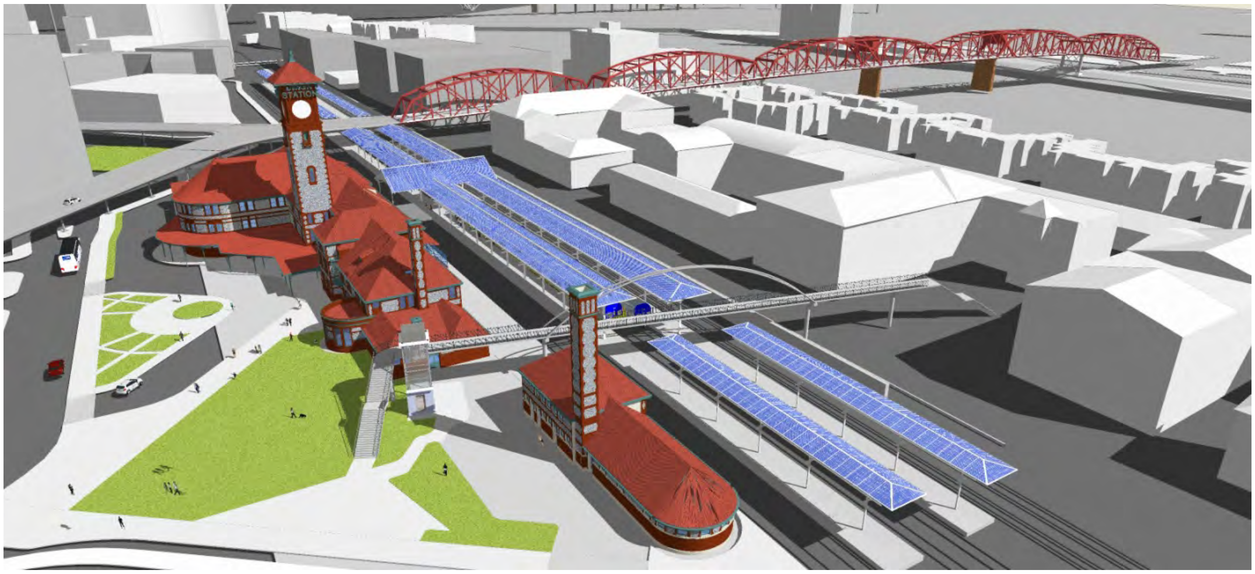
For these reasons, the No-Build Alternative was eliminated from further consideration as part of the set of feasible alternatives.

5.11.2.2 Alternative A: Traditional Umbrella Canopies with High Shed

This alternative would consist of new umbrella canopies and a high shed structure constructed to current rail clearances (approximately 22 feet above top of rail) and with an overhang to the centerline of the adjacent boarding tracks (Figure 5.10-1). The structural steel framing would be fabricated to resemble a traditional truss-like form.

If designed with a peaked roof truss shape, this alternative could most closely resemble the existing platform canopies and high shed at Union Station. However, the width and height of the structures would be significantly increased over the existing dimensions due to the current rail clearance requirements and weather protection objectives. The roofing material could also incorporate glass and/or photovoltaic cells rather than the existing faux terra cotta sheet metal roofing.

Figure 5.10-1. Platform Canopies and High Shed Alternative A – Traditional Umbrella Canopies with High Shed



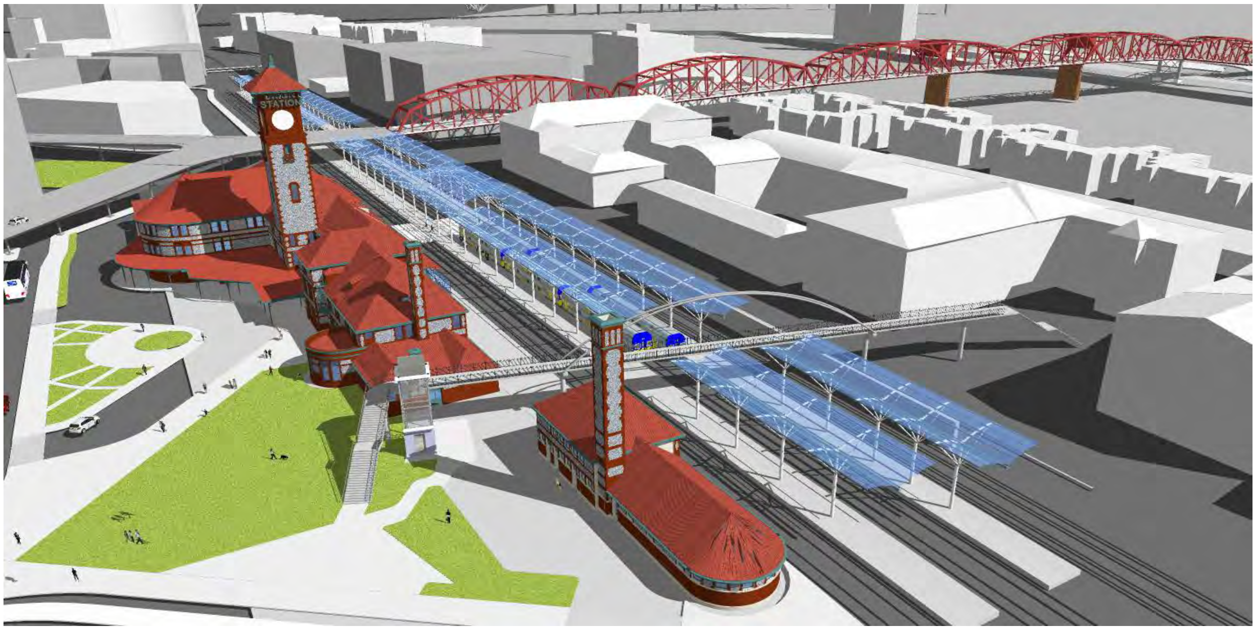
Source: IBI Group. 2016.

5.11.2.3 Alternative B: Contemporary Umbrella Canopies with High Shed

Like Alternative A, this alternative would consist of new umbrella canopies and a high shed structure constructed to current rail clearances (approximately 22 feet above top of rail) and with an overhang to the centerline of the adjacent boarding tracks (Figure 5.10-2). However the design would incorporate more contemporary structural forms. This introduces a wide variety of alternatives; the conceptual example illustrated in the figures shows a "gullwing" design as just one of many possibilities.

The design objective is to produce a lighter, more transparent canopy structure that would meet rail operations requirements and complements the historic structure without attempting to replicate the historic structure. Roof materials would likely consist of tempered glass and/or photovoltaic cells.

Figure 5.10-2. Platform Canopies and High Shed Alternative B – Contemporary Umbrella Canopies with High Shed

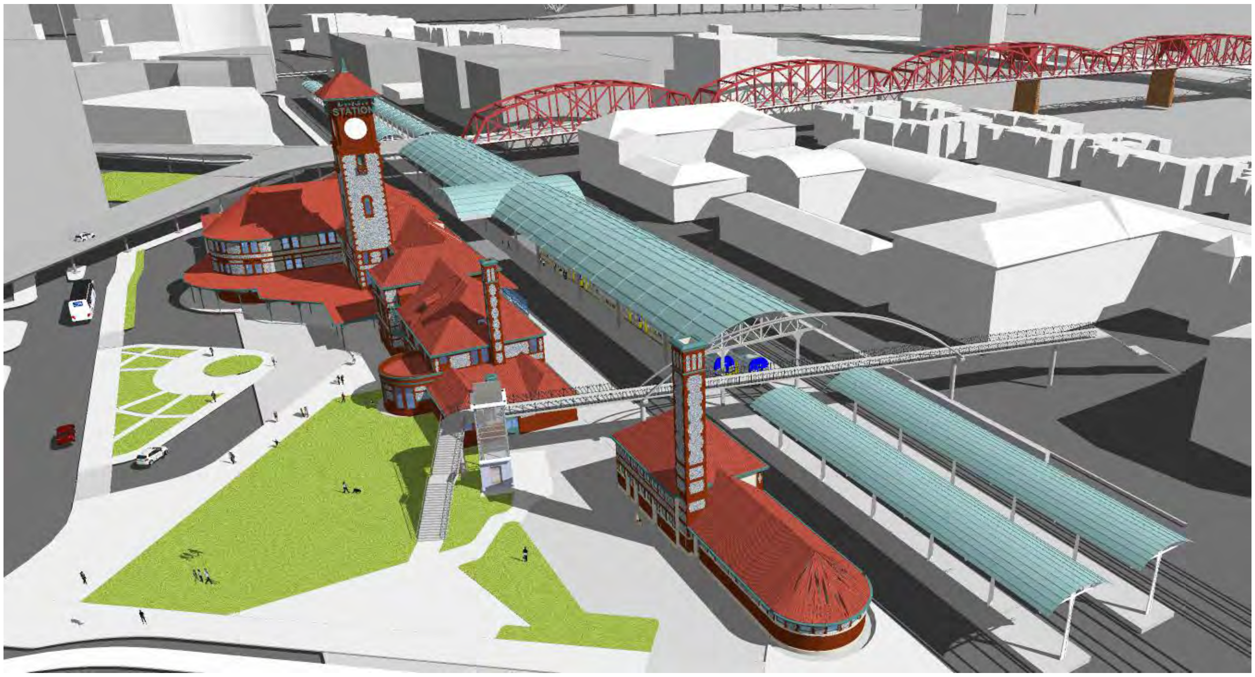


Source: IBI Group. 2016.

5.11.2.4 Alternative C: Traditional Train Shed Form

Alternative C would provide a continuous train shed with a contemporary design styling between the Broadway Bridge and the pedestrian bridge (Figure 5.10-3). North and south of these bridges, respectively, the canopies would continue as umbrella canopies also using a traditional styling, similar to Alternative A. The effect would be of a classic European-style train shed, reminiscent of a train shed concept originally proposed for Union Station in the 1890s but never constructed.

Figure 5.10-3. Platform Canopies and High Shed Alternative C – Traditional Train Shed Form

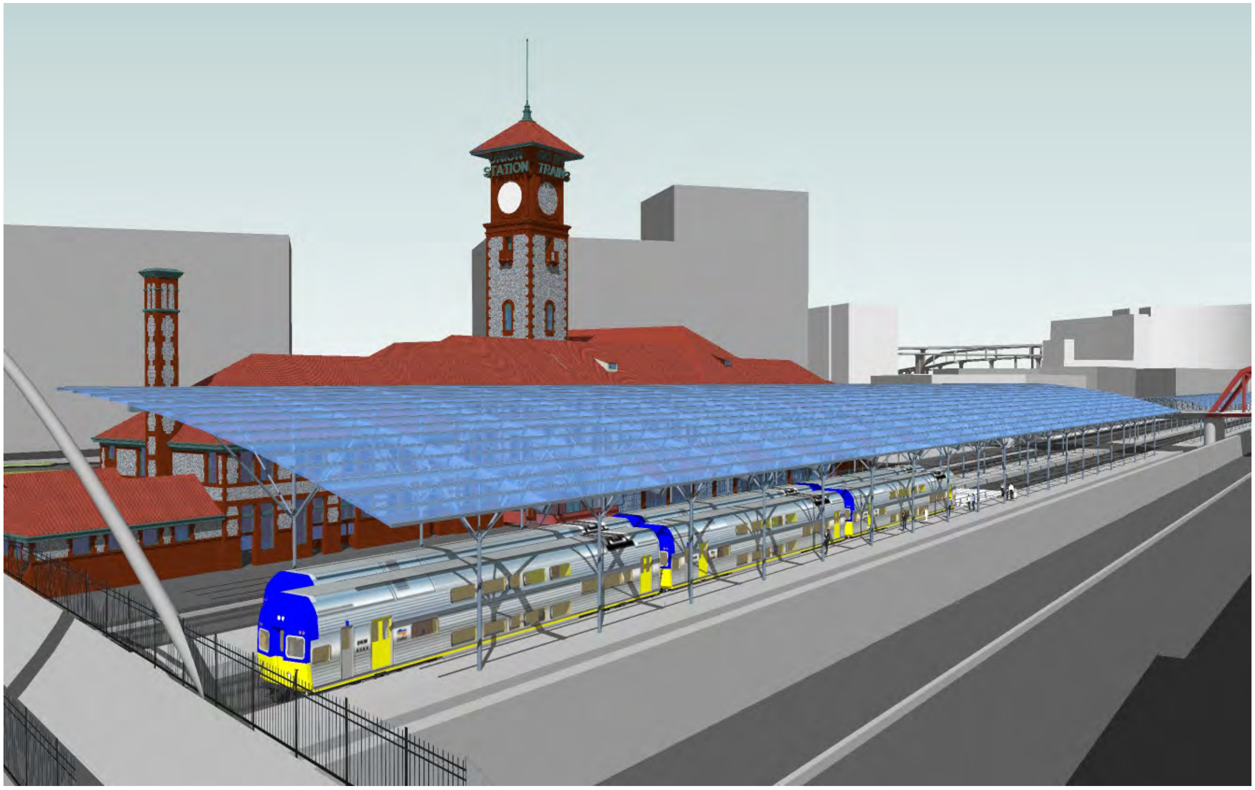


Source: IBI Group. 2016.

5.11.2.5 Alternative D: Contemporary Train Shed Form

Alternative D would provide a continuous train shed with a contemporary design styling between the Broadway Bridge and the pedestrian bridge (Figure 5.10-4). North and south of these bridges, respectively, the canopies would continue as umbrella canopies also using a contemporary styling, similar to Alternative B. Like Alternative B, this alternative aims to incorporate more contemporary structural forms and engineering methods to produce a lighter, more transparent train shed that meets rail operations requirements and complements the historic structure without attempting to replicate the historic structure. Also, like Alternative B, there is a wide variety of structural forms and material choice that is made possible by this alternative.

Figure 5.10-4. Platform Canopies and High Shed Alternative D – Contemporary Train Shed Form



Source: IBI Group. 2016.

5.11.3. Recommendation: Platform Canopies

The project team recommends implementing the contemporary umbrella canopies with high shed (Alternative B) (Figure 5.10-2). This alternative provides the essential benefits for rail operations (increased clearances and improved weather protection) while preserving the historic form of the existing umbrella canopy/high shed system. The capital cost of this alternative would be lower than Train Shed Alternatives C and D, while still providing sufficient area for a photovoltaic system, if desired.

In terms of constructability and maintenance of rail operations during construction, the umbrella canopy would be simpler to implement as part of a staged track reconstruction that upgrades one platform/platform canopy system at a time. It is anticipated that a contemporary platform canopy/high shed design can be developed to capture the positive benefits of a contemporary design approach while honoring the historic platform canopies and adjacent station.

Table 5.11-1. Evaluation of Platform Canopy Alternatives

Evaluation Criteria		No-Build	A	Traditional Umbrella Canopies with High Shed	B	Contemporary Umbrella Canopies with High Shed	C	Traditional Train Shed Form	D	Traditional Train Shed Form
A: Ability to Meet Project Goals										
A.1. Accommodate Future Capacity and Operational Needs of Passenger and Freight Rail	◆	Significant existing rail and passenger operations deficiencies and seismic hazards will persist	●	Opportunity to address rail operations, passenger experience, accessibility, and life safety issues identified.	●	Opportunity to address rail operations, passenger experience, accessibility, and life safety issues identified.	●	Opportunity to address rail operations, passenger experience, accessibility, and life safety issues identified.	●	Opportunity to address rail operations, passenger experience, accessibility, and life safety issues identified.
A.2. Preserve and Protect the Historic Character of Union Station	◆	Platform canopies and High Shed will continue to deteriorate	●	Most similar to existing, historic canopy form designed to current standards; requires caution to distinguish from truly historic building elements	□	Introduces new design that must be thoughtfully integrated with adjacent historic resources.	□	Introduces new design that must be thoughtfully integrated with adjacent historic resources.	□	Introduces new design that must be thoughtfully integrated with adjacent historic resources.
A.3. Improve Economic and Social Vitality	◆	Old and failing platform canopy structures and systems will result in diminished operating efficiency	●	Replacement structures will improve facility operating efficiency	●	Replacement structures will improve facility operating efficiency	●	Replacement structures will improve facility operating efficiency	●	Replacement structures will improve facility operating efficiency
A.4. Improve Environmental Sustainability	◆	Existing inefficient lighting and systems will remain	●	Opportunity to upgrade lighting and systems to increase efficiency. Opportunity to incorporate photovoltaic solar panels into design.	●	Opportunity to upgrade lighting and systems to increase efficiency. Opportunity to incorporate photovoltaic solar panels into design.	●	Opportunity to upgrade lighting and systems to increase efficiency. Opportunity to incorporate photovoltaic solar panels into design.	●	Opportunity to upgrade lighting and systems to increase efficiency. Opportunity to incorporate photovoltaic solar panels into design.
B. Cost and Financing										
B.1. Estimated Capital Cost	□	N/A – No capital improvement	●	Substantial project line item cost, but	●	Substantial project line item cost, but	◆	Larger shed structure potentially carries	◆	Larger shed structure potentially carries

Evaluation Criteria		No-Build	A	Traditional Umbrella Canopies with High Shed	B	Contemporary Umbrella Canopies with High Shed	C	Traditional Train Shed Form	D	Traditional Train Shed Form
		project		lower than shed options		lower than shed options		increased costs and cost risk.		increased costs and cost risk.
B.2. Lifecycle Cost Impacts	◆	Ongoing maintenance costs will likely increase to preserve obsolete infrastructure	●	Increased operating efficiency of modernized lighting and systems	●	Increased operating efficiency of modernized lighting and systems	□	Increased efficiency benefits, but a shed structure will likely have higher costs for cleaning and maintenance.	□	Increased efficiency benefits, but a shed structure will likely have higher costs for cleaning and maintenance.
B.3. Cost Risk	◆	Costs of platform/canopy replacement will likely increase in the future and/or as a stand-alone project	□	Canopy costs will be influenced by future design development decisions on of form and materials	□	Canopy costs will be influenced by future design development decisions on of form and materials	◆	Larger shed structure potentially carries increased costs and cost risk.	◆	Larger shed structure potentially carries increased costs and cost risk.
B.4. Financial Leverage	◆	Likely more difficult to fund future major repairs or replacement as a stand-alone project	●	Potential to leverage energy/sustainability funding sources with photovoltaic option.	●	Potential to leverage energy/sustainability funding sources with photovoltaic option.	●	Potential to leverage energy/sustainability funding sources with photovoltaic option.	●	Potential to leverage energy/sustainability funding sources with photovoltaic option.
C. Implementability and Constructability										
C.1. Technical Complexity and Constructability	□	N/A – No capital cost	●	Increased flexibility to stage construction of linear umbrella-type canopies while preserving station and freight rail operations, as compared to a shed alternative	●	Increased flexibility to stage construction of linear umbrella-type canopies while preserving station and freight rail operations, as compared to a shed alternative	◆	Increased complexity to stage and construct shed structure spanning active rail lines.	◆	Increased complexity to stage and construct shed structure spanning active rail lines.
C.2. Schedule and Schedule Risk	□	N/A – No capital improvement project	●	Increased flexibility to stage construction of linear umbrella-type canopies while preserving station and	●	Increased flexibility to stage construction of linear umbrella-type canopies while preserving station and	◆	Increased complexity to stage and construct shed structure spanning active rail lines.	◆	Increased complexity to stage and construct shed structure spanning active rail lines.

Evaluation Criteria		No-Build	A	Traditional Umbrella Canopies with High Shed	B	Contemporary Umbrella Canopies with High Shed	C	Traditional Train Shed Form	D	Traditional Train Shed Form
				freight rail operations, as compared to a shed alternative		freight rail operations, as compared to a shed alternative				
C.3. Construction Impact on Passenger and Freight Rail Operations	◆	Potentially more disruptive if undertaken as a future project not coordinated with other track improvements	●	Increased flexibility to stage construction of linear umbrella-type canopies while preserving station and freight rail operations, as compared to a shed alternative	●	Increased flexibility to stage construction of linear umbrella-type canopies while preserving station and freight rail operations, as compared to a shed alternative	◆	Potentially increased simultaneous impact on rail operations and platform construction when implementing shed-type structure spanning all tracks	◆	Potentially increased simultaneous impact on rail operations and platform construction when implementing shed-type structure spanning all tracks
C.4. Construction Impact on Union Station Tenants	□	N/A – No capital improvement project	□	Minimal impact anticipated due to location of work on the trackside	□	Minimal impact anticipated due to location of work on the trackside	□	Minimal impact anticipated due to location of work on the trackside	□	Minimal impact anticipated due to location of work on the trackside
C.5. Phasing and Project Segmentation	◆	Potentially more disruptive if undertaken as a future project not coordinated with other track improvements	●	Increased flexibility to stage construction of linear umbrella-type canopies while preserving station and freight rail operations, as compared to a shed alternative	●	Increased flexibility to stage construction of linear umbrella-type canopies while preserving station and freight rail operations, as compared to a shed alternative	◆	Increased complexity to stage and construct shed structure spanning active rail lines.	◆	Increased complexity to stage and construct shed structure spanning active rail lines.
C.6. Risks, Assumptions and Unknowns	◆	Foundation and structural condition unknowns may present unanticipated hazards if not addressed	●	Lower anticipated risk to implement umbrella-type structures with high shed using smaller-scale, prefabricated components as much as possible	●	Lower anticipated risk to implement umbrella-type structures with high shed using smaller-scale, prefabricated components as much as possible	◆	Increased complexity to stage and construct shed structure spanning active rail lines.	◆	Increased complexity to stage and construct shed structure spanning active rail lines.
D. Environmental Impacts and Approvals										
D.1. Environmental Impacts and Project	◆	Temporarily prolongs use historic canopy and high shed	◆	Canopy removal involves permanent loss of historic canopy and high shed	◆	Canopy removal involves permanent loss of historic canopy and high shed	◆	Canopy removal involves permanent loss of historic canopy and high shed	◆	Canopy removal involves permanent loss of historic canopy and high shed

Evaluation Criteria	No-Build	A	Traditional Umbrella Canopies with High Shed	B	Contemporary Umbrella Canopies with High Shed	C	Traditional Train Shed Form	D	Traditional Train Shed Form
Classification	structures, but continued deterioration and eventual loss is likely		structures		structures		structures		structures
D.2. Historic Impacts and Approvals	◆ Temporarily prolongs use historic canopy and high shed structures, but continued deterioration and eventual loss is likely	●	Most similar to existing canopies, though it is key to distinguish new structures from truly historic resources	◆	Preserves historic form/high shed, but introduces new materials and design elements	◆	Most significant change to historic form	◆	Most significant change to historic form
D.3. Decision Making and Approvals	◆ No build alternative may conflict with FRA mandates for ADA Level Boarding and other regulatory requirements	□	Will require discussions and approvals of new design	□	Will require discussions and approvals of new design	◆	More significant changes to historic form will likely require additional consultations	◆	More significant changes to historic form will likely require additional consultations

Source: IBI Group. 2016.

5.12. Rail and Building Maintenance Area

This improvement reorganizes and rationalizes the rail and building maintenance areas on the north side of Union Station to improve operations, safety, security, and aesthetics. The improvements include replacement of the seismically-deficient and non-historic Butler-type shed in the rail maintenance area.

The following alternatives were evaluated:

- The No-Build Alternative would retain the rail and building operations areas as-is, without improvements. The existing Butler-type shed would remain.
- The Attached Gable Shed Only alternative reinstates the historic gable shed that was removed for the construction of the Butler-type shed in the 1960s (also removes the Butler-type shed).
- The Service Court with Detached Sheds alternative creates an open service court between two smaller shed structures – one adjacent to the station building (potentially, the restored attached gable shed) and another adjacent to the track maintenance area.
- The New Replacement Shed with Attached Gable alternative provides a new shed structure covering the width of the maintenance area between Track 1 and the main building.

The results of the evaluation of the four alternatives are summarized in Table 5.12-1.

5.12.1. Design Requirements and Objectives

The key design requirements of the rail and building maintenance area identified through the conditions assessment and stakeholder discussions include:

- Replace the structurally and seismically deficient Butler-type shed.
- Rationalize and separate rail and building maintenance functions on the north end of the main building.
- Accommodate rail maintenance and inspection activities occurring on the adjacent Track 1 North.
- Provide improved perimeter security and visual screening from NW Station Way.
- Reduce and formalize parking for official Amtrak and building management vehicles only.
- Accommodate future truck-based train fueling operations (under design development).
- Provide for consolidated and secure refuse/recycling storage and appropriate disposal of liquid wastes from train servicing.
- Provide secure and covered storage for rail maintenance and baggage operations equipment (carts, tugs, lavatory servicing, etc.
- Consolidated main building mechanical and building support systems at the north end of the building (existing garage).
- Accommodate future exterior equipment for HVAC or other building systems.
- Provide design and adjacencies of interior/exterior rail operations and maintenance facilities to ensure safe and efficient workflow.
- Provide safe and secure storage for hazardous materials and wastes.
- Provide secure storage for spare parts, tools, and other materials.
- Improve the appearance of maintenance facilities from passenger areas, and maintain safe separation of passenger boarding and maintenance activities.
- Improve perimeter security and aesthetics along the Station Way perimeter.

5.12.2. Train Maintenance Shed Alternatives

There are many aspects of the rail and building maintenance area rehabilitation and many of these are subject to ongoing design discussion with PDC and Amtrak. The discussion in this section is limited to the replacement of the Butler-type shed structure, which was identified as structurally and seismically deficient in the Conditions Assessment Report (DOWA/IBI Group, 2015).

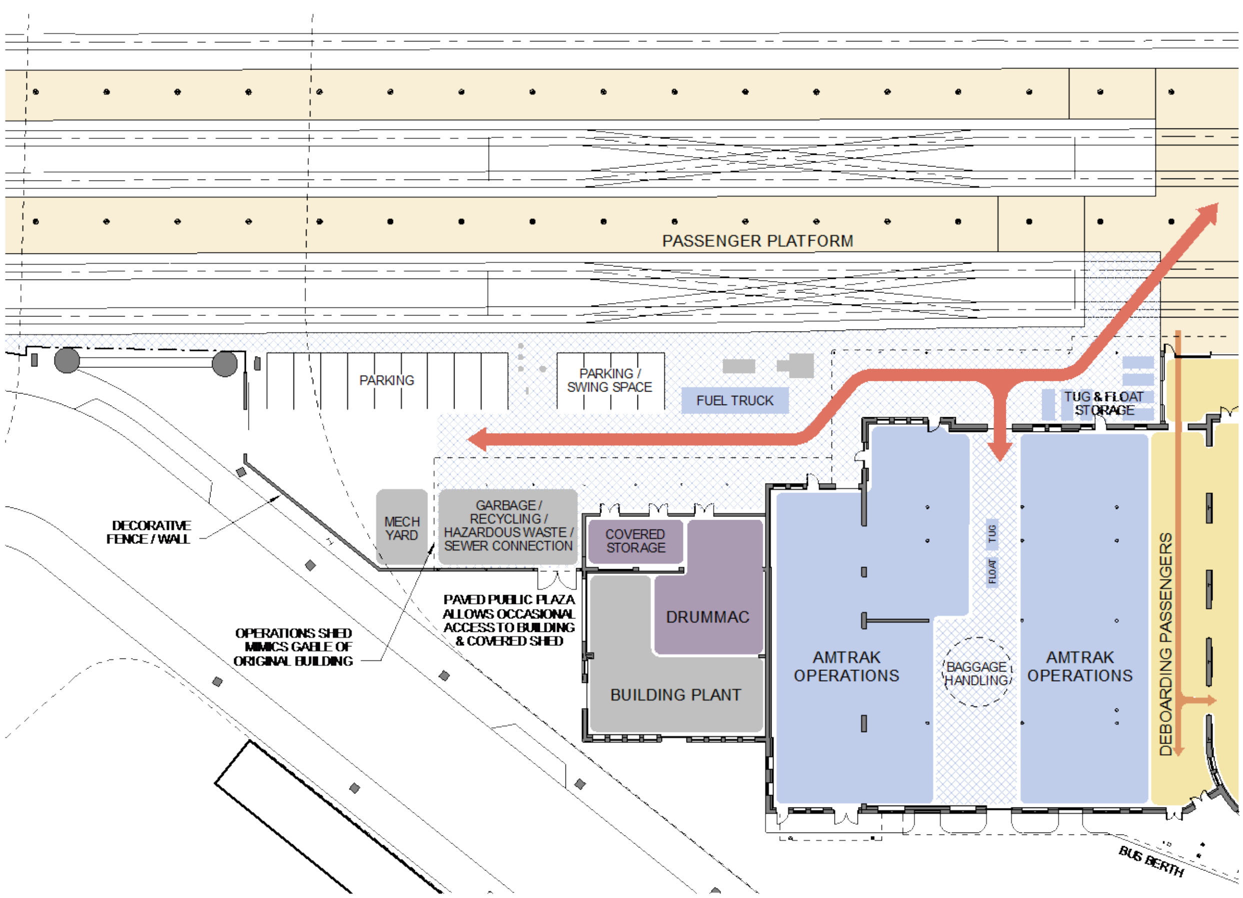
5.12.2.1 Train Maintenance Shed No-Build Alternative

Under the No-Build Alternative, the train maintenance area would remain in its current condition with regular maintenance but with no capital investment. The conditions assessment identified critical structural and seismic deficiencies that require the replacement of the existing Butler-type shed. The structure is also in deteriorated condition with failing roof panels, corrosion, and fading/peeling paint. The large size of the structure tends to block natural light from reaching the maintenance area and the adjacent portion of NW Station Way under the Broadway Bridge viaduct, yet existing artificial lighting is efficient. The structure is also utilitarian in construction and does not complement the adjacent historic structure. Much of the area under the current shed is dedicated to informal parking.

5.12.2.2 Alternative A: Attached Gable Shed Only

This alternative would reconstruct the historic gable shed that was removed for the construction of the Butler-type shed in the 1960s (Figure 5.12-1). This would provide limited outdoor covered space for baggage carts, supplies, etc., but the majority of the rail and building service area and parking would be open to the elements.

Figure 5.12-1. Train Maintenance Shed Alternative A – Attached Gable Shed Only

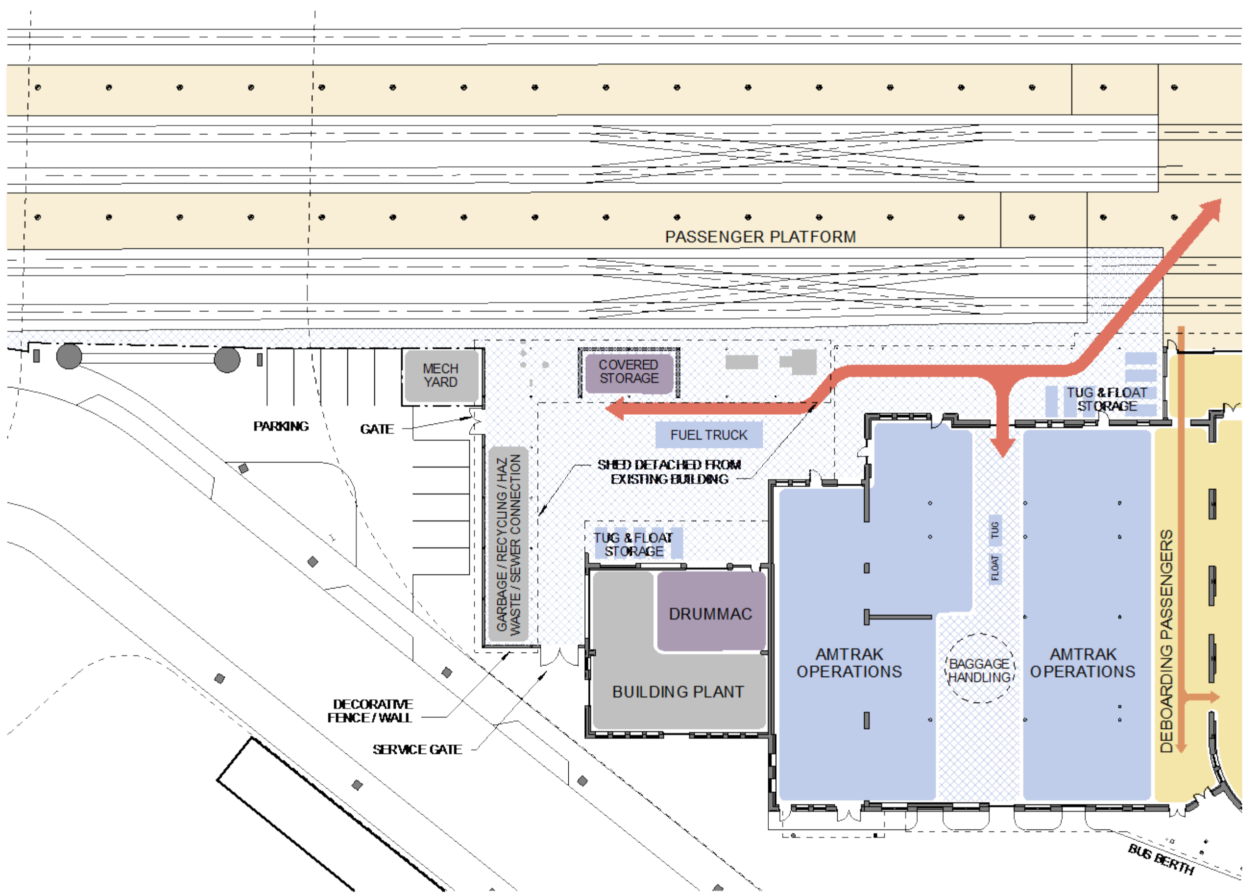


Source: IBI Group.2016.

5.12.2.3 Alternative B: Service Court with Detached Sheds

This alternative would provide an open "service court" between two smaller shed structures – one adjacent to the station building (potentially, the restored attached gable shed) and another adjacent to the track maintenance area (Figure 5.12-2). The center opening would allow for parking of official vehicles and the fuel truck outside of the covered area. The advantage of this option is reduced size and coverage of the shed structures, which would likely result in a reduced cost. It also would avoid parking a fuel truck under a covered area attached to the main building, as is the case today. A drawback of this alternative would be the greater weather exposure of the exterior maintenance area.

Figure 5.12-2. Train Maintenance Shed Alternative B – Service Court with Detached Sheds

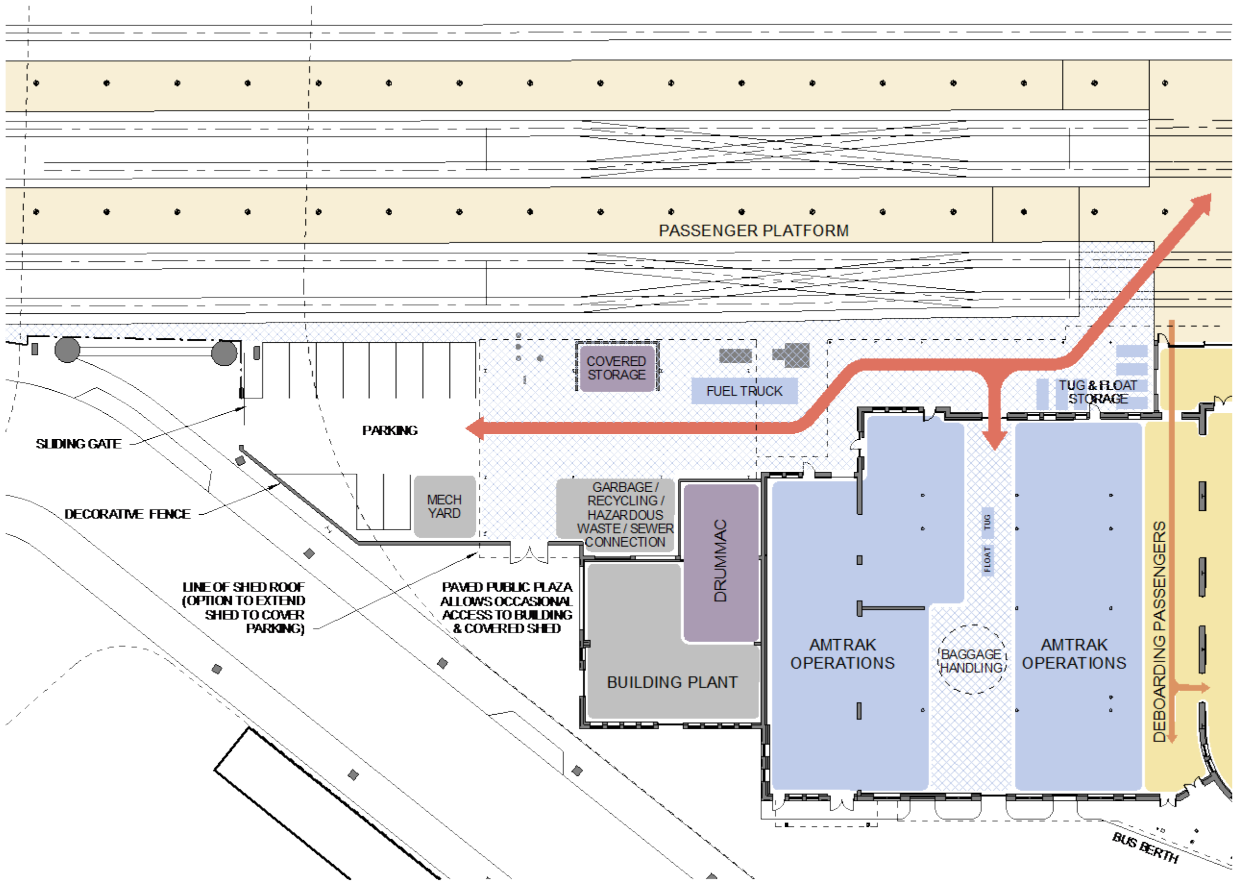


Source: IBI Group. 2016.

5.12.2.4 Alternative C: New Replacement Shed (with Attached Gable)

This alternative would provide a new shed structure covering the width of the maintenance area between Track 1 and the main building (Figure 5.12-3). The length of this structure would likely be shorter in length than the existing Butler-type shed, given anticipated Amtrak needs, the reduced parking requirements, and potential fueling operations (not under cover). This may also allow additional natural light to reach the public street on NW Station Way underneath the Broadway Bridge viaduct. The design of the new shed would likely assume the form of the preferred platform canopy design. However, it is also possible to combine the new replacement shed with a reconstructed attached gable, providing the added benefit of reversing the historic damage to the main building when the Butler-type shed was built.

Figure 5.12-3. Train Maintenance Shed Alternative C – New Replacement Shed with Attached Gable



Source: IBI Group. 2016.

5.12.3. Recommendation: Rail and Building Maintenance Area

The project team recommends implementing the new replacement shed with attached gable (Alternative C) (Figure 5.12-3). This alternative would provide the greatest functional benefit and design flexibility to provide coverage that meets the operations needs of Amtrak. It also would provide the historic benefit of the restored attached gable. The specific sizing requirements and organization of the maintenance area and associated shed structure would be further developed through preliminary engineering.

Table 5.12-1. Evaluation of Train Maintenance Shed Alternatives

Evaluation Criteria		No-Build	A	Attached Gable Shed Only	B	Service Court with Detached Sheds	C	New Replacement Shed (with Attached Gable)
A: Ability to Meet Project Goals								
A.1. Accommodate Future Capacity and Operational Needs of Passenger and Freight Rail	◆	Significant existing rail operations deficiencies and seismic hazards will persist	●	Rationalizes and improves operations, safety, security, and efficiency of rail and building maintenance areas	●	Rationalizes and improves operations, safety, security, and efficiency of rail and building maintenance areas	●	Rationalizes and improves operations, safety, security, and efficiency of rail and building maintenance areas
A.2. Preserve and Protect the Historic Character of Union Station	◆	Maintenance shed will continue to deteriorate and detract from the historic character of the station	●	Eliminates existing shed which detracts from historic character, and restores the compromised historic gable shed that was removed	●	Eliminates existing shed which detracts from historic character, and restores the compromised historic gable shed that was removed	●	Eliminates existing shed which detracts from historic character, and restores the compromised historic gable shed that was removed
A.3. Improve Economic and Social Vitality	◆	Missed opportunity to improve appearance, visual screening and access control of the maintenance area from the public right of way	●	Opportunity to improve appearance, visual screening and access control of the maintenance area from the public right of way	●	Opportunity to improve appearance, visual screening and access control of the maintenance area from the public right of way	●	Opportunity to improve appearance, visual screening and access control of the maintenance area from the public right of wa.
A.4. Improve Environmental Sustainability	◆	Existing inefficient lighting and systems will remain	●	Provides opportunity to implement more energy efficient systems and other sustainability features	●	Provides opportunity to implement more energy efficient systems and other sustainability features	●	Provides opportunity to implement more energy efficient systems and other sustainability features
B. Cost and Financing								
B.1. Estimated Capital Cost	□	N/A – No capital improvement project	●	Likely to be a lower cost alternative (offset by reduced coverage of exterior maintenance area)	□	Likely to be a moderate cost alternative (with moderate coverage of exterior maintenance area)	◆	Likely to be a higher cost alternative (offset by increased coverage of exterior maintenance area)

Evaluation Criteria		No-Build	A	Attached Gable Shed Only	B	Service Court with Detached Sheds	C	New Replacement Shed (with Attached Gable)
B.2. Lifecycle Cost Impacts	◆	Ongoing maintenance costs will likely increase to preserve obsolete infrastructure	●	Reduced lifecycle costs for building systems and due to rail maintenance efficiency and security improvements	●	Reduced lifecycle costs for building systems and due to rail maintenance efficiency and security improvements	●	Reduced lifecycle costs for building systems and due to rail maintenance efficiency and security improvements
B.3. Cost Risk	◆	Costs of maintenance area refurbishment and maintenance shed replacement will likely increase in the future; risk of unanticipated failure or major repair needs for existing shed	☐	Costs to reconstruct the historic gable shed are uncertain and subject to historic design review	☐	Costs to reconstruct the historic gable shed are uncertain and subject to historic design review	☐	Costs to reconstruct the historic gable shed are uncertain and subject to historic design review
B.4. Financial Leverage	◆	Likely more difficult to fund future major repairs or replacement as a stand-alone project	●	Increased funding potential as part of a multifaceted renovation project.	●	Increased funding potential as part of a multifaceted renovation project.	●	Increased funding potential as part of a multifaceted renovation project.
C. Implementability and Constructability								
C.1. Technical Complexity and Constructability	☐	N/A – No capital improvement project	☐	Gable reconstruction will involve historic design coordination and material compatibility with existing structure	☐	Gable reconstruction will involve historic design coordination and material compatibility with existing structure	☐	Gable reconstruction will involve historic design coordination and material compatibility with existing structure
C.2. Schedule and Schedule Risk	☐	N/A – No capital improvement project	☐	Comparable among build alternatives	☐	Comparable among build alternatives	☐	Comparable among build alternatives
C.3. Construction Impact on Passenger and Freight Rail Operations	☐	N/A – No capital improvement project	☐	Rail maintenance functions will have to be temporarily relocated while the area is	☐	Rail maintenance functions will have to be temporarily relocated	☐	Rail maintenance functions will have to be temporarily relocated

Evaluation Criteria		No-Build	A	Attached Gable Shed Only	B	Service Court with Detached Sheds	C	New Replacement Shed (with Attached Gable)
				under construction		while the area is under construction		while the area is under construction
C.4. Construction Impact on Union Station Tenants	☐	N/A – No capital improvement project	☐	Limited impact on non-rail tenants due to back of house location of maintenance area	☐	Limited impact on non-rail tenants due to back of house location of maintenance area	☐	Limited impact on non-rail tenants due to back of house location of maintenance area
C.5. Phasing and Project Segmentation	☐	N/A – No capital improvement project	☐	Rail maintenance functions will have to be temporarily relocated while the area is under construction	☐	Rail maintenance functions will have to be temporarily relocated while the area is under construction	☐	Rail maintenance functions will have to be temporarily relocated while the area is under construction
C.6. Risks, Assumptions and Unknowns	☐	N/A – No capital improvement project	☐	Restoration of the historic gable canopy requires further design development to fully understand feasibility and risks	☐	Restoration of the historic gable canopy requires further design development to fully understand feasibility and risks	☐	Restoration of the historic gable canopy requires further design development to fully understand feasibility and risks
D. Environmental Impacts and Approvals								
D.1. Environmental Impacts and Project Classification	◆	Existing maintenance shed continues to detract from historic character of the station. No improvements to existing hazardous/waste materials storage	●	Potential to reconstruct missing historic gable shed. Improvements will upgrade handling and storage of hazardous materials	●	Potential to reconstruct missing historic gable shed. Improvements will upgrade handling and storage of hazardous materials	●	Potential to reconstruct missing historic gable shed. Improvements will upgrade handling and storage of hazardous materials
D.2. Historic Impacts and Approvals	◆	Existing maintenance shed continues to detract from historic character of the station.	●	Restoration of historic gable is a significant benefit	☐	Restoration of historic gable is a significant benefit, though introduction of new shed elements needs to be carefully considered to ensure historic compatibility	☐	Restoration of historic gable is a significant benefit, though introduction of new shed elements needs to be carefully considered to ensure historic compatibility

Evaluation Criteria		No-Build	A	Attached Gable Shed Only	B	Service Court with Detached Sheds	C	New Replacement Shed (with Attached Gable)
D.3. Decision Making and Approvals	☐	Requires consensus with Amtrak, FRA, and permitting authorities to retain existing conditions	☐	Refinement of maintenance area requirements and design alternatives is a topic of ongoing discussion with Amtrak	☐	Refinement of maintenance area requirements and design alternatives is a topic of ongoing discussion with Amtrak	☐	Refinement of maintenance area requirements and design alternatives is a topic of ongoing discussion with Amtrak

Source: IBI Group. 2016.

5.13. Annex

The proposed annex improvements would address existing deficiencies in the annex building identified during the conditions assessment, and would address the project goals of improving the activation and re-use of the currently underutilized annex to increase Union Station vitality and restore productive purpose to the building.

5.13.1. Design Requirements and Objectives

The key design requirements of the annex identified through the conditions assessment and stakeholder discussions include:

- Repurpose the annex as productive leasable space as part of overall revitalization vision.
- Relocate existing boiler room mechanical equipment to the main building to facilitate re-use.
- Provide structural, seismic, mechanical, life safety, and accessibility upgrades for the annex, similar to the main building.
- Increase the visibility/presence of the annex from the front of Union Station and adjacent public ways.
- Preserve and seismically retrofit the iconic annex chimney.
- Repurpose the surplus Amtrak parking in the adjacent parking area.
- Improve perimeter security between the annex front side and the rail operations/platform areas to the rear of the annex.
- Consolidate Amtrak office and law enforcement support functions into the main building.

5.13.2. Annex No-Build Alternative

Under the No-Build Alternative, the annex building would remain in its current condition with regular maintenance but with no capital investment. Numerous deficiencies were identified with the annex building during the conditions assessment. The structural and seismic condition of the building, including the chimney, is severely deteriorated and poses a hazard to nearby persons and rail infrastructure. Major mechanical systems, electrical, and plumbing are at the end of their useful life, and many aspects of the building to not meet existing code or accessibility requirements. The second floor is accessible only by a single steep stairway, and it lacks elevator service and adequate emergency egress.

The poor condition of the building makes it very difficult to lease at a competitive market rate to a third-party tenant. Amtrak has recently vacated the structure and does not envision needing the annex space to support future rail operations. Without improvement, the building would continue to deteriorate, would likely experience a high vacancy rate, and would pose a continued safety hazard.

5.13.3. Landscaped Area/Annex Parking Alternatives

The re-use of the annex is predicated on improving the visibility and "presence" of the annex building, and ensuring clearer and more secure separation of the annex from rail operations and building support functions. A set of alternatives for the area fronting the annex (landscaped area and annex parking) has been developed to address this issue.

This improvement addresses existing security concerns in the existing landscaped areas, repurposes the redundant parking lot in front of the annex, and increases the prominence of the annex from NW Station Way to help support its re-activation.

The following alternatives were evaluated:

- The No-Build Alternative would retain the existing landscape area and annex parking lot in its current configuration.
- The Hardscaped Annex Plaza alternative creates a new, primarily hardscape, "Annex Plaza" in the location of the existing landscaped area and annex parking lot.

The results of the evaluation of the three alternatives are summarized in Table 5.13-1.

5.13.3.1 Alternative A: Maintain Existing Landscaped Area and Parking

This alternative would retain the existing landscaped area between the main building and the annex, as well as the parking area that currently serves the annex and the Wilf's kitchen/delivery area (Figure 5.13-21. While Amtrak has indicated that this parking is not needed to support its operations, it could be used to support a future annex tenant and/or other building visitors. The landscaped area would continue to be a vegetated area.

A drawback of this alternative is that it does not improve the visibility of the annex from the street, and the existing landscape area has been an ongoing security concern due to the lack of visibility through the landscaping. This would also impact the perceived security of the adjacent pedestrian bridge.

Figure 5.13-1. Annex Alternative A – Existing Landscaped Area and Parking

Source: IBI Group. 2016.

5.13.3.2 Alternative B: Hardscaped Annex Plaza

This alternative would create a new, primarily hardscape, "Annex Plaza" in the location of the existing landscaped area and annex parking (Figure 5.13-2). This includes the western landing of the pedestrian bridge over the Union Station tracks and platforms, and therefore is a pedestrian gateway to and from the river corridor along NW Naito Parkway.

The introduction of the annex plaza would improve the visibility of the annex building, and would create a new public gathering space to increase vitality in this traditionally back-of-house portion of the station complex. Its design would be reminiscent of other urban parks and plazas built in the Portland Central City in recent years, such as Jamison Square and Director Park, and could serve a similar function as a gathering spot for the emerging Broadway Corridor neighborhood. Annex plaza features, while not yet determined at this time, could include seating, fountains, play equipment, landscape planters, public art, event space, rail historic exhibits, food carts, or many other possibilities.

The hardscape surface would also allow for installation of underground sustainability features of the building mechanical systems, such as a rainwater cistern or a ground source bore field for geothermal heating and cooling.

Figure 5.13-2. Annex Alternative B - Hardscaped Plaza

Source: IBI Group. 2016.

5.13.3.3 Recommendation: Landscaped Area/Annex Parking

The project team recommends implementing the annex plaza improvements (Alternative B) (Figure 5.13-2). This transformation would be consistent with the periodic change and re-purposing of this area over the history of Union Station. It would maximize the potential of the annex while creating a community gathering spot that celebrates Union Station and provides benefits to the broader neighborhood.

Table 5.13-1. Evaluation of Landscaped Area/Annex Parking Alternatives

Evaluation Criteria		No-Build	A	Maintain Existing Landscaped Area and Parking	B	Hardscaped Annex Plaza
A: Ability to Meet Project Goals						
A.1. Accommodate Future Capacity and Operational Needs of Passenger and Freight Rail	◆	Existing lack of perimeter security and other deficiencies will persist. Land next to historic station will continue to be devoted to surplus parking	●	Security/perimeter improvements can be implemented to separate Annex uses from rail operations areas	●	Security/perimeter improvements can be implemented to separate Annex uses from rail operations areas
A.2. Preserve and Protect the Historic Character of Union Station	◆	Annex building will likely to continue to be underutilized if immediate surroundings are not improved	□	Preserves current landscaped area without changes, but Annex building visibility and revitalization is negatively impacted	□	Provides additional prominence and vitality to the historic Annex and south Main Building. Must be implemented in a way that is compatible with adjacent historic resources
A.3. Improve Economic and Social Vitality	◆	Limits visibility, vitality, and reuse options for the historic Annex, as well as opportunities to link the Annex to the Main Building and surrounding neighborhood	◆	Limits visibility, vitality, and reuse options for the historic Annex, as well as opportunities to link the Annex to the Main Building and surrounding neighborhood	●	Increases visibility and revitalization opportunities for the historic Annex as a positive Union Station and neighborhood amenity
A.4. Improve Environmental Sustainability	◆	Limits options to implement sustainability features envisioned under and as part of Plaza	◆	Limits options to implement sustainability features envisioned under and as part of Plaza	●	Provides area for incorporation of sustainability features for building systems; reduces and repurposes on-site parking
B. Cost and Financing						
B.1. Estimated Capital Cost	□	N/A – No capital improvement project	●	Relatively minor changes with lower construction costs	◆	Higher construction costs anticipated to reap more significant benefits
B.2. Lifecycle Cost Impacts	□	Similar to current operating/maintenance costs	□	Similar to current operating/maintenance costs	●	Higher building efficiency with sustainability features incorporated into Plaza area
B.3. Cost Risk	●	Low cost risk	●	Low cost risk	◆	Capital cost is subject to future design decisions on materials and features, as well as historic design review
B.4. Financial Leverage	◆	Likely more difficult to fund future	●	Increased funding potential as	●	Potential to leverage

Evaluation Criteria		No-Build	A	Maintain Existing Landscaped Area and Parking	B	Hardscaped Annex Plaza
		improvements a stand-alone project		part of a multifaceted renovation project.		sustainability, arts, urban redevelopment funding sources. Also opportunity for value capture related to higher future Annex lease revenues
C. Implementability and Constructability						
C.1. Technical Complexity and Constructability	□	N/A – No capital improvement project	●	Low complexity	◆	Requires engineering coordination with sustainability features, increasing complexity.
C.2. Schedule and Schedule Risk	□	N/A – No capital improvement project	●	Low schedule risk	◆	Requires additional coordination among work phases and disciplines
C.3. Construction Impact on Passenger and Freight Rail Operations	□	N/A – No capital improvement project	□	Relatively minor construction impacts to modest changes	□	Temporary impacts to construct improvements, but also creates opportunities to use partially-rehabilitated plaza area for construction or rail operations staging
C.4. Construction Impact on Union Station Tenants	□	N/A – No capital improvement project	□	Relatively minor construction impacts to modest changes	□	Temporary impacts to construct improvements, but also creates opportunities to use partially-rehabilitated plaza area for construction or rail operations staging
C.5. Phasing and Project Segmentation	□	N/A – No capital improvement project	●	Area can be used to support construction staging. Improvements could be implemented as a later phase following railside and Main Building improvements	●	Area can be used to support construction staging. Improvements could be implemented as a later phase following railside and Main Building improvements
C.6. Risks, Assumptions and Unknowns	□	N/A – No capital improvement project	●	Low risk alternative	□	Requires further design development to understand risks of more complex project element
D. Environmental Impacts and Approvals						

Evaluation Criteria		No-Build	A	Maintain Existing Landscaped Area and Parking	B	Hardscaped Annex Plaza
D.1. Environmental Impacts and Project Classification	●	No changes preserves existing appearance of area	●	Likely to retain much of the existing appearance of the area	□	Positive impact of implementing building sustainability infrastructure under Plaza, balanced with potential impact to adjacent historic resources
D.2. Historic Impacts and Approvals	□	No changes, but opportunity to improve surroundings of historic resources are deferred	□	Relatively minor changes anticipated to existing conditions	◆	More significant changes to area will likely merit additional historic review
D.3. Decision Making and Approvals	□	N/A – No capital improvement project	□	Design subject to historic design review	◆	Likely to be subjected to a more intensive historic design review

Source: IBI Group. 2016.

5.13.4. Annex Floor Plan Alternatives

Within the existing Union Station annex building, three floor levels currently exist, including a two-story office and sunken boiler and storage room spaces. Three floor plan alternatives have been developed utilizing the existing shells and floor levels in different ways.

This improvement addresses interior architectural reconfiguration to address the deterioration, code compliance and accessibility issues, and re-use opportunities for the underutilized Annex building.

The following alternatives were evaluated:

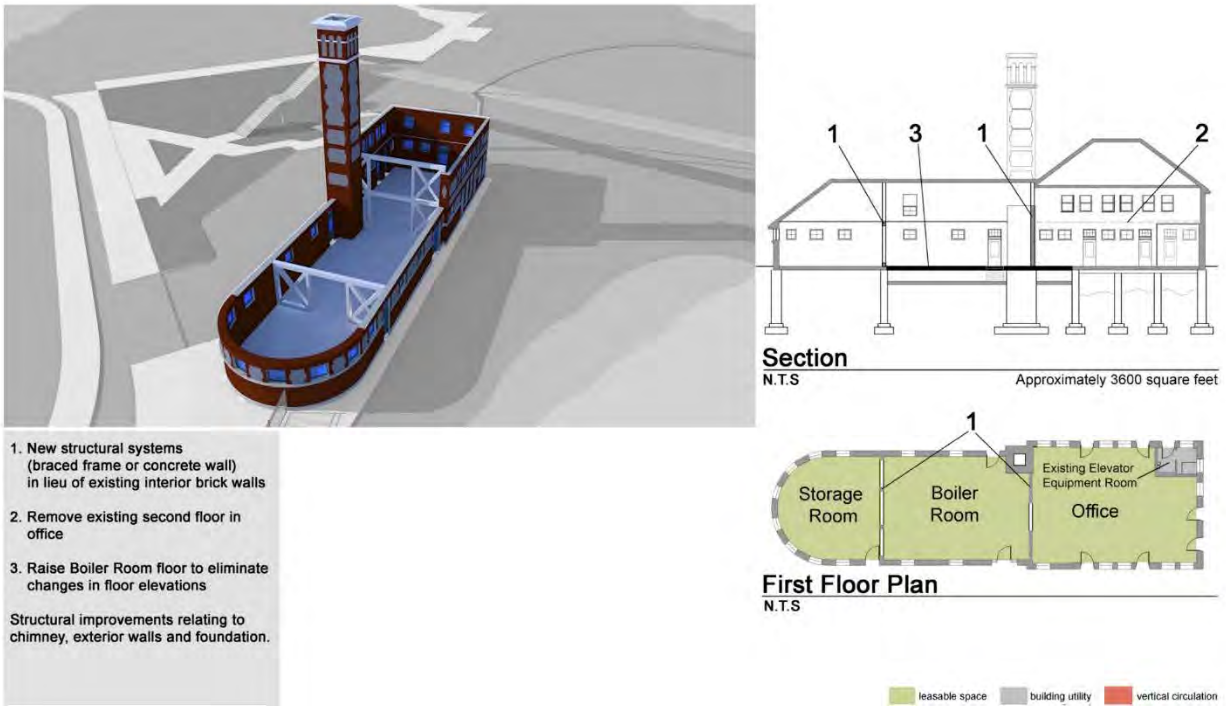
- The No-Build Alternative retains the existing floorplan as-is, with the boiler room decommissioned and devoted to mechanical/storage functions and the two-story offices in their existing deteriorated condition.
- The Single-Story Shell alternative removes the second floor offices in favor of a single story, high-ceiling interior space throughout the volume of the building.
- The 2+1 Floor alternative retains the two-story office portion as well as the one-story former boiler room. New elevator and egress stair are required for the remodeled two-story area.
- The Boiler Room Basement alternative retains the second floor office space and the existing boiler and storage room floor and adds a mezzanine level in the high ceilinged area, creating more leasable area in the Annex. New elevator and egress stairs are required.

The results of the evaluation of the four alternatives are summarized in Table 5.13-2.

5.13.4.1 Alternative A: Single-Story Shell Alternative

Under this alternative, the second floor office would be removed and the lower boiler and storage room floors would be in-filled to bring it up to the main floor level in the office portion (Figure 5.13-3). By removing the second floor office, an additional stair and new elevator would not be needed. Raising the boiler room floor would eliminate changes in floor elevations, therefore not requiring stairs and an elevator to this level. Structural improvements to reinforce the annex chimney, exterior walls and foundation would be needed, including a braced frame or concrete wall being constructed to reinforce the existing brick walls.

Figure 5.13-3. Annex Floor Plan Alternative A - Single Story Shell

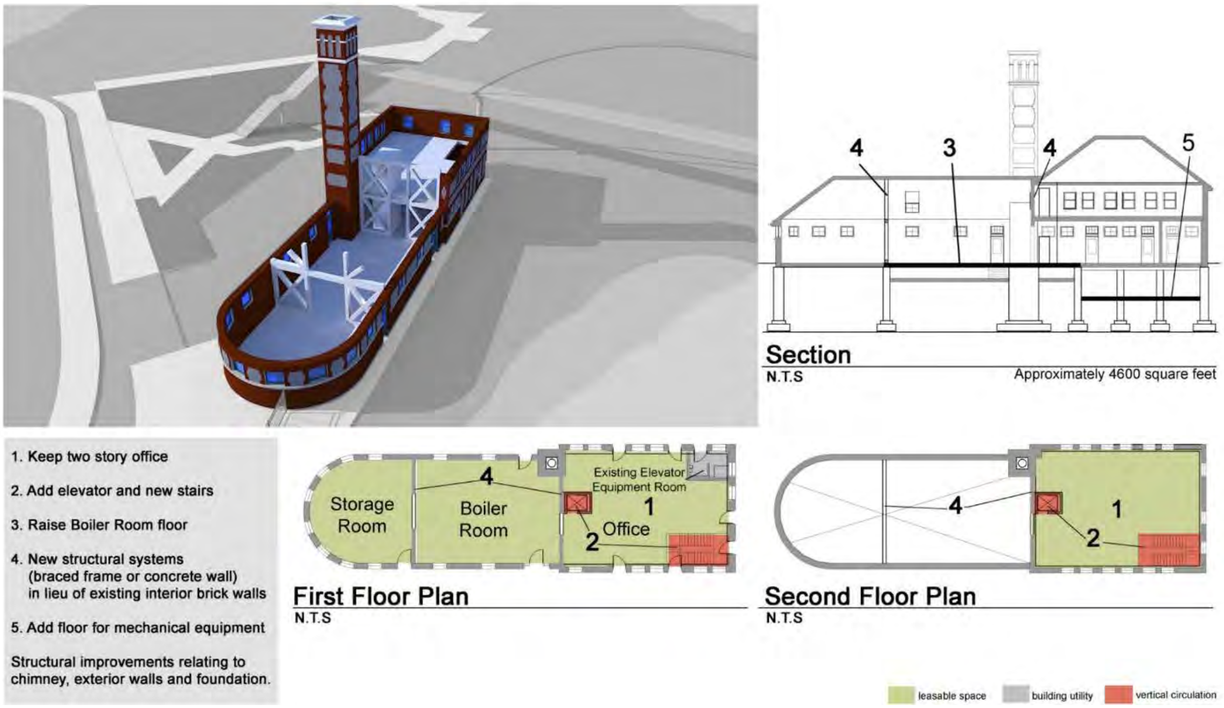


Source: IBI Group. 2016.

5.13.4.2 Alternative B: 2+1 Floor Alternative

Under the 2+1 Floor Alternative, the second floor office would be left intact while the boiler and storage room floors would be brought up to the level in the main office (Figure 5.13-4). A new elevator and stairs would be required in this option to access the second floor. Below the existing first floor office, a new lower floor could be partially excavated to create an area for mechanical equipment. Structural improvements to reinforce the chimney, exterior walls and foundation would be needed, including a braced frame or concrete wall being constructed to reinforce the existing brick walls.

Figure 5.13-4. Annex Floor Plan Alternative B - 2-Story Office + 1-Story Boiler

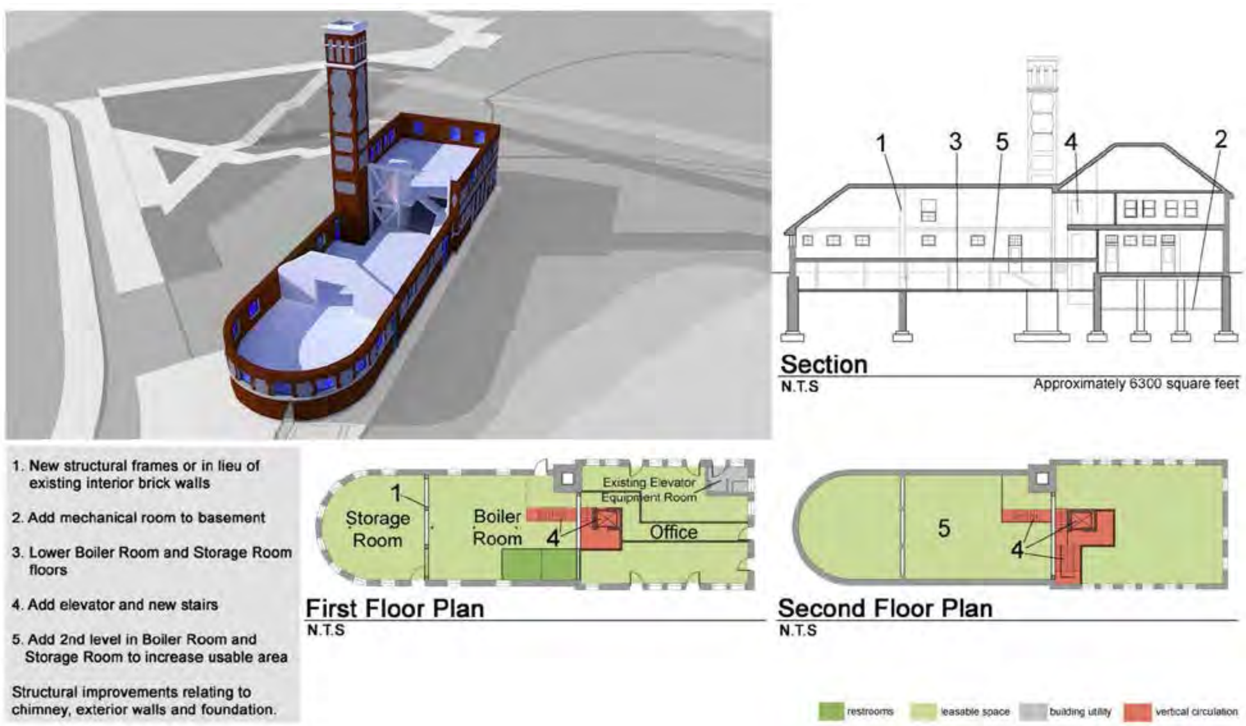


Source: IBI Group. 2016.

5.13.4.3 Alternative C: Boiler Room Basement Alternative

Improvements under this Boiler Room Basement alternative would attempt to create as much leaseable area as possible in the structure (Figure 5.13-5). This option would leave the second floor of the office intact and would lower the existing boiler and storage room floors to add a second level above those two spaces, creating four levels in the annex. This second level in the boiler and storage room area would increase the usable area of the annex, and the level below can remain as a mechanical room function. A new elevator and stair would be needed to access both the second floor office and the basement level in the boiler/storage room area. Structural improvements to reinforce the chimney, exterior walls and foundation would be needed, including a braced frame or concrete wall being constructed to reinforce the existing brick walls.

Figure 5.13-5. Annex Floor Plan Alternative C – Boiler Room Basement



Source: IBI Group. 2016.

5.13.4.4 Recommendation: Annex Floor Plan

The project team recommends implementing the Single-Story Shell Alternative (Alternative A) for the annex (Figure 5.13-3). This alternative would provide the most flexibility for re-use of the annex building, once the basic building upgrades have been completed and the annex is ready for leasing and fit-out based on future market and neighborhood conditions. The additional cost and space consumption of stair and elevator access to a second floor or mezzanine may not be cost effective for many uses; however, the single story shell alternative could be designed in a manner to accommodate the addition of a second floor mezzanine in the future, if warranted by the tenant.

Table 5.13-2. Evaluation of Annex Floor Plan Alternatives

Evaluation Criteria		No-Build	A	Single Story Shell	B	2-Story Office + 1-Story Boiler	C	Boiler Room Basement
A: Ability to Meet Project Goals								
A.1. Accommodate Future Capacity and Operational Needs of Passenger and Freight Rail	□	Space is not utilized for rail operations	□	Space is not utilized for rail operations	□	Space is not utilized for rail operations	□	Space is not utilized for rail operations
A.2. Preserve and Protect the Historic Character of Union Station	◆	Does not implement necessary improvements to repurpose and revitalize the Annex. Ongoing risk of significant seismic damage/failure into the future	●	Preserves and repurposes Annex, but with architectural/structural modifications to the interior	●	Floor plan most closely resembles the existing historical Annex interior, with upgrades and modifications	●	Preserves and repurposes Annex, but with architectural/structural modifications to the interior
A.3. Improve Economic and Social Vitality	◆	Limits reuse options of the Annex due to seismic hazard	◆	Decreases leasable space	□	Similar to existing leasable space	●	Adds leasable floor space
A.4. Improve Environmental Sustainability	◆	Does not upgrade to energy inefficient building systems	●	Includes more energy efficient and sustainable building systems upgrades	●	Includes more energy efficient and sustainable building systems upgrades	●	Includes more energy efficient and sustainable building systems upgrades
B. Cost and Financing								
B.1. Estimated Capital Cost	◆	Cost to address deterioration and repair will likely increase in the future	●	Lowest costs for usability upgrades; no elevator, and 1 set of restroom facilities, balanced withe costs to install horizontal trusses where floor is removed.	□	Moderate costs to provide new elevator and egress to relatively small second floor office area (for small gain in leasable SF). Additional costs to raise floor in central Boiler area.	◆	Highest costs due to multi-stop elevator, additional stairs and additional restrooms. Higher costs to upgrading/building second floor, lowering floor slab in the Boiler area and adding basement slab under the office.
B.2. Lifecycle Cost Impacts	◆	Annex retains higher energy and operating costs	□	Minimal maintenance cost	□	Minimal maintenance cost	□	Minimal maintenance cost
B.3. Cost Risk	◆	Less certainty about	□	Moderate cost risk	□	Moderate cost risk	◆	Increased complexity of

Evaluation Criteria		No-Build	A	Single Story Shell	B	2-Story Office + 1-Story Boiler	C	Boiler Room Basement
		future costs of construction and repairs if deferred to future. Potential for higher costs of emergency repairs						structure presents higher cost risk
B.4. Financial Leverage	◆	Likely more difficult to pursue Annex repairs as a future stand-alone project	●	Increased funding potential as part of a multifaceted renovation project	●	Increased funding potential as part of a multifaceted renovation project	●	Increased funding potential as part of a multifaceted renovation project
C. Implementability and Constructability								
C.1. Technical Complexity and Constructability	□	N/A – No capital improvement project	◆	Highly technical engineering and construction	◆	Highly technical engineering and construction	◆	Highly technical engineering and construction. Adds new framing elements that will require pile supports.
C.2. Schedule and Schedule Risk	□	N/A – No capital improvement project	□	Dependent on brick tests and whether existing elements can handle connections required for seismic upgrade	□	Dependent on brick tests and whether existing elements can handle connections required for seismic upgrade	□	Dependent on brick tests and whether existing elements can handle connections required for seismic upgrade.
C.3. Construction Impact on Passenger and Freight Rail Operations	◆	More difficult to use Annex for temporary rail/passenger/tenant space during the construction phase if not renovated	◆	Annex renovation, particularly core drilling holes in the Boiler east wall, may result in rail disruptions or temporary track closures given close proximity	◆	Annex renovation, particularly core drilling holes in the Boiler east wall, may result in rail disruptions or temporary track closures given close proximity	◆	Annex renovation, particularly core drilling holes in the Boiler east wall, may result in rail disruptions or temporary track closures given close proximity
C.4. Construction Impact on Union Station Tenants	◆	More difficult to use Annex for temporary rail/passenger/tenant space during the construction phase if not renovated	□	Impact limited to Annex tenants who could potentially be relocated to main building; building has a high percentage of vacancies	□	Impact limited to Annex tenants who could potentially be relocated to main building; building has a high percentage of vacancies	□	Impact limited to Annex tenants who could potentially be relocated to main building; building has a high percentage of vacancies

Evaluation Criteria		No-Build	A	Single Story Shell	B	2-Story Office + 1-Story Boiler	C	Boiler Room Basement
C.5. Phasing and Project Segmentation	◆	More difficult to use Annex for temporary rail/passenger/tenant space during the construction phase if not renovated	●	Potential to use renovated Annex for temporary rail/passenger/tenant space	●	Potential to use renovated Annex for temporary rail/passenger/tenant space	●	Potential to use renovated Annex for temporary rail/passenger/tenant space
C.6. Risks, Assumptions and Unknowns	◆	Likely more difficult to pursue Annex repairs as a future stand-alone project	☐	Dependent on brick tests and whether existing elements can handle connections required for seismic upgrade. Condition of existing wood foundation piles is unknown.	☐	Dependent on brick tests and whether existing elements can handle connections required for seismic upgrade. Condition of existing wood foundation piles is unknown.	☐	Dependent on brick tests and whether existing elements can handle connections required for seismic upgrade. Condition of existing wood foundation piles is unknown.
D. Environmental Impacts and Approvals								
D.1. Environmental Impacts and Project Classification	◆	Results in continued degradation, underutilization, and potential future loss of a significant historic resource.	●	Results in preservation and repurposing of a significant historic resource	●	Results in preservation and repurposing of a significant historic resource	●	Results in preservation and repurposing of a significant historic resource
D.2. Historic Impacts and Approvals	◆	Defers opportunity to preserve historic resource to a future time	◆	Changes character of building need to be balanced with reuse potential	◆	Changes character of building need to be balanced with reuse potential	◆	Changes character of building need to be balanced with reuse potential
D.3. Decision Making and Approvals	☐	No issues anticipated	☐	Proposed reconfiguration will require historic design review	☐	Proposed reconfiguration will require historic design review	☐	Proposed reconfiguration will require historic design review

Source: IBI Group. 2016.

5.13.5. Annex Chimney Alternatives

The existing annex chimney is approximately 7 feet 10 inches square and 80 feet high above the concrete base. The current construction consists of approximately 20- to 21-inch thick unreinforced brick walls. The conditions assessment identified the annex chimney as significantly deteriorated and not seismically sufficient. Reinforcement of the chimney itself and the chimney foundation is be required, or an alternative (shortening) or removal of the chimney) must be considered. The annex chimney is no longer a functional structure, but is historically important because it is evocative of the building's historic function as a boiler room.

This alternative would address the structural/seismic deficiencies and deterioration of the 80-foot annex chimney, which is currently inoperable but is a character-defining feature of the annex.

The following alternatives were evaluated:

- The No-Build Alternative retains the chimney as-is, without improvements. Deterioration would be expected to continue, and life safety risks due to seismic hazard would remain.
- The Ghost Chimney alternative replaces the existing masonry chimney with a new reconstructed form that is evocative of the mass and height of the former chimney but with the alternate materials.
- The Full Height Chimney with Reinforcement alternative reconstructs the chimney using original face bring around a seismically upgraded foundation and core
- The Chimney Height Reduction with Reinforcement alternative similarly reconstructs the chimney using original face brick around a seismically upgraded foundation and core, but with an overall reduced height
- The Remove Chimney alternative removes the existing chimney entirely.

The results of the evaluation of the five alternatives are summarized in Table 5.13-3.

5.13.5.1 Annex Chimney Alternative A: Full Height Chimney with Reinforcement

Alternative A would reconstruct the chimney using original face brick around a seismically upgraded foundation and core (Figure 5.13-6). Maintaining the existing chimney would be ideal in maintaining the complete historic character of the exterior of the annex. In order to retain the brick chimney as it appears currently, it would be necessary to carefully dismantle the exterior brick, remove the remaining interior brick, and rebuild the chimney as a reinforced concrete structure and reapply the exterior brick as a veneer. Much like the clock tower in the main building, the annex chimney foundation would also need to be reinforced and tied to the chimney. Insertion of micropiles around the perimeter of the pile cap for seismic strengthening would be required. This option introduces a number of technical and constructability risks that would have to be further evaluated in future phases of design; however, the benefit of this alternative would be the preservation of the full height chimney with little to no permanent indication of the retrofit.

Figure 5.13-6. Annex Chimney Alternative A – Full Height Chimney with Reinforcement

Source: IBI Group. 2016.

5.13.5.2 Annex Chimney Alternative B: Chimney Height Reduction with Reinforcement

Alternative B would reconstruct the chimney using original face brick around a seismically upgraded foundation and core, but with an overall reduced height (Figure 5.13-7). This alternative is a similar reconstruction of the historic chimney as described in Alternative A; however the height of the chimney would be reduced from its full height of 80 feet to a lower height of approximately 50-60 feet. The cornice brick work at the top of the existing chimney would likely be reconstructed at the top of the reduced-height chimney. This option presents less risk due to breakage of original brick during the removal process, because fewer of the original face brick are required for reconstruction. The alternative may also reduce the extent of structural/seismic improvements such as foundation strengthening. The downside of this alternative is that this option compromises the original form of the full-height chimney.

Figure 5.13-7. Annex Chimney Alternative B – Chimney Height Reduction with Reinforcement

Source: IBI Group. 2016.

5.13.5.3 Annex Chimney Alternative C: Ghost Chimney

Alternative C would replace the existing masonry chimney with a new reconstructed form that is evocative of the mass and height of the former chimney, called a ghost chimney. This alternative improvement would acknowledge the historic presence of the chimney following tis removal. Several conceptual designs for a ghost chimney have been developed, as described below.

5.13.5.3.1. *Glass Ghost Chimney with Diagonal Supports*

One of the ghost chimney options is to create a glass curtain wall structure that emphasizes its transparency yet gives homage to the original chimney (Figure 5.13-8). The spacing of mullions and supports would be broken up evenly along the height of the tower, and diagonal bracing across the inside of the glass tower would be visible through the glass. A glass curtain wall tower would replace the existing 8 feet by 8 feet chimney utilizing a tube steel structure. Tube steel columns at each corner would run the height of the new structure with tube steel beams placed at equal increments. Smaller diagonal tubes would run up each side of the ghost chimney, also at equal increments beginning and ending at each beam. A glass curtain wall roof would cap the top of the new glass tower with tube steel supports spanning the top of the tower. For the foundation, 3 to 4 feet of existing concrete would be removed and replaced with a new 3 feet deep by 13 foot square pile cap, reinforced around the perimeter with closed ties and longitudinal reinforcing. Beam portions may extend out into the building to provide access to vertical and battered piles. The piles would be located beyond the original pile cap, which is 15 feet 6 inches square.

Figure 5.13-8. Annex Chimney Alternative C - Glass Ghost Chimney with Diagonal Supports

Source: IBI Group. 2016.

5.13.5.3.2. Glass Ghost Chimney with Metal Banding

Another option similar to the previous ghost chimney is a glass curtain wall structure with metal banding, reminiscent of the brick and stucco pattern of the existing chimney (Figure 5.13-9). The metal banding would correspond to areas of the existing chimney with wider areas of brick between stucco portions; curtain wall mullions would also add to the ghosted pattern of original rhythm of brick, stucco, and decorative trim. A glass curtain wall with metal banding would replace the existing 8 feet by 8 feet chimney utilizing a tube steel structure. Four corner columns of tube steel would be used with tube steel beams hidden behind the metal banding. This metal banding would occur at locations to represent the rhythm of the brick in-between the stucco pattern of the existing chimney. At the middle of the new glass ghost chimney, the metal banding would be absent to reflect the stucco patterning along this portion of the existing chimney; the structural tubes would also skip up to the next metal band, allowing the middle of the ghost chimney to be as transparent as possible. The top of the new chimney would include a metal reveal, and a metal roof would cap off the tower using tube steel supports across the span. For the foundation, 3 to 4 feet of existing concrete would be removed and replaced with a new 3 feet deep by 13 foot square pile cap, reinforced around the perimeter with closed ties and longitudinal reinforcing. Beam portions may extend out into the building to provide access to vertical and battered piles. The piles would be located beyond the original pile cap, which is 15 feet 6 inches square.

Figure 5.13-9. Annex Chimney Alternative C - Glass Ghost Chimney with Metal Banding

Source: IBI Group. 2016.

5.13.5.3.3. Steel Framed Ghost Chimney

A further ghost chimney option is one using all steel components to reflect the pattern of the existing chimney (Figure 5.13-10). The existing 8 feet by 8 feet chimney would be replaced by a steel structure consisting of wide flange columns and beams with steel angle and plate detailing. Wide flange beams would be used as the main structure as well as defining the areas where the brick pattern is located on the existing chimney, while steel angles would describe areas of the stucco patterning. Smaller wide flange beams and steel angles would be used at the top of ghost chimney to reflect the arched design and trim work. For the foundation, 3 to 4 feet of existing concrete would be removed and replaced with a new 3 feet deep by 13 foot square pile cap, reinforced around the perimeter with closed ties and longitudinal reinforcing. Beam portions may extend out into the building to provide access to vertical and battered piles. The piles would be located beyond the original pile cap, which is 15 feet 6 inches square.

Figure 5.13-10. Annex Chimney Alternative C - Steel Framed Ghost Chimney

Source: IBI Group. 2016.

5.13.5.4 Annex Chimney Alternative D: Remove Chimney

This alternative would remove the annex chimney entirely, modifying the roof line to give the appearance that the chimney was never present (Figure 5.13-11). While this is technically the least complicated alternative, it has the significant drawback of severely compromising this character-defining feature of the historic annex.

Figure 5.13-11. Annex Chimney Alternative D - Remove Chimney

Source: IBI Group. 2016.

5.13.5.5 Recommendation: Annex Chimney

The project team recommends implementing Alternative A, the Full Height Chimney Reconstruction with Reinforced Core (Figure 5.13-6). The annex chimney is evocative of the building's historic use as Union Station's boiler room. The historic benefit of preserving the character-defining annex chimney was the key factor in selecting the chimney preservation alternative. This alternative assumes technical viability of chimney restoration, including but not limited to the ability to salvage existing face brick. Technical feasibility and constructability considerations would continue to be explored in future design phases.

Table 5.13-3. Evaluation of Annex Chimney Alternatives

Evaluation Criteria		No-Build	A	Full Height Chimney with Reinforcement	B	Chimney Height Reduction with Reinforcement	C	Ghost Chimney	D	Remove Chimney
A: Ability to Meet Project Goals										
A.1. Accommodate Future Capacity and Operational Needs of Passenger and Freight Rail	◆	Potential risk of structure/seismic failure of the Annex chimney to impact rail operations/life safety	●	Reduces seismic hazard to tracks and rail operations	●	Reduces seismic hazard to tracks and rail operations	●	Reduces seismic hazard to tracks and rail operations	●	Reduces seismic hazard to tracks and rail operations
A.2. Preserve and Protect the Historic Character of Union Station	◆	Does not address deteriorated state of the chimney; ongoing risk of failure or significant seismic damage in the future	●	Maintains existing character-defining feature of structure	□	Change to form but maintains a modified chimney as character defining feature	□	Changes character of the structure but provides a replacement that speaks the Annex's historic function	◆	Removes a character-defining feature of the Annex
A.3. Improve Economic and Social Vitality	◆	Limits reuse options of the Annex due to seismic hazard	●	Mitigates seismic hazard that could prevent revitalization of the Annex	●	Mitigates seismic hazard that could prevent revitalization of the Annex	●	Mitigates seismic hazard that could prevent revitalization of the Annex	●	Mitigates seismic hazard that could prevent revitalization of the Annex
A.4. Improve Environmental Sustainability	□	Minimal impact anticipated	□	Minimal impact anticipated	□	Minimal impact anticipated	□	Minimal impact anticipated	□	Minimal impact anticipated
B. Cost and Financing										
B.1. Estimated Capital Cost	◆	Cost to address deterioration and repair will likely increase in the future	◆	Higher cost alternative to stabilize structure, provide seismic reinforcement, and implement foundation improvements.	◆	Higher cost alternative to stabilize structure, provide seismic reinforcement, and implement foundation improvements.	◆	Higher cost alternative to create a visually-appealing replacement structure, provide seismic reinforcement, and implement foundation	●	Lower cost alternative; cost is to remove tower and dispose or reuse brick, additional cost to revise roof framing and add new tile roofing

Evaluation Criteria		No-Build	A	Full Height Chimney with Reinforcement	B	Chimney Height Reduction with Reinforcement	C	Ghost Chimney	D	Remove Chimney
								improvements.		
B.2. Lifecycle Cost Impacts	◆	Future repair/replacement costs will likely increase in the future	☐	Normal maintenance of masonry after initial construction cost	☐	Normal maintenance of masonry after initial construction cost	☐	Minimal maintenance if ghost structure is made from weathering steel and allowed to rust. Periodic cleaning and painting if standard steel is used	☐	Normal roof maintenance after initial demolition and roof construction costs
B.3. Cost Risk	◆	Less certainty about future costs of construction and repairs if deferred to future	◆	Cost risk due to reconstruction of the existing chimney using reclaimed, historic face brick and specialty labor.	◆	Cost risk due to reconstruction of the existing chimney using reclaimed, historic face brick and specialty labor.	◆	Cost risk due to future design decisions regarding appearance and materials of the ghost chimney	☐	Cost risk due to repairs necessary to repair areas where chimney was removed, in a manner that is acceptable to historic reviewers
B.4. Financial Leverage	◆	Likely more difficult to pursue Annex repairs as a future stand-alone project	●	Increased funding potential as part of a multifaceted renovation project.	●	Increased funding potential as part of a multifaceted renovation project.	●	Increased funding potential as part of a multifaceted renovation project.	●	Increased funding potential as part of a multifaceted renovation project.
C. Implementability and Constructability										
C.1. Technical Complexity and Constructability	☐	N/A – No capital improvement project	◆	Highly technical engineering and construction. Requires specialized labor to deconstruct and reconstruct the chimney. Risk of material	◆	Highly technical engineering and construction. Requires specialized labor to deconstruct and reconstruct the chimney. Risk of material	◆	Ghost structure will require engineering. It is not a simple piece of artwork. Depending on concept for ghost structure	◆	Roof truss that connects to chimney would need to be lengthened. Restoration must be completed in a way that is complementary to

Evaluation Criteria		No-Build	A	Full Height Chimney with Reinforcement	B	Chimney Height Reduction with Reinforcement	C	Ghost Chimney	D	Remove Chimney
				breakage during deconstruction		breakage during deconstruction		may be more complicated engineering than other options		existing structure, including repair of historic materials
C.2. Schedule and Schedule Risk	☐	N/A – No capital improvement project	☐	Technical complexity may contribute to schedule risk	☐	Technical complexity may contribute to schedule risk	☐	Design approvals may contribute to schedule risk	☐	Design approvals may contribute to schedule risk
C.3. Construction Impact on Passenger and Freight Rail Operations	◆	More difficult to use Annex for temporary rail/passenger/tenant space during the construction phase if not renovated	◆	Possible impact on rail during construction stabilization	◆	Possible impact on rail during construction stabilization	◆	Possible impact on rail during demolition and construction	◆	Possible impact on rail during demolition
C.4. Construction Impact on Union Station Tenants	◆	More difficult to use Annex for temporary rail/passenger/tenant space during the construction phase if not renovated	☐	Impact limited to Annex tenants who could potentially be relocated to main building; building has a high percentage of vacancies	☐	Impact limited to Annex tenants who could potentially be relocated to main building; building has a high percentage of vacancies	☐	Impact limited to Annex tenants who could potentially be relocated to main building; building has a high percentage of vacancies	☐	Impact limited to Annex tenants who could potentially be relocated to main building; building has a high percentage of vacancies
C.5. Phasing and Project Segmentation	◆	Likely more difficult to pursue Annex repairs as a future stand-alone project	●	Could be completed as a separate or later phase from main building and track improvements	●	Could be completed as a separate or later phase from main building and track improvements	●	Could be completed as a separate or later phase from main building and track improvements	●	Could be completed as a separate or later phase from main building and track improvements
C.6. Risks, Assumptions and Unknowns	◆	Increased deterioration will likely increase risk and complexity of repair in the future	☐	Ability to use batter piles will be limited because of proximity to existing vertical	☐	Ability to use batter piles will be limited because of proximity to existing vertical	☐	If ghost structure is as tall as original chimney, the structure will	☐	Unknowns regarding restoration of Annex façade and roof impacted by

Evaluation Criteria		No-Build	A	Full Height Chimney with Reinforcement	B	Chimney Height Reduction with Reinforcement	C	Ghost Chimney	D	Remove Chimney
				wood piles. Anchoring to existing concrete may be difficult and requires testing for verification.		wood piles. Anchoring to existing concrete may be difficult and requires testing for verification.		need significant bracing, similar to a radio tower.		chimney replacement
D. Environmental Impacts and Approvals										
D.1. Environmental Impacts and Project Classification	◆	Results in continued degradation, underutilization, and potential future loss of a significant historic resource	●	Results in preservation and repurposing of a significant historic resource	●	Results in preservation and repurposing of a significant historic resource	●	Results in preservation and repurposing of a significant historic resource	◆	Results loss of character-defining feature of a significant historic resource
D.2. Historic Impacts and Approvals	◆	Results in continued degradation, underutilization, and potential future loss of a significant historic resource	●	Retains existing character of structure	□	Preserves character/form but in modified stat.	□	Preserves form but with loss of historic material	◆	Results loss of character-defining feature of a significant historic resource
D.3. Decision Making and Approvals	□	No issues anticipated	□	Proposed changes will require historic design review and approval	□	Proposed changes will require historic design review and approval	□	Proposed changes will require historic design review and approval	□	Proposed changes will require historic design review and approval

Source: IBI Group. 2016.

6. Rail Yard Improvements Considered

This section describes the evaluation of rail yard improvement alternatives and recommended preferred alternatives.

6.1.1. Introduction

As part of this process, HDR presented recommendations for improvements in the Existing Rail Infrastructure and Operations Report (September 14, 2015), and the Site Utilities Report (June 19, 2015). The Trackwork Conceptual Design Report (HDR, 2016) builds upon the recommendations presented in those reports, as well as on the subsequent meetings and discussions held between the design team and project stakeholders. In most cases, the concepts explored are as laid out in the earlier reports; however, there are a few cases (such as on-site yard control and the improvements to fueling) that differ from the report based on more recent direction.

The main focus of the Trackwork Conceptual Design Report (HDR, 2016) was to develop a conceptual level cost estimate for the potential improvements and, for each improvement considered, the report includes a description of the proposed improvement, a concept-level design sketch, an evaluation matrix, and a cost estimate. The conceptual designs summarized in this Alternatives Considered Report are to be considered at approximately the 5% level of design. To facilitate evaluating different scenarios, each improvement has been developed as if it were a stand-alone consideration. For example: installing Track #6 includes all trackwork necessary for that improvement. However, in reality, the installation of Track #6 would probably require signalizing and powering up all switches, which is evaluated as its own stand-alone improvement.

The Trackwork Conceptual Design Report (HDR, 2016) covers only those improvements put forth in the reports listed above and focuses only on trackwork, utilities within the yard, or other improvements related to the yard and/or Amtrak operations outside of the main terminal building and annex. Improvements to these structures, and/or the operations within them, are included and evaluated in separate reports (as described in other chapters of this report). Funding sources for each potential improvement are not discussed.

6.1.2. Previous Assumptions and Findings

Several of these concepts are predicated on assumptions put forth in the Existing Rail Infrastructure and Operations Report (HDR, 2015). However, discussions regarding these assumptions, and their design implications, continue to proceed with Amtrak, Federal Railroad Administration (FRA), Oregon Department of Transportation (ODOT), and the Portland Development Commission. Public input may also have an influence on these concepts. As a result, the rail design concepts, analyzed in the Trackwork Conceptual Design Report (HDR, 2016) and summarized in this report, are subject to change:

- The platform length within Union Station will be a controlling factor in the location of the passenger crossing and on daily operations, and will be based on system-wide requirements set forth by both the States and Amtrak.
- Train lengths for Amtrak *Cascades* service will be standardized for all trains to allow for correct placement of fueling, water, and power facilities, as well as to determine final berthing locations.
- Train network modeling (RTC) is not included in the cost to design any improvements, and is not required.
- Initial Terminal and Road Air Brake Test will be performed overnight only on Track #1 by Amtrak switching crews. Amtrak and the states have not fully endorsed this operational requirement and continue to consider its implications, especially with respect to operating cost.
- Track #1 will be reserved for overnight inspection.
- A 25-foot buffer length from the train signal to the fouling point is acceptable.
- Freight rail use of Track #4 will be eliminated pending the reinstatement of Track #6.

- The construction of on-site yard control would require Amtrak to provide staffing for on-site yardmaster and train switching crews. Amtrak is currently considering this requirement.
- The Trackwork Conceptual Design Report (HDR, 2016) does not include cost estimates for operations or maintenance.

6.1.3. Improvements to Existing Trackwork

This proposed improvement would replace existing, old, or broken equipment in the yard with new equipment, install additional equipment, and develop an improved maintenance program for tie replacement (Figure 6.1.3-1).

Two options were evaluated for improvements to existing trackwork:

- The No-Build option would not make any track improvements; and,
- The build option would implement improvements to existing trackwork as a whole (not piecemeal).

The results of the evaluation of the two options are summarized in Table 6.1.3-1.

6.1.3.1 Conceptual Scope

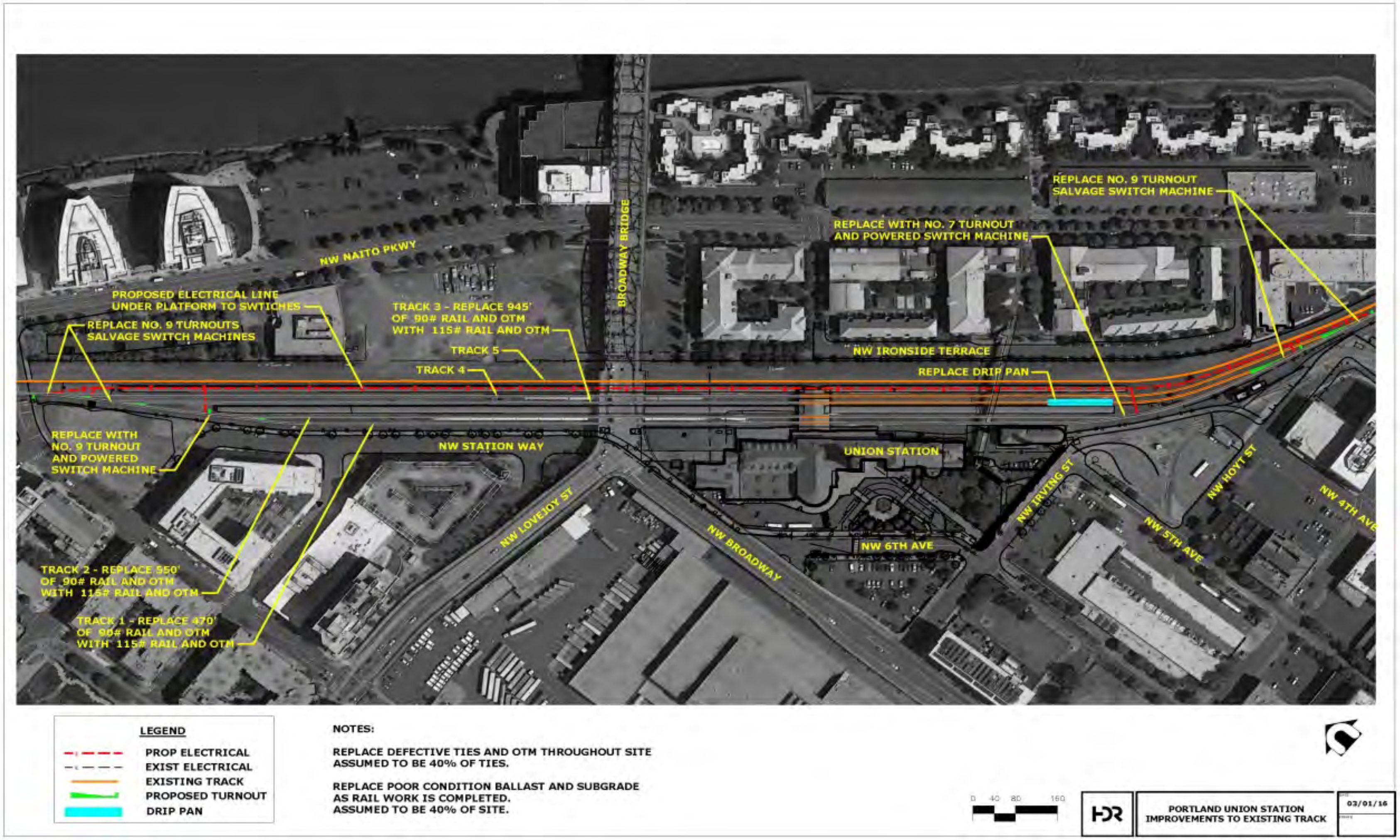
The following are the key conceptual scope elements for the proposed improvements:

- Replace 90# rail and Other Trackside Materials (OTM) with heavier, industry standard 115# rail.
- Weld the existing rail joints
- Replace existing defective ties within Tracks #1 - Tracks #4 with new wood ties and formalize an ongoing tie replacement program
- Replace the drip pan on the south end of Track #3 with a new, HDPE pan
- Replace the No. 7 turnout at the south end of the yard (between Tracks 1 and 2) with a No. 9 turnout *if the geometry will allow this without extensive rework*. The decision to replace the No. 7 with a No. 9 would need to be determined in Preliminary Engineering
- Replace existing turnouts in kind
- Replace the existing switch machines on the south end of tracks 1-4
- Install switch machines at the two turnouts leading to Track #1 south
- Install correct voltage power to all switch machines

6.1.3.2 Recommendation

The project team recommends implementing the proposed track improvements to accommodate the anticipated 2035 passenger volumes. Reduced maintenance and down-time would provide a substantial return–on-investment for this improvement alternative; a focused study on existing and future operating and maintenance costs could be undertaken in preliminary engineering.

Figure 6.1.3-1. Improvements to Existing Trackwork



Source: HDR. 2016.

Table 6.1.3-1. Evaluation of Alternatives for Improvements to Existing Trackwork

Evaluation Criteria	A	No-Build / No Trackwork Improvements	B	Implement Trackwork
A: Ability to Meet Project Goals				
A.1. Accommodate Future Capacity and Operational Needs of Passenger and Freight Rail	◆	Continued use of existing track materials could lead to continued, unplanned track outages	●	No impact to future capacity; New track materials will help avoid unplanned track outages due to track failure, improving Amtrak operational needs; no impact to freight, no impact to seismic or security
A.2. Preserve and Protect the Historic Character of Union Station	□	No Change	□	No impact to historic features or finishes
A.3. Improve Economic and Social Vitality	□	No Change	□	Little to no impact to economic vitality of neighborhood; no impact on building efficiency
A.4. Improve Environmental Sustainability	□	No Change	●	No impact to LEED rating; No impact on energy or materials consumption; Stormwater benefit from replacing drip pan on the south end of Track #3
B. Cost and Financing				
B.1. Estimated Capital Cost	□	No Change	●	Medium level of cost compared to other track alternatives
B.2. Lifecycle Cost Impacts	◆	Continued use of existing track materials could lead to unplanned track outages and increased maintenance needs; some existing materials are nearing the end of their useful life; presence of jointed track increases maintenance needs	●	New track materials will reduce future track maintenance and avoid unplanned track outages due to track failure. Ongoing maintenance will be more cost effective in the long run, as many elements have reached the end of their useful life
B.3. Cost Risk	□	No significant risk associated.	□	Little to no cost risk due to uncertainties
B.4. Financial Leverage	□	Not applicable to rail improvements	□	Not applicable to rail improvements
C. Implementability and Constructability				
C.1. Technical Complexity and Constructability	□	No Change	●	Currently considering only standard methods and materials; Low to medium construction timeframe compared to other track alternatives
C.2. Schedule and Schedule Risk	□	No Change	◆	Low to medium risk of schedule delay due to turnout procurement time; little to no risk due to need for design approvals - assuming standard methods and materials
C.3. Construction Impact on Passenger and Freight Rail Operations	□	No Change	◆	Medium to high potential for disruptions to passenger trains - detailed staging plans will be required; Medium level of passenger inconvenience expected due to potential for limited track closure; no freight impacts

Evaluation Criteria	A	No-Build / No Trackwork Improvements	B	Implement Trackwork
C.4. Construction Impact on Union Station Tenants	☐	No Change	●	Low level of construction noise expected from work in yard; Little to no impact to tenants
C.5. Phasing and Project Segmentation	☐	No Change	●	High potential to stage work to spread costs; High potential for implementing independent of other track alternatives; High probability for efficiencies by combining with other track alternatives
C.6. Risks, Assumptions and Unknowns	☐	No Change	●	Assuming little excavation in existing ground, there is little to no risk associated with improvements to track materials; no risk to historic features; High possibility to mitigate risks
D. Environmental Impacts and Approvals				
D.1. Environmental Impacts and Project Classification	☐	No Change	●	Little to no risk associated with track maintenance; High likelihood of categorical exclusion; No schedule risk due to NEPA
D.2. Historic Impacts and Approvals	☐	No Change	●	No issues of concern for historic review agencies
D.3. Decision Making and Approvals	☐	No Change	●	No key decisions or approvals required; No permitting requirements

Source: HDR. 2016.

6.1.4. Signalize and Remotely Control All Tracks

This proposed improvement would signalize the tracks using Centralized Traffic Control. This would require installing communications conduit from a central control point to the north and south switches, as well as installing switch point indicators and other infrastructure needed for a fully signalized system (Figure 6.1-2).

Two options were evaluated for improvements to signalize and remotely control all tracks:

- The No-Build option would leave the yard as it currently exists with no communications system or Centralized Traffic Control; and,
- The build option would install an entire signalized system.

The results of the evaluation of the two options are summarized in Table 6.1.3-2.

6.1.4.1 Conceptual Scope

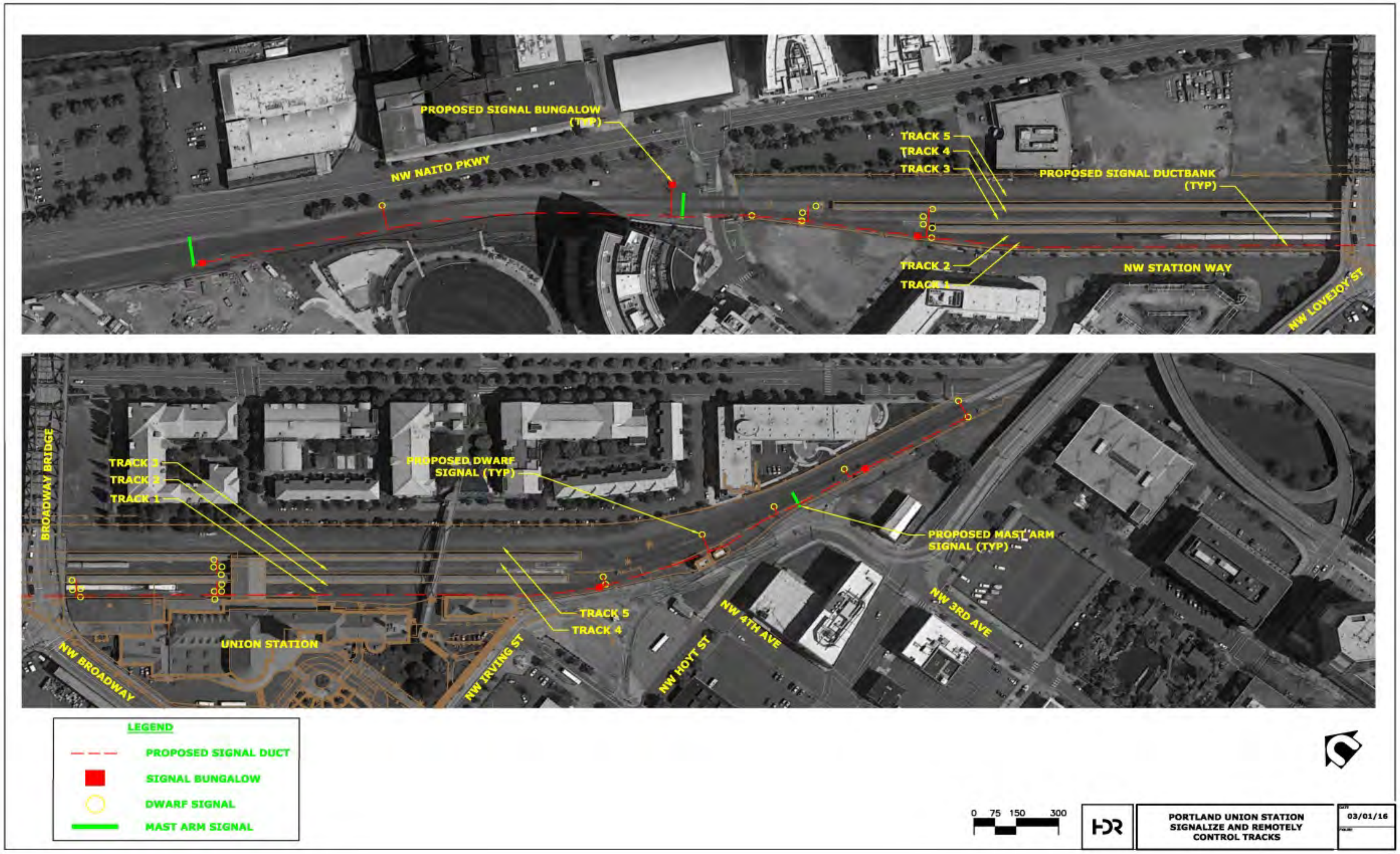
The following are the key conceptual scope elements for the proposed improvements:

- Install signal conduit
- Install signal houses
- Detail wiring diagrams
- Develop and coordinate an operating plan with all parties

6.1.4.2 Recommendation

The project team recommends implementing the centralized traffic control improvements. Though higher in capital cost than other track alternatives, signalization will be necessary for implementing the 2035 passenger train volumes and has been characterized as necessary by the FRA.

Figure 6.1.3-2. Signalize and Remotely Control All Tracks



Source: HDR. 2016.

Table 6.1.3-2. Evaluation of Signalization and Remote Control Alternatives

Evaluation Criteria	A	No-Build / No Signalization or Remote Control	B	Signalize and Remotely Control All Tracks
A: Ability to Meet Project Goals				
A.1. Accommodate Future Capacity and Operational Needs of Passenger and Freight Rail	◆	Inefficient operations may make it very difficult to achieve 2035 passenger train volumes	●	Operations will be much more efficient with a signalized system, allowing for greater flexibility, easier coordination with the local railroad network, and switching movements that do not require the conductor to exit the train or ground personnel to walk to a switch (saving considerable time); Implementation will enable better freight movement through area; no impact to seismic or safety
A.2. Preserve and Protect the Historic Character of Union Station	☐	No change	●	No change
A.3. Improve Economic and Social Vitality	☐	No change	●	Signalizing and remotely controlling the switches is considered necessary to accommodate the 2035 train volumes; higher capacity means more passengers accommodated, improving economic and social vitality; no impact to leased space marketability
A.4. Improve Environmental Sustainability	☐	No change	●	Powered and signalized switches will allow for the desired 2035 passenger train volumes and improve the ability of freight to move through the area - both will increase the mode share of passenger rail on the I-5 corridor, reducing emissions
B. Cost and Financing				
B.1. Estimated Capital Cost	☐	No change	◆	Requires purchasing turnouts, signals, and installing communications conduit between switches and the signal houses; Considered a medium to high potential cost with respect to other track improvements
B.2. Lifecycle Cost Impacts	◆	No immediate change, but as passenger volumes increase traffic through the station will be difficult to manage operationally and could cause delays	●	Operations will be much more efficient with a signalized system, removing the requirement for an operator to walk to and physically throw a track switch, a considerable reduction in labor
B.3. Cost Risk	☐	No change	◆	Minimal risk associated with turnout procurement or installation. Signal equipment could be off the shelf. Risk associated with hazardous soils if encountered while excavating for conduit placement
B.4. Financial Leverage	☐	Not applicable to rail improvements	☐	Not applicable to rail improvements
C. Implementability and Constructability				
C.1. Technical Complexity and Constructability	☐	No change	◆	Signaling design is typically very complex; Typical design parameters regarding buffer length between train berthing location and signal location cannot be met, resulting in the potential that the future length of Cascades trains for use

Evaluation Criteria	A	No-Build / No Signalization or Remote Control	B	Signalize and Remotely Control All Tracks
				at Union Station may be limited. This would limit Amtrak's flexibility on the system, which could require policy changes from Amtrak. Medium construction duration relative to other track alternatives
C.2. Schedule and Schedule Risk	□	No change	◆	High probability of schedule risk due to complex design, required approvals from FRA, Amtrak, and railroads
C.3. Construction Impact on Passenger and Freight Rail Operations	□	No change	◆	Medium to high degree of disruption to rail operations; No direct impact to passengers; Medium to high potential for temporary reduction in trackside capacity; High potential for impacts to freight
C.4. Construction Impact on Union Station Tenants	□	No change	□	Little impact to tenants due to construction noise in yard
C.5. Phasing and Project Segmentation	□	No change	◆	Little to no ability to phase work; Little to no ability to accomplish independent of other work: other options dependent on signalizing and remotely controlling tracks include installing scissor crossovers, constructing Track 6, installing new switch machines, constructing a yardmaster control room in the station, and probably the installation of new platforms and canopies (due to the installation of conduits within the platform).
C.6. Risks, Assumptions and Unknowns	□	No change	●	Low risk due to unforeseen conditions in underground work; No risk of damage to historic features; Low ability to minimize risk of unforeseen conditions underground
D. Environmental Impacts and Approvals				
D.1. Environmental Impacts and Project Classification	◆	Desired 2035 passenger train volumes will be difficult to achieve, reducing the environmental efficacy of the overall project	●	No significant environmental impacts; High probability of categorical exclusion; Little to no risk due to NEPA
D.2. Historic Impacts and Approvals	□	No change	●	No change
D.3. Decision Making and Approvals	◆	Medium to High risk of schedule delay due to Class 1 railroads, Amtrak, and FRA needing to approve change in track control system, both from an infrastructure as well as operational perspective	◆	Medium to High risk of schedule delay due to Class 1 railroads, Amtrak, and FRA needing to approve change in track control system, both from an infrastructure as well as operational perspective

Source: HDR. 2016.

6.1.5. Fuel Delivery System

This proposed improvement would construct a new fueling system to replace the existing method of stretching hoses across the tracks from the Portland Terminal Railroad (PTRR) access road (Figure 6.1.3-3). Fueling would occur entirely within the PDC-owned site. The system would be designed to be expanded to the south in the future if desired; the expansion south would mirror the north installation in terms of equipment and layout. The system would also accommodate the Diesel Emissions Fluid (DEF) additive required for newer locomotives.

Since the writing of the Existing Rail Infrastructure Report (HDR, 2015), Amtrak has provided the following direction on the conceptual design of this proposed fuel delivery system improvement:

- No on-site fuel storage allowed
- Provide underground piping system with leak detection, and
- Fueling will be performed from a truck parked under the existing Butler Shed north of the station building

Two options were evaluated for improvements to the fuel delivery system:

- The No-Build option would not address fueling at Union Station now or in the future; and,
- The build option would construct the fuel pumping, piping and hose infrastructure needed to fuel from the north platforms.

The results of the evaluation of the two options are summarized in Table 6.1.3-3.

6.1.5.1 Conceptual Scope

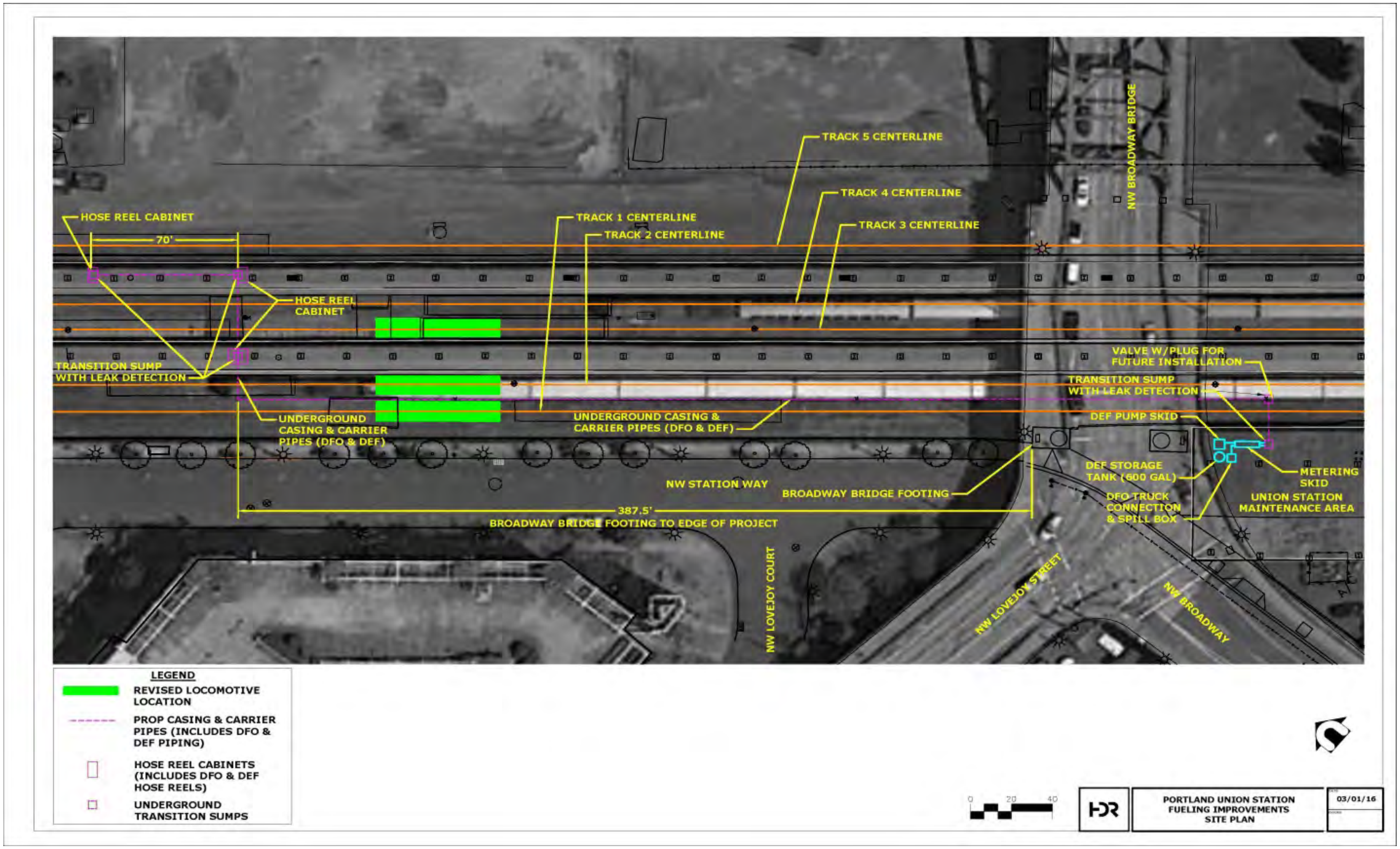
The following are the key conceptual scope elements for the proposed improvements:

- Construction of fueling and DEF equipment under the Butler Shed
- Underground piping with leak detection
- Piping underneath the existing platforms to hose reel cabinets on-platform

6.1.5.2 Recommendation

The project team recommends implementing the new fueling system option, as the existing system is unsustainable from a safety as well as an operations and maintenance standpoint.

Figure 6.1.3-3. Fuel Delivery System



Source: HDR. 2016.

Table 6.1.3-3. Evaluation of Fuel Delivery System Alternatives

Evaluation Criteria	A	No-Build / No Change to Existing Fueling System	B	Installing Fueling System
A: Ability to Meet Project Goals				
A.1. Accommodate Future Capacity and Operational Needs of Passenger and Freight Rail	◆	Future capacity increases may not be met if pulling fueling hoses over tracks is required; Does not improve the experience of passengers as delays can be expected due to fueling via dragged hose; Status quo does not meet Amtrak operating needs or design standards; Assuming status quo remains, freight is not impacted; no change to ADA accessibility; no change to site security	●	Decreased fueling time will enable meeting future capacity; Improved fueling will result in quicker turn-around, improving passenger experience; Fueling infrastructure will meet Amtrak operational needs and design standards; no freight impact; no ADA impact; no impact to site security
A.2. Preserve and Protect the Historic Character of Union Station	□	No change	●	No impact to historic features or character; no impact to finishes or materials; improvements would be minimal, mostly underground, and approximately 700' north of building, reducing historic impact
A.3. Improve Economic and Social Vitality	◆	Future capacity increases may not be met if pulling fueling hoses over tracks is required, limiting passenger train volumes and thereby limiting the economic vitality of the neighborhood and marketability of tenant spaces; no change to building management or efficiency	●	Improved fueling will enable the desired increase in passenger trains to the station, improving the economic vitality of the neighborhood; increasing passenger train volume will improve marketability of leased tenant spaces; no impact to building management or efficiency
A.4. Improve Environmental Sustainability	◆	Current method of stretching hose over active track causes the need to quickly remove the hose in the event a train is entering the station - this has caused minor fuel spills in the past	●	Implementation will provide regimented fueling procedures, will eliminate the potential for spills from dragged hoses, and will localize the fueling procedure to known, distinct areas
B. Cost and Financing				
B.1. Estimated Capital Cost	□	No change	●	Low capital cost relative to other track alternatives
B.2. Lifecycle Cost Impacts	◆	Existing operations may require two fueling personnel to accommodate NFPA regulations - requirements state that fueling with only one person can only be done within 50' of source	□	Medium change in operating cost to Amtrak for need for second person to operate fueling; Low increase in operating cost due to monitoring of underground pipes
B.3. Cost Risk	◆	Continued risk of cost due to greater potential for fuel spill	□	Low to medium cost risk due to underground work - estimates assume contaminated soils
B.4. Financial Leverage	□	Not applicable to rail improvements	□	Not applicable to rail improvements
C. Implementability and Constructability				
C.1. Technical Complexity and Constructability	□	No change	◆	May require stormwater system that can be shut off from city storm system in case of leakage. Leak monitoring system may be complex to design and implement; north-only construction

Evaluation Criteria	A	No-Build / No Change to Existing Fueling System	B	Installing Fueling System
				duration would be shorter than north and south design
C.2. Schedule and Schedule Risk	☐	No change	◆	Low schedule risk for design; High level of schedule risk due to permitting fuel lines; Medium level of risk due to unknown conditions underground
C.3. Construction Impact on Passenger and Freight Rail Operations	☐	No change	●	Relatively short duration of construction impacts to passengers and passenger trains; no impact to freight
C.4. Construction Impact on Union Station Tenants	☐	No change	●	Relatively short duration of construction impacts to passengers and passenger trains; low level of impact to tenants due to noise
C.5. Phasing and Project Segmentation	☐	No change	●	High ability to phase work to spread costs; High ability to accomplish independent of other work; High cost efficiencies to be gained by coordinating with platform and canopy replacement
C.6. Risks, Assumptions and Unknowns	◆	Status quo procedures for fueling expose owner and operator to high potential for spills; no risk of damage to historic features; establishment of operating procedures as only mitigation leaves open potential for future mistakes by fueling personnel	☐	High likelihood of contaminated soils
D. Environmental Impacts and Approvals				
D.1. Environmental Impacts and Project Classification	◆	Status quo procedures for fueling expose owner and operator to high potential for spills; no risk of damage to historic features; establishment of operating procedures as only mitigation leaves open potential for future mistakes by fueling personnel	●	Low risk of spills to be mitigated by training, procedures, containment, and shutoff that disconnects from city stormwater system; high likelihood of categorical exclusion; low risk of schedule delay due to NEPA
D.2. Historic Impacts and Approvals	☐	No change	●	No impacts due to historic review and approval
D.3. Decision Making and Approvals	☐	No change	☐	Low to no risk of delay due to approval from Amtrak, freight or FRA; Medium risk of delay due to Fire Marshall approval

Source: HDR. 2016.

6.1.6. Relocate and Reduce Width of Passenger Crossing

This proposed improvement would relocate and reduce the width and location of the passenger crossing in order to maximize the available space for trains south of the passenger crossing. Reducing the passenger crossing will allow for the loading of passengers on the *Cascades* routes south of the crossing, increasing overall station capacity (Figure 6.1.3-4).

Two options were evaluated for modifying the passenger crossing:

- The No-Build option would leave the passenger crossing in place with no modification; and,
- The build option would relocate the passenger crossing location and reduce the overall width of the passenger crossing.

The results of the evaluation of the two options are summarized in Table 6.1.3-4.

6.1.6.1 Conceptual Scope

The following are the key conceptual scope elements for the proposed improvements:

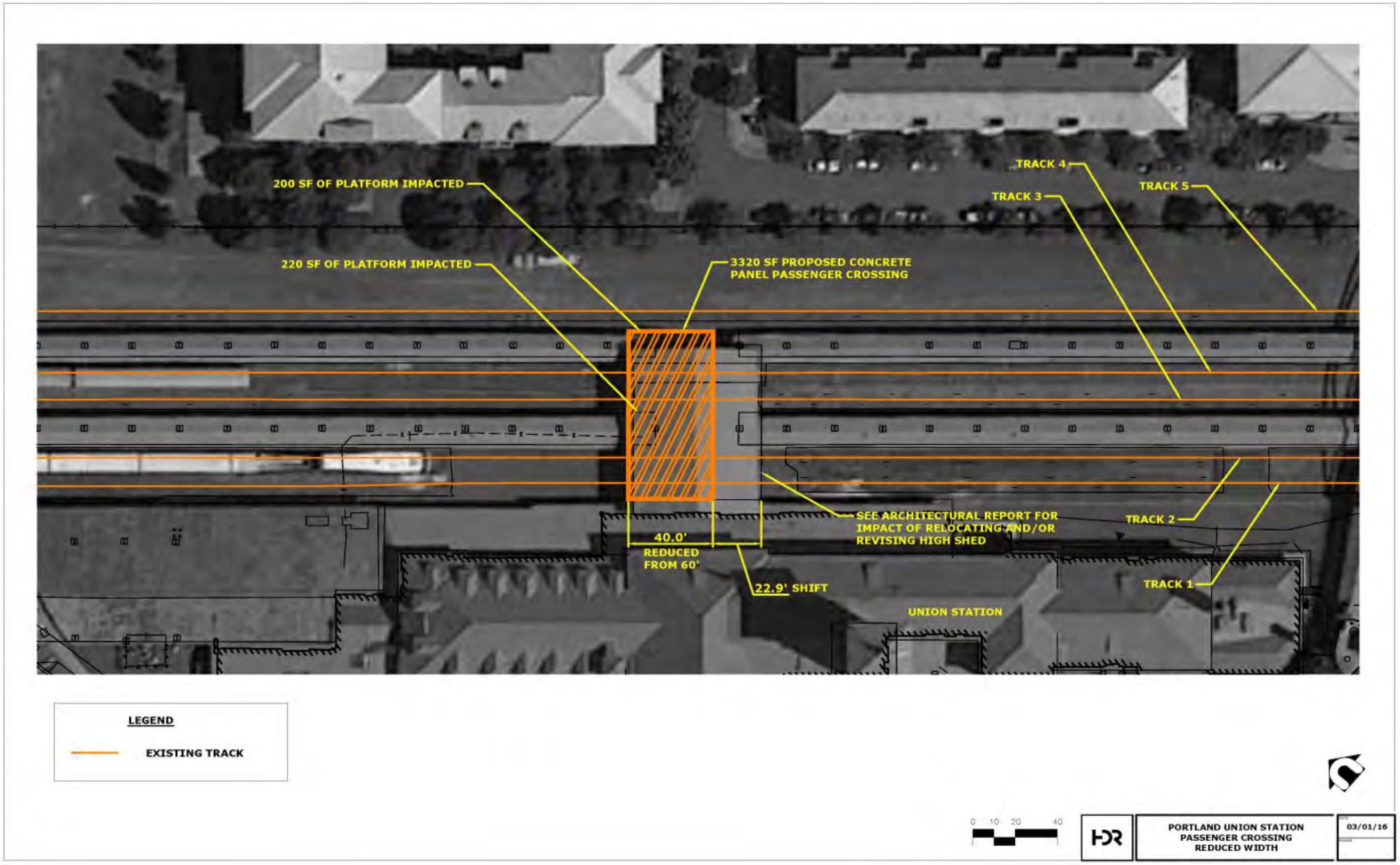
- Demolition of existing passenger crossing
- Reconstruction of the existing passenger crossing in new location farther north

6.1.6.2 Recommendation

The project team recommends implementing the relocation and reduction of the passenger crossing. Passenger loading south of the passenger crossing must be available in order to achieve the anticipated 2035 train volumes.

Several key assumptions regarding train length are driving specifics of this recommendation. The project team recommends the adoption of a system-wide, defined and accepted design train length that all parties can agree upon, a detailed 2035 train schedule showing berthing locations at Union Station, and an accepted operating plan that limits boarding south of the crossing to the northern end of the trains where the tracks are tangent.

Figure 6.1.3-4. Relocate and Reduce Width of Passenger Crossing



Source: HDR. 2016.

Table 6.1.3-4. Evaluation of Alternatives to Relocate and Reduce Passenger Crossing Width

Evaluation Criteria	A	No-Build / No Change to Existing Passenger Crossing	B	Modify Passenger Crossing
A: Ability to Meet Project Goals				
A.1. Accommodate Future Capacity and Operational Needs of Passenger and Freight Rail	◆	No immediate impact, but it may prove impossible to reach the desired 2035 passenger train volumes without being able to load passengers onto Cascades trains south of the crossing	●	Modification will allow berthing of Cascades trains south of the crossing, which will help accommodate future capacity. No impact to freight, security, or seismic issues.
A.2. Preserve and Protect the Historic Character of Union Station	◆	Preserves the existing passenger crossing - Existing high shed is structurally and seismically deficient and would likely need to be rebuilt to meet current codes	☐	Relocating the passenger crossing requires reconstruction of the high shed. The high shed covering the passenger crossing has been changed in the past, so altering the location and/or width is likely not considered a significant impact. Location and width must accommodate future passenger flow into and out of building. Design could accommodate historic finishes and character
A.3. Improve Economic and Social Vitality	◆	No immediate change, but as passenger volumes increase not being able to berth the cascades consists on the south side will negatively impact operations and could cause delays.	●	Implementation will help accommodate future capacity. This would contribute to the economic vitality of both the neighborhood and the building by improving passenger rail travel through the corridor. Increased passenger flow will increase quality and marketability of the station. No impact to building management or efficiency
A.4. Improve Environmental Sustainability	☐	No change	●	Reconfiguring the passenger crossing will allow for future increased volumes of train traffic, improving mode share of passenger rail along the I-5 corridor and reducing emissions; no impact to stormwater or hazardous materials; no effect on LEED status
B. Cost and Financing				
B.1. Estimated Capital Cost	☐	No change	◆	The relocation of the crossing itself is considered low capital cost, but this will require the reconfiguration of the high shed over the crossing, which would be considered a medium-high cost
B.2. Lifecycle Cost Impacts	☐	No change	☐	Assuming that there are no ongoing maintenance costs associated with the existing high shed, no changes to operational or maintenance costs
B.3. Cost Risk	☐	No change	◆	Requires reconfiguring high shed, which would probably require reconfiguring the adjacent platforms and canopies, which would be a high cost effort
B.4. Financial Leverage	☐	No change	☐	Unknown
C. Implementability and Constructability				
C.1. Technical Complexity and Constructability	☐	No change	◆	Relocation requires reconfiguring high shed, which will require a significant architectural effort to obtain agreement from all parties. Selection of materials and form for high shed would need to consider constructability and

Evaluation Criteria	A	No-Build / No Change to Existing Passenger Crossing	B	Modify Passenger Crossing
				cost. Construction timeframe would be increased due to need to serve passengers throughout construction.
C.2. Schedule and Schedule Risk	☐	No change	◆	Should be considered a longer time-frame for design due to the visual impact from reconstructing the high shed; obtaining buy-in from all parties will take longer during early stages of design. Unforeseen conditions will exist due to need to construct footings for high shed
C.3. Construction Impact on Passenger and Freight Rail Operations	☐	No change	◆	High degree of impact to passenger travel during construction. Construction staging will need to allow for continued passenger travel; this could increase construction time. Could realize reduction in station capacity during construction. No impact to freight operations
C.4. Construction Impact on Union Station Tenants	☐	No change	◆	Tenant most impacted will be Amtrak operations. High degree of potential for construction noise outside of station building
C.5. Phasing and Project Segmentation	☐	No change	◆	Low potential to phase relative to other improvements, as relocating the passenger crossing requires reconstruction of the adjacent platforms, canopies, and high shed. Potential for efficiencies if similar materials are used on platform canopies as on high shed
C.6. Risks, Assumptions and Unknowns	☐	No change	◆	High level of risk that the final width and location of the passenger crossing will depend on an agreed-upon design train length for the future as well as a detailed 2035 schedule showing berthing locations at Union Station - obtaining this agreement from Amtrak, ODOT, and WSDOT may delay schedule significantly. It may be that operational changes that allow for boarding only certain cars at Union Station may also be required (since the platforms are curved at the south end), requiring approval from Amtrak, ODOT and WSDOT
D. Environmental Impacts and Approvals				
D.1. Environmental Impacts and Project Classification	◆	No immediate change; but as passenger volumes increase not being able to berth the cascades consists on the south side will negatively impact operations and could cause delays, reducing the effectiveness of the station to serve more trains.	●	Low potential impact to historical nature since high shed has been altered several times in the past. High likelihood of eligibility for categorical exclusion. Low risk to NEPA process and approvals
D.2. Historic Impacts and Approvals	☐	No change	●	Team has concluded that there is low potential impact to historical nature since high shed has been altered several times in the past. SHPO recognizes the transportation need of revising the passenger crossing and high shed. Could see increased design time to obtain buy-in from community regarding redesign of shed materials.

Evaluation Criteria	A	No-Build / No Change to Existing Passenger Crossing	B	Modify Passenger Crossing
D.3. Decision Making and Approvals	☐	No change	◆	Reconfiguring high shed may require public approval process on new look and feel of shed and canopies. Approvals process could increase schedule. Similar permitting requirements as the rest of the project.

Source: HDR. 2016.

6.1.7. Install Powered Scissor Crossovers

This proposed improvement would install powered scissor crossovers within the station limits in order to provide the flexibility to move trains from track to track and from north of the passenger crossing to south of the passenger crossing, without fouling the main lines, and allowing for multiple trains on site throughout the day (Figure 6.1.3-5).

Five options were evaluated for installing powered scissor crossovers:

- The No-Build option would leave the existing track configuration in place; and,
- Four build options would install the powered scissor crossovers in various configurations:
    - Construct a set of crossovers for Tracks #1 and #2
    - Construct a set of crossovers for Tracks #3 and #4
    - Construct both sets of scissor crossovers
    - Construct only platform modifications and utility infrastructure to accommodate scissors at a later date

The results of the evaluation of the five options are summarized in Table 6.1.3-5.

6.1.7.1 Conceptual Scope

The following are the key conceptual scope elements for the proposed improvements:

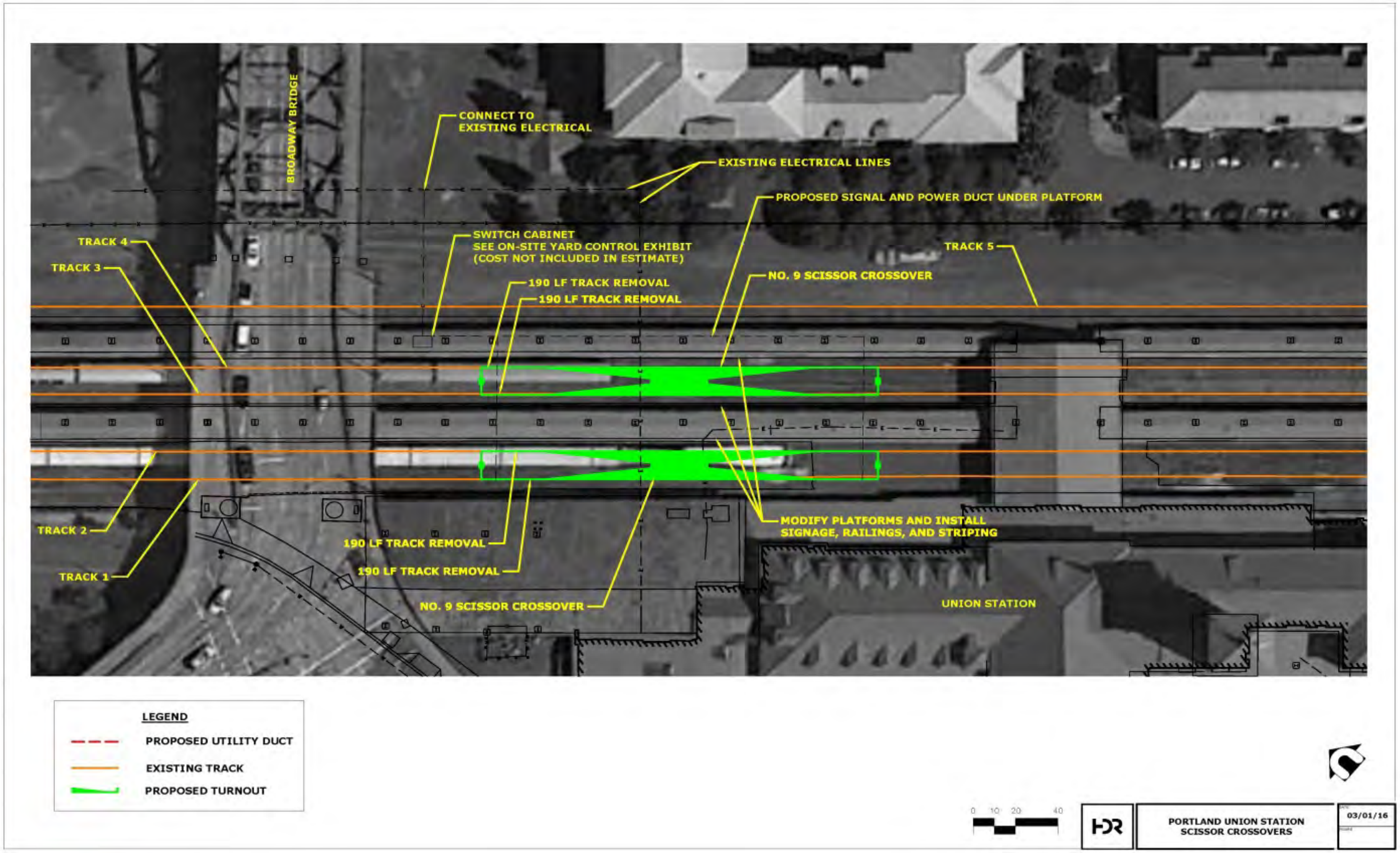
- Install crossovers
- Install power to crossovers

6.1.7.2 Recommendation

The project team recommends that PDC does not install either crossover at this time. Concerns regarding the safety of installing crossovers within the station limits, the limited space available for signal buffers, as well as the reliance on train schedule assumptions and lack of modeling for the station make the installation prohibitive.

It is recommended that a detailed, system-wide 2035 schedule be developed and adopted by Amtrak and PDC, including defined train berthing locations within Union Station. An additional recommendation includes acceptance of the use of Track 1 north for maintenance prior to proceeding with future crossover construction.

Figure 6.1.3-5. Install Powered Scissor Crossovers



Source: HDR. 2016.

Table 6.1.3-5. Evaluation of Powered Scissor Crossover Alternatives

Evaluation Criteria	A	No-Build / No Scissor Crossover	B	Scissors between TK 1 & 2	C	Scissors between TK 3 & 4	D	Both Scissors Installed	E	Construct Platform and Utility Modifications Only
A: Ability to Meet Project Goals										
A.1. Accommodate Future Capacity and Operational Needs of Passenger and Freight Rail	◆	Does not provide flexibility required to operate at desired 2035 passenger train volumes; Does not provide added flexibility for maintenance only on Track 1 north.	●	Positively impacts future station capacity by providing greater flexibility within the station. Allows for option of performing overnight maintenance on Track 1 north, which is required for level boarding. Provides less flexibility and capacity than scissors in both locations	☐	Positively impacts station capacity by providing greater flexibility, but does not help with performing overnight maintenance on Track 1 north, which is required for level boarding. Provides less flexibility and capacity than scissors on both tracks.	●	Maximized the impact on capacity by providing the most flexibility for future operations; Allows for the option of performing overnight maintenance on Track 1 north, required for level boarding	☐	Design does not provide flexibility for increased capacity but does allow for easier installation of scissors in the future
A.2. Preserve and Protect the Historic Character of Union Station	☐	No change	☐	No impact to historic features or finishes	☐	No impact to historic features or finishes	☐	No impact to historic features or finishes	☐	No impact to historic features or finishes
A.3. Improve Economic and Social Vitality	☐	No change	☐	One scissor crossover will increase train capacity through the station, improving economic vitality of neighborhood; no impact to marketability of leased spaces	☐	One scissor crossover will increase train capacity through the station, improving economic vitality of neighborhood; no impact to marketability of leased spaces	●	Two crossovers would maximize train capacity through the station and provide most flexibility, maximizing the positive effect on neighborhood vitality; no impact to marketability of leased spaces	☐	No change

Evaluation Criteria	A	No-Build / No Scissor Crossover	B	Scissors between TK 1 & 2	C	Scissors between TK 3 & 4	D	Both Scissors Installed	E	Construct Platform and Utility Modifications Only
A.4. Improve Environmental Sustainability	□	No change	●	No impact to LEED rating; Implementation could increase train capacity through the station, improving the mode share of passenger rail in the corridor and reducing emissions; no impact to stormwater	●	No impact to LEED rating; Implementation could increase train capacity through the station, improving the mode share of passenger rail in the corridor and reducing emissions; no impact to stormwater	●	No impact to LEED rating; Maximizes train capacity through the station and provides most flexibility, presumably maximizing the increase in mode share for passenger rail within the corridor and helping reduce emissions; no impact to stormwater	□	No change
B. Cost and Financing										
B.1. Estimated Capital Cost	□	No change	◆	Similar cost for installing on Tracks 3 & 4. Cost of four turnouts and their installation. Design would also require modifications to platform geometry and safety and security measures on one platform for an additional cost	◆	Similar cost for installing on Tracks 1 & 2. Cost of four turnouts and their installation. Design would require modifications to platform geometry and safety and security measures on one platform for an additional cost	◆	Most expensive alternative. Cost of eight turnouts and their installation. Design would require modifications to platform geometry and safety and security measures of two platforms for an additional cost.	●	Low cost for platform reconfiguration and utility stub ups for future use
B.2. Lifecycle Cost Impacts	□	No change	◆	Similar cost for installing on Tracks 3 & 4. Would require new	◆	Similar cost for installing on Tracks 1 & 2. Would	◆	Most expensive alternative - higher life cycle cost due	□	No change

Evaluation Criteria	A	No-Build / No Scissor Crossover	B	Scissors between TK 1 & 2	C	Scissors between TK 3 & 4	D	Both Scissors Installed	E	Construct Platform and Utility Modifications Only
				Amtrak staff position to be trained and empowered to operate switches within the station		require new Amtrak staff position to be trained and empowered to operate switches within the station		to more turnouts installed. Would require Amtrak staff position to be trained and empowered to operate switches within the station		
B.3. Cost Risk	☐	No change	◆	High design cost uncertainty due to need to gain approval from Amtrak, FRA, and Class 1 railroads	◆	High design cost uncertainty due to need to gain approval from Amtrak, FRA, and Class 1 railroads for scissors. Medium to high cost risk due to need to get design approval for platform modifications from Amtrak, FRA	◆	High design cost uncertainty due to need to gain approval from Amtrak, FRA, and Class 1 railroads for scissors. Medium to high cost risk due to need to get design approval for platform modifications from Amtrak, FRA	☐	Medium to high cost risk due to need to get design approval for platform modifications from Amtrak, FRA
B.4. Financial Leverage	☐	Not applicable to rail improvements	☐	Not applicable to rail improvements	☐	Not applicable to rail improvements	☐	Not applicable to rail improvements	☐	Not applicable to rail improvements
C. Implementability and Constructability										
C.1. Technical Complexity and Constructability	☐	No change	◆	Safety measures requested by stakeholders will require extensive design and coordination efforts; Medium level of construction time relative to other track alternatives	◆	Safety measures and platform modifications requested by stakeholders will require extensive design and coordination effort; Medium level of construction time	◆	Safety measures and platform modifications requested by stakeholders will require extensive design and coordination efforts; Medium level of	◆	Safety measures and platform modifications requested by stakeholders will require extensive design and coordination effort

Evaluation Criteria	A	No-Build / No Scissor Crossover	B	Scissors between TK 1 & 2	C	Scissors between TK 3 & 4	D	Both Scissors Installed	E	Construct Platform and Utility Modifications Only
						relative to other track alternatives		construction time relative to other track alternatives. High level of complexity for design modifications to platform		
C.2. Schedule and Schedule Risk	☐	No change	◆	Approvals from stakeholders (Amtrak, FRA, ODOT) considered a significant design schedule risk	◆	Approvals from stakeholders (Amtrak, FRA, ODOT) considered a significant design schedule risk	◆	Approvals from stakeholders (Amtrak, FRA, ODOT) considered a significant design schedule risk	◆	Approvals from stakeholders (Amtrak, FRA, ODOT) considered a significant design schedule risk
C.3. Construction Impact on Passenger and Freight Rail Operations	☐	No change	◆	High degree of impact to passenger train operations during implementation - detailed staging plans will be required; High degree of impacts to passengers; High degree of temporary reduction in trackside capacity; no freight rail impacts	◆	High degree of impact to passenger train operations during implementation - detailed staging plans will be required; High degree of impacts to passengers; High degree of temporary reduction in trackside capacity; no freight rail impacts	◆	High degree of impact to passenger train operations during implementation - detailed staging plans will be required; High degree of impacts to passengers; High degree of temporary reduction in trackside capacity; no freight rail impacts	◆	High degree of impact to passenger train operations during implementation - detailed staging plans will be required; High degree of impacts to passengers; High degree of temporary reduction in trackside capacity; no freight rail impacts
C.4. Construction Impact on Union Station Tenants	☐	No change	●	Little to no impacts to tenants	●	Little to no impacts to tenants	●	Little to no impacts to tenants	●	Little to no impacts to tenants
C.5. Phasing and Project Segmentation	☐	No change	◆	Low ability to phase work to spread costs;	◆	Low ability to phase work to spread	◆	Low ability to phase work to	◆	Low ability to phase work to

Evaluation Criteria	A	No-Build / No Scissor Crossover	B	Scissors between TK 1 & 2	C	Scissors between TK 3 & 4	D	Both Scissors Installed	E	Construct Platform and Utility Modifications Only
				Implementation would require the need to power up and signalized all switches, to employ a yardmaster at the station, and construct a switch control facility at the station; High ability to gain cost efficiencies through combination with other track alternatives		costs; Implementation would require the need to power up and signalized all switches, to employ a yardmaster at the station, and construct a switch control facility at the station; High ability to gain cost efficiencies through combination with other track alternatives. Platform modification would require reconstruction of canopy		spread costs; Implementation would require the need to power up and signalized all switches, to employ a yardmaster at the station, and construct a switch control facility at the station; High ability to gain cost efficiencies through combination with other track alternatives. Platform modification would require reconstruction of canopy		spread costs; Low ability to accomplish work independent of other track alternatives - Platform modification would require reconstruction of canopy; high potential for efficiencies if combined with other utility work
C.6. Risks, Assumptions and Unknowns	◆	Without modeling the station and surrounding rail network beyond the minimal amount of work to date, it is difficult to draw conclusions regarding	◆	The minimal scheduling and routing within the station performed so far has led to conservative assumptions regarding the need for the scissor crossings - it could be that further modeling and/or detailed scheduling will prove scissors are not needed; High	◆	The minimal scheduling and routing within the station performed so far has led to conservative assumptions regarding the need for the scissor crossings - it could be that further modeling and/or detailed scheduling	◆	The minimal scheduling and routing within the station performed so far has led to conservative assumptions regarding the need for the scissor crossings - it could be that further modeling and/or detailed	◆	The minimal scheduling and routing within the station performed so far has led to conservative assumptions regarding the need for the scissor crossings - it could be that further modeling and/or detailed

Evaluation Criteria	A	No-Build / No Scissor Crossover	B	Scissors between TK 1 & 2	C	Scissors between TK 3 & 4	D	Both Scissors Installed	E	Construct Platform and Utility Modifications Only
		whether or not the station and surrounding network could operate at the desired 2035 volumes. The minimal scheduling and routing within the station performed so far has led to conservative assumptions regarding the need for the scissor crossings		ability to minimize risk through further analysis		will prove scissors are not needed; High ability to minimize risk through further analysis		scheduling will prove scissors are not needed; High ability to minimize risk through further analysis		scheduling will prove scissors are not needed; High ability to minimize risk through further analysis
D. Environmental Impacts and Approvals										
D.1. Environmental Impacts and Project Classification	☐	No changes	☐	No adverse effects; High likelihood of categorical exclusions as this would fill a need for operations; No risk of delay due to NEPA	●	No adverse effects; High likelihood of categorical exclusions as this would fill a need for operations; No risk of delay due to NEPA	●	No adverse effects; High likelihood of categorical exclusions as this would fill a need for operations; No risk of delay due to NEPA	●	No adverse effects; High likelihood of categorical exclusions as this would fill a need for operations; No risk of delay due to NEPA
D.2. Historic Impacts and Approvals	☐	No changes	☐	No issues of concern for historic review	☐	No issues of concern for historic review	☐	No issues of concern for historic review	☐	No issues of concern for historic review

Evaluation Criteria	A	No-Build / No Scissor Crossover	B	Scissors between TK 1 & 2	C	Scissors between TK 3 & 4	D	Both Scissors Installed	E	Construct Platform and Utility Modifications Only
D.3. Decision Making and Approvals	□	No changes	◆	FRA and Amtrak continue to express reluctance to accept scissors within a station area, though designs are only conceptual. It may be that, despite further design revisions to accommodate stakeholder concerns, approval may prove unachievable	◆	FRA and Amtrak continue to express reluctance to accept scissors within a station area, though designs are only conceptual. It may be that, despite further design revisions to accommodate stakeholder concerns, approval may prove unachievable. FRA and Amtrak have expressed concern over dynamic envelope of train through scissor and the impact this would have on the platforms - impacts to platform widths and geometry could be extensive. Platform design would also impact canopy design	◆	FRA and Amtrak continue to express reluctance to accept scissors within a station area, though designs are only conceptual. It may be that, despite further design revisions to accommodate stakeholder concerns, approval may prove unachievable. FRA and Amtrak have expressed concern over dynamic envelope of train through scissor and the impact this would have on the platforms - impacts to platform widths and geometry could be extensive. Platform design would also impact canopy design	◆	FRA and Amtrak have expressed concern over dynamic envelope of train through scissor and the impact this would have on the platforms - impacts to platform widths and geometry could be extensive. Platform design would also impact canopy design

Source: HDR. 2016.

6.1.8. Shorten the Existing Platforms

The Existing Rail Infrastructure and Operations Report (HDR, 2015) presented the option of extending the existing platforms to the south in order to extend the length of the platform available for *Cascades* service boarding and alighting. However, the track geometry is such that extending the platforms south will result in boarding cars along a curved platform, which is not recommended because the gap between the car and the platform then varies. This proposed improvement would *shorten* the platform to coincide with the limits of straight track (Figure 6.1.3-6). The option also includes paving a section of track to allow for a baggage cart path to the station.

Two options were evaluated for improvements to the existing platforms:

- The No-Build option would leave the existing platform configuration in place with no modification; and,
- The build option would shorten both platforms and constructs a baggage cart path.

The results of the evaluation of the two options are summarized in Table 6.1.3-6.

6.1.8.1 Conceptual Scope

The following are the key conceptual scope elements for the proposed improvements:

- Shorten existing platforms
- Construct baggage cart path

6.1.8.2 Recommendation

The project team recommends shortening both platforms and constructing the baggage cart path.

We also recommend a design train length be determined and agreed to by all parties. This option also would require an operating plan by Amtrak that does not allow for boarding in Portland in the southern-most cars; this would need to be endorsed by Amtrak.

Figure 6.1.3-6. Shorten Existing Platforms

Source: HDR. 2016.

Table 6.1.3-6. Evaluation of Alternatives to Shorten Existing Platforms

Evaluation Criteria	A	No-Build / Do Not Shorten Platforms	B	Shorten the Existing Platforms / Construct Baggage Cart Path
A: Ability to Meet Project Goals				
A.1. Accommodate Future Capacity and Operational Needs of Passenger and Freight Rail	◆	No change to passenger train capacity; Does not meet the operating needs or design standards of Amtrak due to curved platforms adjacent to passenger and baggage cars; No freight impacts; Reduces ADA accessibility due to potential for curved platforms adjacent to passenger cars; No impact to safety or security	●	Positively impacts station capacity by accommodating the berthing of trains south of the passenger crossing; Meets the operating needs and design standards of Amtrak by shortening platforms to adjacent to tangent track only; No freight impacts; Improves ADA accessibility due to removal of curved platform; No impact to safety or security; Improves Amtrak operations by adding baggage cart path
A.2. Preserve and Protect the Historic Character of Union Station	☐	No change	☐	No change
A.3. Improve Economic and Social Vitality	☐	No change	☐	No change
A.4. Improve Environmental Sustainability	☐	No change	☐	No change
B. Cost and Financing				
B.1. Estimated Capital Cost	☐	No change	●	Low cost magnitude relative to other track alternatives
B.2. Lifecycle Cost Impacts	☐	No change	●	Low to no lifecycle cost increases
B.3. Cost Risk	☐	No change	●	Low cost uncertainty due to unknowns with potential underground construction
B.4. Financial Leverage	☐	Not applicable to rail improvements	☐	Not applicable to rail improvements
C. Implementability and Constructability				
C.1. Technical Complexity and Constructability	☐	No change	●	Low level of technical complexity - standard methods and materials assumed; relatively short timeframe when compared to other track alternatives
C.2. Schedule and Schedule Risk	☐	No change	◆	High degree of schedule risk due to required approvals and operational changes required from Amtrak; Low risk of delays and low schedule risk once approvals and operational changes from Amtrak are received

Evaluation Criteria	A	No-Build / Do Not Shorten Platforms	B	Shorten the Existing Platforms / Construct Baggage Cart Path
C.3. Construction Impact on Passenger and Freight Rail Operations	☐	No change	◆	High degree of impact on passenger operations during construction - these disruptions would need to be mitigated through concerted effort during construction staging; High potential to reduce station capacity during construction; No freight impacts
C.4. Construction Impact on Union Station Tenants	☐	No change	●	Low level of technical complexity - standard methods and materials assumed; relatively short timeframe when compared to other track alternatives
C.5. Phasing and Project Segmentation	☐	No change	◆	Low ability to phase work to spread costs; Low ability to implement independent of other alternatives - can be independent, but there is a high ability for schedule and cost efficiencies when paired with replacement of platform canopies and/or constructing 15" high platforms. However, platform alterations tied directly to train lengths, track 6 implementation, passenger crossing location, and scissor crossover installation
C.6. Risks, Assumptions and Unknowns	☐	No change	◆	Low potential for unknown ground conditions below existing platform; High risk due to reliance on assumption that operational changes from Amtrak can be obtained to shorten platforms - no boarding will be available south of tangent track - decision coincides with need to determine future train length and berthing locations; low risk to historic features - platforms have changed multiple times over the years; High ability to mitigate risk due to assumptions before implementation through agreement on operational changes from Amtrak
D. Environmental Impacts and Approvals				
D.1. Environmental Impacts and Project Classification	☐	No change	●	Low potential for environmental impacts or adverse effects; High likelihood of categorical exclusion; No schedule risk due to NEPA
D.2. Historic Impacts and Approvals	☐	No change	●	No impacts due to historic features; Low risk associated with historic reviews & approvals since this would be considered a transportation change and the platforms have been altered throughout the years; no schedule risk associated with historic reviews process
D.3. Decision Making and Approvals	☐	No change	●	No key stakeholder or regulatory approvals associated with alternative; No permitting or regulatory requirements risk

Source: HDR. 2016.

6.1.9. Construct Track #6

After purchasing Union Station in 1987, the Portland City Council established the Union Station Transportation Committee to prepare a long range vision and track plan. In 1991, the City of Portland commissioned a Union Station Transportation Study that analyzed the numbers of tracks and platforms that should be preserved to support existing Amtrak rail passenger services and future intercity and metro area operations. As a result of the study, the City decided to retain five of the existing tracks to meet existing and future transportation needs balanced with redevelopment opportunities. Additionally, in the mid-1990s, ODOT and PTRR simplified area track layout and signaling, which included the removal of Track #6. Between 1997 and 2013, a mix of market rate and subsidized multi-family rental units were built on the property east of Track #6.

This proposed improvement would rebuild Track #6 allowing for a second freight main adjacent to the station yard (Figure 6.1.3-7). Freight trains would use Tracks #5 and #6 exclusively, and would not need to enter the yard on Track #4, allowing for the increased passenger train volumes.

The evaluation matrix considers three options: construct Track #6 to the west of the Broadway Bridge pier, alter the platform between Tracks 4 & 5, and shift Track #5 to accommodate freight trains; construct Track #6 to the east of the Broadway Bridge pier and purchase Right-of-Way (ROW) to accommodate; and the No-Build option would leave the existing system of five tracks in place.

Three options were evaluated for constructing Track #6:

- The No-Build option would leave the existing system of five tracks in place; and,
- Two build options would construct Track #6 in different configurations:
    - Construct Track #6 to the west of the Broadway Bridge pier, alter the platform between Tracks 4 & 5, and shift Track #5 to accommodate freight trains
    - Construct Track #6 to the east of the Broadway Bridge pier and purchase Right-of-Way (ROW) to accommodate

The results of the evaluation of the three options are summarized in Table 6.1.3-7.

6.1.9.1 Conceptual Scope

The following are the key conceptual scope elements for the proposed improvements:

- Construct new trackwork (Track #6)
- Construct special trackwork
- Shift approximately 1,050 feet of Track #5 to make space for Track #6
- Construct bridge pier protection
- Revise the existing width of the platform between Tracks 4 and 5; Reconfigure existing canopy
- Reconstruct NW 9th Avenue crossing
- Signalize trackwork
- Install noise mitigation in nearby residences
- Other improvements as noted in Figure 6.1.3-7

6.1.9.2 Recommendation

To accommodate the loss in current capacity, and to allow for the most flexible operating plan for passenger trains into and out of the station, the project team recommends construction of Track #6. If the 2035 expected passenger train volumes are realized, all four tracks within the station will be required for passenger trains, no longer allowing for freight traffic on Track #4. Track #6 will also likely be needed for phasing of other track, canopy, and platform improvements.

Based on the desire to limit ROW impacts, the project team recommends constructing Track #6 to the west of the Broadway Bridge pier and altering the platform to accommodate the newly constructed Track #6.

Figure 6.1.3-7. Construct Track #6

Source: HDR. 2016.

Table 6.1.3-7. Evaluation of Track #6 Construction Alternatives

Evaluation Criteria	A	No-Build / Do Not Construct Track 6	B	Construct Track 6 West of Bridge Pier	C	Construct Track 6 East of Bridge Pier
A: Ability to Meet Project Goals						
A.1. Accommodate Future Capacity and Operational Needs of Passenger and Freight Rail	◆	Based on analysis completed, Union Station and the local rail network unlikely to be able to handle predicted 2035 passenger trains without implementation	●	Would allow for Tracks 1-4 for passenger only, Track 5 predominantly for freight, and Track 6 for freight only, providing greater passenger rail flexibility and capacity - addition of track 6 will allow for desired 2035 passenger train volumes; Improved operations of trains will improve passenger experiences through reduced delays and improved on-time performance; Implementation will result in two main lines through area, improving freight traffic	●	Would allow for Tracks 1-4 for passenger only, Track 5 predominantly for freight, and Track 6 for freight only, providing greater passenger rail flexibility and capacity - addition of track 6 will allow for desired 2035 passenger train volumes; Improved operations of trains will improve passenger experiences through reduced delays and improved on-time performance; Implementation will result in two main lines through area, improving freight traffic
A.2. Preserve and Protect the Historic Character of Union Station	☐	No Change	☐	No impact to historic features or finishes	☐	No impact to historic features or finishes
A.3. Improve Economic and Social Vitality	◆	No immediate impact (2017 train volumes can be accommodated), but as train volumes increase, traffic through the station will be difficult to manage operationally and delays to passenger and freight trains are likely to occur	●	Construction of Track 6 is considered necessary to accommodate the 2035 train volumes; higher capacity means more passengers accommodated, improving economic and social vitality of neighborhood; no impact to building efficiency	●	Construction of Track 6 is considered necessary to accommodate the 2035 train volumes; higher capacity means more passengers accommodated, improving economic and social vitality of neighborhood; no impact to building efficiency
A.4. Improve Environmental Sustainability	◆	Not implementing alternative may not allow for the desired 2035 passenger train volumes, thereby reducing the ability to reduce vehicle emissions along the I-5 corridor	●	No impact to LEED rating; The addition of Track 6 will allow for the desired 2035 passenger train volumes and improve the ability of freight to move through the area, increasing the mode share for passenger trains in the I-5 corridor and reducing emissions; no impacts to stormwater	●	No impact to LEED rating; The addition of Track 6 will allow for the desired 2035 passenger train volumes and improve the ability of freight to move through the area, increasing the mode share for passenger trains in the I-5 corridor and reducing emissions; no impacts to stormwater
B. Cost and Financing						
B.1. Estimated Capital Cost	☐	No capital cost	◆	Requires relatively high capital cost to realign track 5, construct track 6, and procure turnouts for connections.	◆	Requires relatively high capital cost to realign track 5, construct track 6, and procure turnouts for connections. Powering-up

Evaluation Criteria	A	No-Build / Do Not Construct Track 6	B	Construct Track 6 West of Bridge Pier	C	Construct Track 6 East of Bridge Pier
				Powering-up switches and signalization would also probably be required		switches and signalization would also probably be required
B.2. Lifecycle Cost Impacts	☐	Continued use of Track 4 for freight will provide more need for maintenance in future	●	Assuming maintenance for Tracks 5 and 6 will be paid for by the Railroads, there will be a reduction in maintenance due to freight trains not using Track 4	●	Assuming maintenance for Tracks 5 and 6 will be paid for by the Railroads, there will be a reduction in maintenance due to freight trains not using Track 4
B.3. Cost Risk	☐	No Change	◆	Negotiators with the BNSF, UP, and/or PTRR may require other investments to the local rail network in the area before agreeing to project	◆	Negotiators with the BNSF, UP, and/or PTRR may require other investments to the local rail network in the area before agreeing to project
B.4. Financial Leverage	☐	No Change	☐	Not applicable to rail improvements	☐	Not applicable to rail improvements
C. Implementability and Constructability						
C.1. Technical Complexity and Constructability	☐	No Change	◆	Approval from BNSF, UP, and PTRR required; Track lead realignment is complex due to fitting an additional turnout in limited horizontal space; concept has been completed but not agreed to by railroads. Track construction would need to keep freight traffic unimpeded, which can lead to increased cost and liability during construction; Medium to high duration of construction relative to other track alternatives. Construction west of bridge pier will require altering the width of the platform between tracks 4 & 5, which could impact the architectural design of the canopies	◆	Approval from BNSF, UP, and PTRR required; Track lead realignment is complex due to fitting an additional turnout in limited horizontal space; concept has been completed but not agreed to by railroads. Track construction would need to keep freight traffic unimpeded, which can lead to increased cost and liability during construction; Medium to high duration of construction relative to other track alternatives. Construction east of the bridge requires additional right of way
C.2. Schedule and Schedule Risk	☐	No Change	◆	High potential for schedule delay due to the fact that the design and operations plan must be approved by railroads, Amtrak, and FRA.	◆	High potential for schedule delay due to the fact that the design and operations plan must be approved by railroads, Amtrak, and FRA.
C.3. Construction Impact on Passenger and Freight Rail Operations	☐	No Change	◆	High degree of disruption to ongoing rail operations when compared with other track alternatives - detailed construction staging will be required; staging will be required to minimize reductions in trackside capacity; Implementation will	◆	High degree of disruption to ongoing rail operations when compared with other track alternatives - detailed construction staging will be required; staging will be required to minimize reductions in trackside capacity; Implementation will require freight rail

Evaluation Criteria	A	No-Build / Do Not Construct Track 6	B	Construct Track 6 West of Bridge Pier	C	Construct Track 6 East of Bridge Pier
				require freight rail impacts - staging plans will require minimal disruptions to network and continued negotiations / approvals from railroads.		impacts - staging plans will require minimal disruptions to network and continued negotiations / approvals from railroads
C.4. Construction Impact on Union Station Tenants	☐	No Change	☐	Not expected to significantly affect tenants	☐	Not expected to significantly affect tenants
C.5. Phasing and Project Segmentation	☐	No Change	◆	Low to no ability to phase work to spread costs; The construction of Track 6 would also likely require the powering up of turnouts and the signalization of the switches within the station; High probability of cost efficiencies if work is combined with track improvements within yard	◆	Low to no ability to phase work to spread costs; The construction of Track 6 would also likely require the powering up of turnouts and the signalization of the switches within the station; High probability of cost efficiencies if work is combined with track improvements within yard
C.6. Risks, Assumptions and Unknowns	☐	No Change	◆	Without modeling the station and surrounding rail network beyond the minimal amount of work to date, it is difficult to draw conclusions regarding whether or not the station and surrounding network could operate at the desired 2035 volumes. The minimal scheduling and routing within the station performed so far have led to conservative assumptions regarding the need for Track 6; High ability to minimize risks based on assumptions through modeling and scheduling	◆	Without modeling the station and surrounding rail network beyond the minimal amount of work to date, it is difficult to draw conclusions regarding whether or not the station and surrounding network could operate at the desired 2035 volumes. The minimal scheduling and routing within the station performed so far have led to conservative assumptions regarding the need for Track 6; High ability to minimize risks based on assumptions through modeling and scheduling
D. Environmental Impacts and Approvals						
D.1. Environmental Impacts and Project Classification	☐	No Change	◆	The addition of Track 6 would require a noise and vibration assessment. If project noise and vibration levels exceed specified thresholds, mitigation measures would be required for the nearby residential units. Noise and vibration mitigation requirements for nearby residences could lead to schedule delays during implementation	◆	The addition of Track 6 would require a noise and vibration assessment. If project noise and vibration levels exceed specified thresholds, mitigation measures would be required for the nearby residential units. Noise and vibration mitigation requirements for nearby residences could lead to schedule delays during implementation. Construction east of the bridge pier also requires purchasing ROW from neighboring parcels

Evaluation Criteria	A	No-Build / Do Not Construct Track 6	B	Construct Track 6 West of Bridge Pier	C	Construct Track 6 East of Bridge Pier
D.2. Historic Impacts and Approvals	☐	No Change	●	No issues of concern to historic features. Track 6 was in operation until recently (mid-1990's), so this would be a return to an earlier condition	●	No issues of concern to historic features. Track 6 was in operation until recently (mid-1990's), so this would be a return to an earlier condition
D.3. Decision Making and Approvals	☐	No Change	◆	Design must be approved by Class I railroads, who may require investments elsewhere to offset impacts to the freight system. They may also require modeling.	◆	Design must be approved by Class I railroads, who may require investments elsewhere to offset impacts to the freight system. They may also require modeling.

Source: HDR. 2016.

6.1.10. Raise Platform Heights

This proposed improvement would raise the existing two platform heights to 15 inches above top of rail (TOR) (Figure 6.1.3-8). Raising the platforms would bring the platforms in compliance with ADA standards, consistent with federal and state requirements and PDC's policies on accessibility. The raised platforms would enable level-boarding status for the Amtrak Superliner cars. This proposed improvement may qualify for federal and state funding programs aimed at increasing accessibility.

Three options were evaluated for raising the platform heights:

- The No-Build option would leave the platforms at existing heights with no modifications; and,
- Two build options would construct Track #6 in different configurations:
    - Raise both platforms between Tracks 2 & 3 and Tracks 4 & 5 to 15 inches above TOR
    - Raise the platform between Tracks 2 & 3 to 15 inches and raise the platform between Tracks 4-5 to 8 inches above TOR

The results of the evaluation of the three options are summarized in Table 6.1.3-8.

6.1.10.1 Conceptual Scope

The following are the key conceptual scope elements for the proposed improvements:

- Demolish existing platforms and canopies pending selection of preferred canopy alternative
- Construct utilities
- Construct platforms at 15 inches above TOR
- Construct new canopies (not included in rail estimate)
- Raise Track #5 (see Section 6.1.3.9)

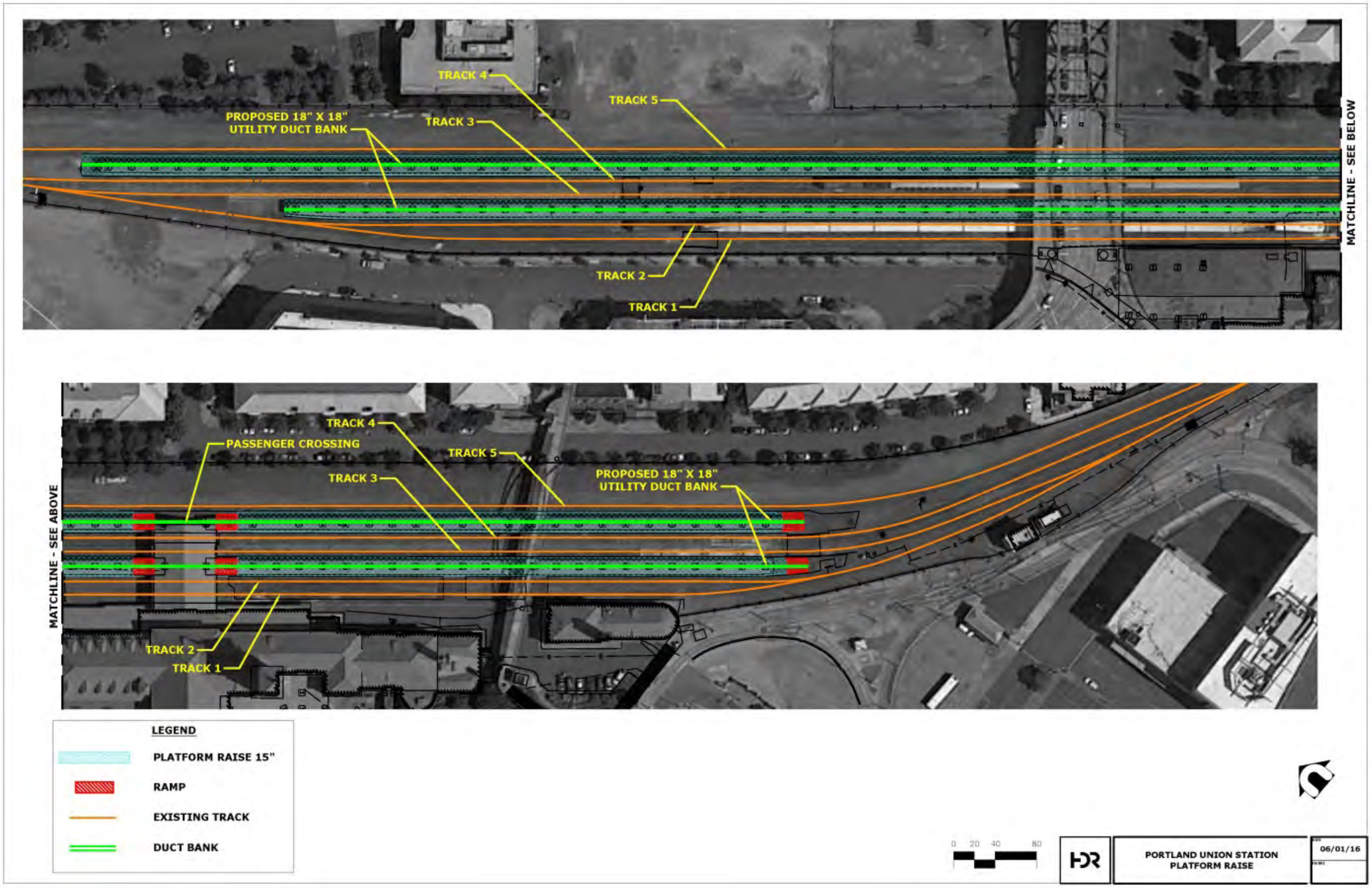
6.1.10.2 Recommendation

If PDC decides to construct Track 6, the project team recommends raising all platforms to 15 inches above TOR. FRA has stated that level boarding implementation is a project requirement. If PDC decides not to construct Track 6, then the project team recommends raising only the platform for Tracks 2 and 3 to 15 inches and raising the platform for Tracks 4 and 5 to 8 inches.

Also recommended is development and implementation of a system-wide design criterion to define the height of the passenger car to be serviced in the future. If a standard height can be agreed upon by all parties, the benefits of level-boarding can be achieved for all car types using the station, not solely the Superliner cars.

The cost for the two build options is similar – in both cases, both platforms are removed and reconstructed, but at different heights above TOR.

Figure 6.1.3-8. Raise Platform Heights



Source: HDR. 2016.

Table 6.1.3-8. Evaluation of Raising Platform Heights Alternatives

Evaluation Criteria	A	No-Build / Do Not Raise Platforms	B	Raise Both Platforms to 15" Above TOR	C	Raise Platform between Tracks 2 and 3 to 15" Above TOR; Raise Platform for Tracks 4 and 5 to 8" Above TOR
A: Ability to Meet Project Goals						
A.1. Accommodate Future Capacity and Operational Needs of Passenger and Freight Rail	◆	If PDC chooses *not* to construct raised platforms, a waiver from the FRA will be required, which may not be possible to receive. FRA has already stated need for raised platforms.	◆	Raising platforms to 15" above TOR fulfills FRA requirements for ADA accessibility and accommodates Amtrak design standards; no impact to seismic or safety; Requires raising Track 5 and construction of Track 6 to accommodate freight movements	☐	FRA requirements for ADA accessibility will be accommodated on platform between Tracks 2 & 3 only - FRA waiver may be required; no impacts to freight during construction. Differences in platform heights would impact Amtrak operating plan
A.2. Preserve and Protect the Historic Character of Union Station	☐	No change	☐	No impact to historic features or finishes - platforms have changed over time and are not considered historic elements; Raising platforms will require modifying the existing canopies which could trigger adverse effect depending on canopy type/form selected.	☐	No impact to historic features or finishes - platforms have changed over time and are not considered historic elements; Raising only one platform would probably require altering canopies on other platform to remain consistent in visual expression
A.3. Improve Economic and Social Vitality	☐	No change	☐	No impact to neighborhood viability; no impact to marketability of leased spaces	☐	No impact to neighborhood viability; no impact to marketability of leased spaces
A.4. Improve Environmental Sustainability	☐	No change	☐	No impact on LEED rating; no environmental impacts	☐	No impact on LEED rating; no environmental impacts
B. Cost and Financing						
B.1. Estimated Capital Cost	☐	No change	☐	Medium level of capital cost compared to other track alternatives	☐	Medium level of capital cost compared to other track alternatives
B.2. Lifecycle Cost Impacts	☐	No change	☐	No impact on lifecycle costs	☐	No impact on lifecycle costs
B.3. Cost Risk	☐	No change	●	Low level of cost risk due to unknowns; low complexity of design	●	Low level of cost risk due to unknowns; low complexity of design
B.4. Financial Leverage	☐	Not applicable to rail improvements	☐	Not applicable to rail improvements	☐	Not applicable to rail improvements
C. Implementability and Constructability						

Evaluation Criteria	A	No-Build / Do Not Raise Platforms	B	Raise Both Platforms to 15" Above TOR	C	Raise Platform between Tracks 2 and 3 to 15" Above TOR; Raise Platform for Tracks 4 and 5 to 8" Above TOR
C.1. Technical Complexity and Constructability	☐	No change	☐	Low complexity of design due to materials and methods - expecting standard methods for platform design; Medium construction duration compared to other track alternatives	☐	Low complexity of design due to materials and methods - expecting standard methods for platform design; Medium construction duration compared to other track alternatives
C.2. Schedule and Schedule Risk	☐	No change	☐	Low level time frame for design approvals; Medium level of risk due to unforeseen conditions underground	☐	Low level time frame for design approvals; Medium level of risk due to unforeseen conditions underground
C.3. Construction Impact on Passenger and Freight Rail Operations	☐	No change	◆	High degree of impact to both passenger and freight rail operations - detailed staging plans will be required; High degree of impacts to passengers - platforms would be closed in sequence to reconstruct; freight rail traffic will be impacted - agreement from railroads on operating plans will be required	☐	Medium degree of impact to passenger rail operations - detailed staging plans will be required; medium degree of impacts to passengers - platform would be closed in sequence to reconstruct
C.4. Construction Impact on Union Station Tenants	☐	No change	●	Low level of noise due to construction in yard; no impacts to tenants	●	Low level of noise due to construction in yard; no impacts to tenants
C.5. Phasing and Project Segmentation	☐	No change	☐	Low ability to phase work to spread costs; Low ability to phase work independent of other track alternatives - requires altering canopies, raising track 5 and constructing track 6; High potential for cost efficiencies by combining work with other track alternatives, including replacing canopies, installing utilities, revising width per installation of track 6, and revising passenger crossing width and location	●	Low ability to phase work to spread costs; High ability to phase work independent of other track alternatives; high potential for efficiencies by combining with other track alternatives, including replacing canopies, installing utilities, and revising passenger crossing width and location
C.6. Risks, Assumptions and Unknowns	☐	No change	☐	High risk of delays due to unforeseen conditions from underground work; High ability to mitigate cost of delay due to unforeseen conditions by assuming longer construction and contaminated soils	☐	High risk of delays due to unforeseen conditions from underground work; High ability to mitigate cost of delay due to unforeseen conditions by assuming longer construction and contaminated soils

Evaluation Criteria	A	No-Build / Do Not Raise Platforms	B	Raise Both Platforms to 15" Above TOR	C	Raise Platform between Tracks 2 and 3 to 15" Above TOR; Raise Platform for Tracks 4 and 5 to 8" Above TOR
D. Environmental Impacts and Approvals						
D.1. Environmental Impacts and Project Classification	□	No change	●	No environmental impacts; High likelihood of categorical exclusion; No risk of schedule delay due to NEPA	●	No environmental impacts; High likelihood of categorical exclusion; No risk of schedule delay due to NEPA
D.2. Historic Impacts and Approvals	□	No change	◆	Altering platform heights requires reconstruction of platform canopies, which could trigger an adverse effect depending on design of canopy	◆	Altering platform heights requires reconstruction of platform canopies, which could trigger an adverse effect depending on design of canopy
D.3. Decision Making and Approvals	◆	Approval from FRA would be required in order to *not* install raised platforms	◆	Low risk of schedule delay due to need for FRA and Amtrak approval; Medium risk of delay due to need for agreement from railroads on temporary operating plans due to impacts to track 5 and installation of track 6; No permitting requirements	□	Low risk of schedule delay due to need for FRA and Amtrak approval; Medium risk of delay due to need for waiver from FRA to not install raised platforms throughout; No permitting requirements

Source: HDR. 2016.

6.1.11. Raise Track #5

This proposed improvement would raise Track #5 by 7 inches (through additional ballast and tamping) in order to remove the potential conflict between raising the platforms to 15 inches above TOR and the adjacent freight traffic on Track #5; the maximum height of a platform adjacent to a freight track is 8 inches (Figure 6.1.3-9).

Two options were evaluated for raising Track #5:

- The No-Build option would leave Track #5 15 inches below the raised platform, leaving a potential conflict with freight trains; and,
- The build option would raise Track #5 by 7 inches if platforms are raised by 15 inches.

The results of the evaluation of the two options are summarized in Table 6.1.3-9.

6.1.11.1 Conceptual Scope

The following are the key conceptual scope elements for the proposed improvements:

- Install ballast
- Surface, Line and Dress ballasted track
- Reconstruct at grade crossing of NW 9th Avenue

6.1.11.2 Recommendation

If PDC decides to raise the platforms to 15 inches above TOR, the project team recommends implementing the build alternative to raise Track #5 by 7 inches.

Figure 6.1.3-9. Raise Track #5

Source: HDR. 2016.

Table 6.1.3-9. Evaluation of Raising Track #5 Alternatives

Evaluation Criteria	A	No-Build / Do Not Raise Track 5	B	Raise Track 5
A: Ability to Meet Project Goals				
A.1. Accommodate Future Capacity and Operational Needs of Passenger and Freight Rail	◆	If Track 5 isn't raised, either freight will not be able to access Track 5, or the platform cannot be raised for level boarding, both of which are required by their respective stakeholders	●	Raising Track 5 allows for the raising of platform 3-4 to 15" above top of rail on Track 4, which is required for Level Boarding of passenger trains, while still allowing freight trains to use Track 5 (which cannot operate adjacent to a 15" high platform). Level boarding improves ADA accessibility and is required by FRA. No impact to security, seismic concerns, or safety.
A.2. Preserve and Protect the Historic Character of Union Station	□	No change	□	This is a transportation need and is not expected to impact historical character
A.3. Improve Economic and Social Vitality	□	No change	●	Increasing the capacity of Union Station to accept more trains per day, and improving passenger experience with new platforms, requires that the platforms be raised to level boarding height (per FRA regulations). Increasing capacity and improving the platforms will improve the economic and social vitality of the station itself, and thus the neighborhood.
A.4. Improve Environmental Sustainability	□	No change	□	No significant environmental impact
B. Cost and Financing				
B.1. Estimated Capital Cost	□	No change	◆	Medium order of magnitude cost impact - requires alterations to the crossing at NW 9th avenue. This crossing would also be impacted by the addition of Track 6, which would probably be constructed as a construction staging solution
B.2. Lifecycle Cost Impacts	□	No change	●	Low order of magnitude cost impact
B.3. Cost Risk	□	No change	●	Low order of magnitude cost risk
B.4. Financial Leverage	□	Not applicable to rail improvements	□	Not applicable to rail improvements
C. Implementability and Constructability				
C.1. Technical Complexity and Constructability	□	No change	●	Low complexity of design - would require modifying Track 5 for approximately 650' - 750' beyond platform. This includes raising Track 5 through the 9th Avenue grade crossing, while keeping Track 4 crossing at the existing elevation. Low construction timeframe.
C.2. Schedule and Schedule Risk	□	No change	◆	High schedule risk for approvals and permitting for associated construction of Track 6. High schedule risk for stakeholder decision making as well for Track 6. Low schedule risks for raising Track 5 itself.
C.3. Construction Impact	◆	If Track 5 isn't raised, either freight will not be	●	Project would be required to raise Track 5 without interference to freight and

Evaluation Criteria	A	No-Build / Do Not Raise Track 5	B	Raise Track 5
on Passenger and Freight Rail Operations		able to access Track 5, or the platform cannot be raised for level boarding, both of which are required by their respective stakeholders		passenger operations. Risk is lowered with the addition of Track 6 for freight movements and the use of overnight/weekend work for connections as needed. Low impacts to passengers - would limit Track 5 to freight use only. Low impact to passenger trains as these would be limited to Tracks 1-4 during construction.
C.4. Construction Impact on Union Station Tenants	□	No change	●	No significant impact to tenants. Construction staging would be required to accommodate passenger and freight trains. Staging would probably require night/weekend work. Limited impacts to Union Station tenants - construction would need to be done quickly (bulk of work in 2-3 weeks)
C.5. Phasing and Project Segmentation	□	No change	◆	No ability to phase work. Requires the construction of Track 6 for construction staging, as well as alterations to NW 9th Avenue grade crossing.
C.6. Risks, Assumptions and Unknowns	◆	Not increasing the height of Track 5 would require keeping platform 4-5 at 8" above TOR, which will require a variance from FRA, which is a significant risk	□	No significant risk associated with track raise. Freight railroads could require modeling of train network before giving approval. No risk to historic features
D. Environmental Impacts and Approvals				
D.1. Environmental Impacts and Project Classification	□	No change	◆	Low impact from raising Track 5. However, constructing Track 6 for staging purposes requires mitigation to nearby residences, a high environmental impact. Low likelihood of receiving categorical exclusion due to impacts from Track 6 installation. Medium to High schedule risk due to NEPA process regarding Track 6
D.2. Historic Impacts and Approvals	□	No change	●	Low impact to historical elements and approvals
D.3. Decision Making and Approvals	◆	Not raising Track 5 will require keeping the adjacent platform at 8" above TOR; this will require an FRA allowance, which does not seem likely at this time.	◆	Raising Track 5, and installing Track 6 for staging purposes, will require approvals from FRA, State of Oregon, and Railroads. Permitting for revised NW 9th crossing required from State and Federal agencies. Construction of Track 6 requires approval from railroads. Could see high impacts to schedule due to railroad approvals.

Source: HDR. 2016.

6.1.12. Construct On-Site Yard Control

This proposed improvement would employ a Yardmaster for Union Station in order to coordinate between BNSF and Union Pacific (UP) dispatchers directly, rather than coordination being routed through the Portland Terminal Railroad (PTRR). The Yardmaster would control switching within station limits via a locked control panel located on one of the platforms; this control panel would include phone and/or data lines to communicate with the appropriate dispatch (Figure 6.1.3-10).

The Existing Rail Infrastructure Report (HDR, 2015) discussed including a control room within Union Station; however, the project team has determined that the necessary control could be provided via a locked console on the platform. This would be more desirable from a safety standpoint if the installation of the scissor crossovers was also implemented: the Yardmaster would be able to see each of the scissor switch points before switching, adding another layer of safety.

Two options were evaluated for constructing on-site yard control:

- The No-Build option would leave the existing system in place requiring coordination through PTRR; and,
- The build option would implement on-site yard control.

The results of the evaluation of the two options are summarized in Table 6.1.3-10.

6.1.12.1 Conceptual Scope

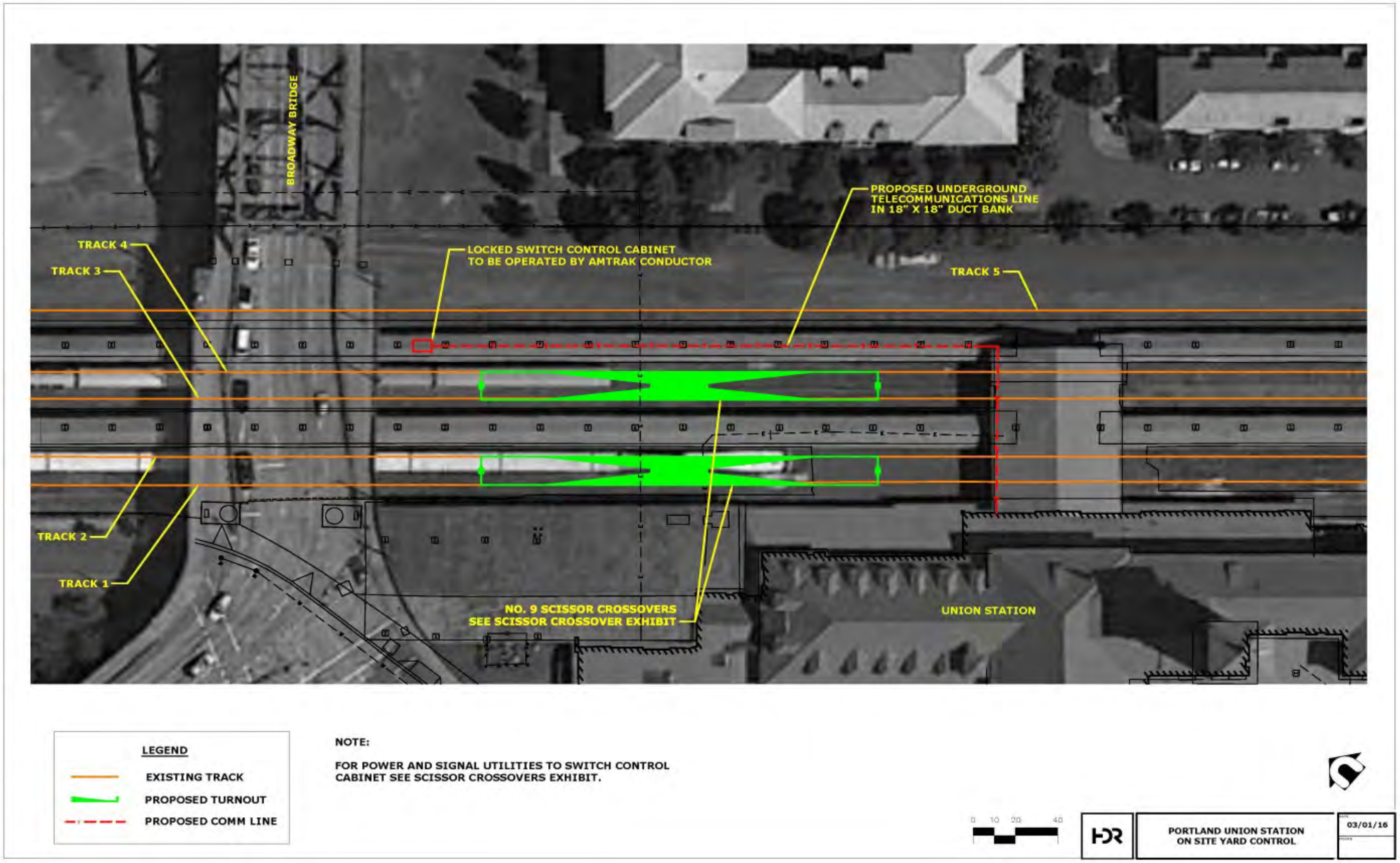
The following are the key conceptual scope elements for the proposed improvements:

- Construct switching console on the platform between Tracks 4 and 5
- Conduit installation (currently assumed to run back to building)
- Amtrak staffing change to include Yardmaster (not included in the Capital cost estimate)

6.1.12.2 Recommendation

The project team recommends installation of on-site yard control to support the 2035 passenger train volumes if the yard is signalized and all switches powered up.

Figure 6.1.3-10. Construct On-Site Yard Control



Source: HDR. 2016.

Table 6.1.3-10. Evaluation of On-Site Yard Control Alternatives

Evaluation Criteria	A	No-Build / Remotely control Switching	B	Employ On-Site Yardmaster and Switch Locally
A: Ability to Meet Project Goals				
A.1. Accommodate Future Capacity and Operational Needs of Passenger and Freight Rail	◆	Inefficient operations due to a yardmaster being offsite could result in delays as passenger train volumes through the station increase, and could ultimately limit the ability of Amtrak to achieve its desired 2035 train volumes	●	Will increase efficiency of trains coming through the station by eliminating the need for PTRR to assist train routing between BNSF and UPRR - this increased efficiency will be needed to accommodate desired 2035 train volumes; Increased efficiency will improve passenger experience and will accommodate Amtrak business/operational needs; no impacts to freight movements - yardmaster would only control switching of passenger trains within the station limits; no impacts to seismic or safety issues
A.2. Preserve and Protect the Historic Character of Union Station	□	No change	●	No impacts to historic character of Union Station, or its materials or finishes
A.3. Improve Economic and Social Vitality	◆	Poor efficiency in train movements could limit the ability of Amtrak to achieve its desired 2035 passenger train volumes, thereby limiting the economic vitality of the neighborhood	●	Will increase efficiency of trains coming through the station, which will improve the economic vitality of the neighborhood
A.4. Improve Environmental Sustainability	◆	Medium potential that poor efficiency in train movement due to current operational model could lead to increased idling time for locomotives, as well as a reduction in the mode share of traffic along the I-5 corridor	●	Increased passenger train efficiency will improve the reduction of carbon emissions due to increased mode share along the I-5 corridor; no impacts to stormwater
B. Cost and Financing				
B.1. Estimated Capital Cost	□	No change	●	Low capital cost with respect to other track alternatives
B.2. Lifecycle Cost Impacts	□	No change	◆	Employment of on-site yardmaster will require increase in operational budget for Amtrak, a significant cost increase
B.3. Cost Risk	□	No change	◆	Medium to high risk of design and schedule delays due to requirement for approvals with Amtrak, FRA, BNSF, UP, and PTRR
B.4. Financial Leverage	□	Not applicable to rail improvements	□	Not applicable to rail improvements
C. Implementability and Constructability				
C.1. Technical Complexity and Constructability	□	No change	◆	Medium complexity of design required to custom-design cabinet and switching components within; Technical and operational solutions suggested will require approvals from Amtrak and FRA
C.2. Schedule and	□	No change	◆	Medium to high risk to schedule due to need for approvals for both equipment

Evaluation Criteria	A	No-Build / Remotely control Switching	B	Employ On-Site Yardmaster and Switch Locally
Schedule Risk				and operating plan from Amtrak, FRA, UP, BNSF, and PTRR; Low schedule risk due to local approvals and permitting
C.3. Construction Impact on Passenger and Freight Rail Operations	☐	No change	☐	Low to medium impacts to passengers and rail operations due to underground construction of utility feeds as well as installation of switching cabinet; No impacts to freight; construction impacts to platforms can be staged to minimize disruption and loss of capacity
C.4. Construction Impact on Union Station Tenants	☐	No change	●	Low degree of disruption to Union Station tenants due to construction - construction duration would be relatively short when compared to other track alternatives being considered
C.5. Phasing and Project Segmentation	☐	No change	☐	Medium ability to phase work - underground work could be done before cabinet installation or platform reconstruction; Medium ability to accomplish independent of other alternatives, but would need to be decided upon as part of an overall program ahead of time in order to stage the work correctly; High ability to economize if coordinated with installation of other utilities or improvements to switches
C.6. Risks, Assumptions and Unknowns	☐	No change	●	Low risk due to unknown conditions; High degree of ability to mitigate unknown risks due to need for alternative to be decided upon as part of an overall program before implementation
D. Environmental Impacts and Approvals				
D.1. Environmental Impacts and Project Classification	☐	No change	●	No potential for environmental impacts or adverse effects; high likelihood of categorical exclusion; no schedule or implementation risk due to NEPA
D.2. Historic Impacts and Approvals	☐	No change	●	Equipment being considered would be placed in a cabinet on a platform and would be directly related to station functioning; No issues of potential concern to review agencies with respect to historical review and approval; no risk to schedule due to historical impact
D.3. Decision Making and Approvals	☐	Agreement to continue current operations procedures beyond 2035 will be required from Amtrak, BNSF, UP, FRA, and PTRR	◆	Key stakeholder approvals include Amtrak, BNSF, UP, FRA, and PTRR and will be required to move forward; Medium to High likelihood of delay to schedule due to required approvals from stakeholders; High likelihood of schedule delays due to need to develop agreed-upon operating procedures with all stakeholders

Source: HDR. 2016.

6.1.13. Reconfigure Drip Pans

This proposed improvement would replace the existing drip pan system to accommodate the future 2035 train berthing locations, install a new oil water separator for the improved lines, and replace the existing piping as needed to account for the removal of the stormwater feeds from the existing platform canopies into the drip pan system (Figure 6.1.3-11).

Two options were evaluated for reconfiguring the drip pans:

- The No-Build option would leave the existing pans in place with no modifications; and,
- The build option would replace the existing drip pan system and locate the pans to correspond to the berthing locations.

The results of the evaluation of the two options are summarized in Table 6.1.3-11.

6.1.13.1 Conceptual Scope

The following are the key conceptual scope elements for the proposed improvements:

- Replace existing piping
- Install new oil water separator
- Other improvements noted in Figure 6.1.3-11

6.1.13.2 Recommendation

The project team recommends replacing the drip pan system. Connection of the platform canopy drainage into the track drip pan system is not good practice, as the pollution control system was not designed to accept that stormwater. This is unnecessary treatment of canopy runoff, and increases the maintenance needs for the oil water separators. Furthermore, as 2035 train volumes are implemented, replacement of the drip pan system will be required.

Figure 6.1.3-11. Reconfigure Drip Pans Improvements

Source: HDR. 2016.

Table 6.1.3-11. Evaluation of Drip Pans Improvements Alternatives

Evaluation Criteria	A	No-Build / Use Existing Drip Pans	B	Reconfigure Drip Pans
A: Ability to Meet Project Goals				
A.1. Accommodate Future Capacity and Operational Needs of Passenger and Freight Rail	◆	Drip pans must be located under fueling locomotives; if drip pans are not adjusted to match future train berthing locations (based on future train volumes), a waiver from the regulating authority will be required; this may be difficult to obtain. Some of the existing platform canopies drain into the track pan system, which is not good practice	●	Revising the drip pan locations will be required in order to accommodate new train berthing locations based on future train volumes; revisions will accommodate Amtrak operational needs; no impact to freight movement
A.2. Preserve and Protect the Historic Character of Union Station	□	No change	□	No impact to historical features
A.3. Improve Economic and Social Vitality	◆	Drip pans must be located under fueling locomotives; if drip pans are not adjusted to match future train berthing locations (based on future train volumes), a waiver from the regulating authority will be required; this may be difficult to obtain, potentially limiting the desire to increase passenger train volumes	●	Adjusting the drip pans to future train berthing locations will enable increased passenger train volumes at the station, increasing the economic and social viability of the station; no impact on leased spaces within building
A.4. Improve Environmental Sustainability	◆	Drip pans must be located under fueling locomotives; if drip pans are not adjusted to match future train berthing locations (based on future train volumes), a waiver from the regulating authority will be required; this may be difficult to obtain, potentially limiting the desire to increase passenger train volumes.	●	Reconfiguring drip pans will reduce the potential for fuel spills, improving stormwater quality and reducing the potential for contamination. Adjusting the drip pans to future train berthing locations will enable increased passenger train volumes, increasing the mode share for passenger rail along the I-5 corridor and thereby reducing emissions
B. Cost and Financing				
B.1. Estimated Capital Cost	□	No change	●	Reconfiguring drip pans has a low capital cost with respect to other track alternatives
B.2. Lifecycle Cost Impacts	□	No change	●	No significant lifecycle cost impact
B.3. Cost Risk	◆	Not reconfiguring the drip pans could lead to increased fines and cleanup costs in the event of a spill	□	Low cost risk associated with underground work
B.4. Financial Leverage	□	Not applicable to rail improvements	□	Not applicable to rail improvements
C. Implementability and Constructability				

Evaluation Criteria	A	No-Build / Use Existing Drip Pans	B	Reconfigure Drip Pans
C.1. Technical Complexity and Constructability	□	No change	●	Low technical complexity
C.2. Schedule and Schedule Risk	□	No change	●	Low schedule risk
C.3. Construction Impact on Passenger and Freight Rail Operations	□	No change	●	Low degree of disruption to passenger operations during construction when compared with other track alternatives; No freight impacts
C.4. Construction Impact on Union Station Tenants	□	No change	●	Low impact on tenants at Union Station during construction; Low potential for noise to impact tenants - construction schedule would be relatively quick
C.5. Phasing and Project Segmentation	□	No change	●	Ability to phase work to reduce cost is low to none; Work can be phased independent of other alternatives; Strong chance of gaining efficiency by staging work with other alternatives, especially with Improvements to Existing Trackwork
C.6. Risks, Assumptions and Unknowns	□	No change	□	Medium risk due to unknown conditions of working underground; Medium risk due to required interface with existing oil water separator; No risk to damage to historic features; High ability to mitigate risk by investigation during preliminary engineering
D. Environmental Impacts and Approvals				
D.1. Environmental Impacts and Project Classification	◆	Medium risk due to potential for fuel spill due to not relocating drip pans to accommodate future train berthing locations; Medium risk that not implementing drip pan reconfiguration will lead to difficulty in approvals from local DEQ	●	Low potential for environmental impacts or adverse effects; High likelihood of categorical exclusion; Low schedule and implementation risk due to NEPA process
D.2. Historic Impacts and Approvals	□	No change	□	No impacts to historic features; No risk to approvals process due to historic features
D.3. Decision Making and Approvals	◆	Medium risk that not implementing alternative could lead to difficulty in obtaining permits; Local DEQ and permitting process may require alternative to be implemented; Medium risk to feasibility of not implementing due to local DEQ permitting	●	Alternative will make it easier to get approvals from local DEQ; Permitting may require alternative to be undertaken; Implementing alternative could make permitting process faster, improving schedule risk

Source: HDR. 2016.

6.1.14. Provide 480V Locomotive Power

This proposed improvement would replace the existing 480V power supply feeds for idling locomotives with new feeds in underground ducts, leading to power stanchions within the yard (Figure 6.1.3-12). Stanchions would be located at berthing locations coordinated with anticipated 2035 passenger train volumes, consists, and lengths. The conceptual design considers placement of electrical ducts beneath new, 15-inch high platforms.

Two options were evaluated for reconfiguring the drip pans:

- The No-Build option would leave the existing system in place with no modifications; and,
- The build option would replace the entire 480V system.

The results of the evaluation of the two options are summarized in Table 6.1.3-12.

6.1.14.1 Conceptual Scope

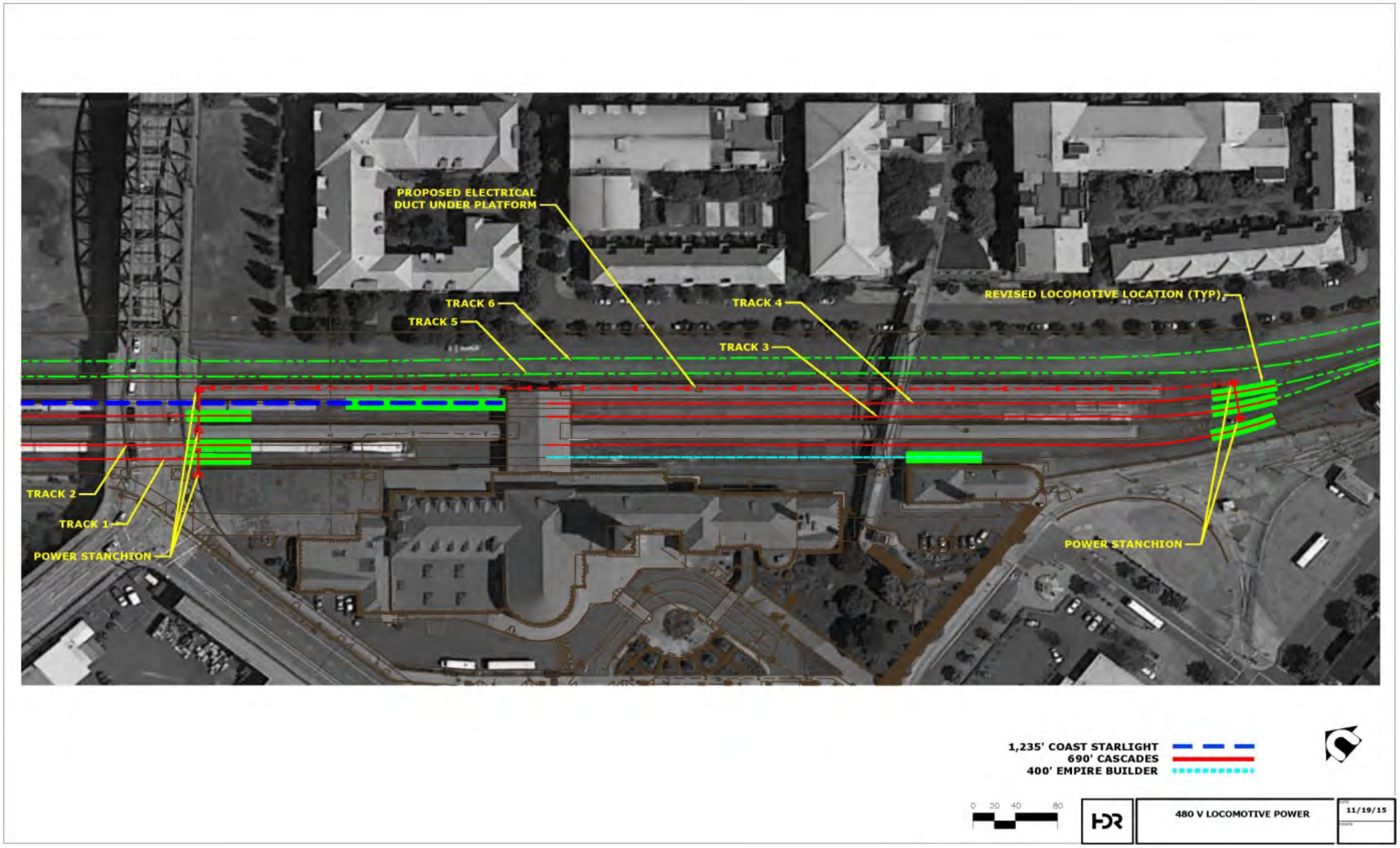
The following are the key conceptual scope elements for the proposed improvements:

- Construct new electrical ductbank under platform
- Install new power stanchions within yard

6.1.14.2 Recommendation

The project team recommends constructing a new 480V Locomotive Power to accommodate the anticipated 2035 passenger volumes.

Figure 6.1.3-12. Provide 480V Locomotive Power



Source: HDR. 2016.

Table 6.1.3-12. Evaluation of Alternatives to Provide 480V Locomotive Power

Evaluation Criteria	A	No-Build / Do Not Reconfigure 480V Power	B	Reconfigure 480V Locomotive Power
A: Ability to Meet Project Goals				
A.1. Accommodate Future Capacity and Operational Needs of Passenger and Freight Rail	◆	If berthing locations are revised to accommodate future capacity the existing locomotive power will not be located at locomotives.	●	If berthing locations are revised to accommodate future capacity, reconfiguration of locomotive power will meet operating needs of Amtrak
A.2. Preserve and Protect the Historic Character of Union Station	□	No change	□	No change
A.3. Improve Economic and Social Vitality	◆	If locomotive power is not provided to future berthing locations, future capacity will be limited, reducing the effectiveness of the station	●	Increasing the rail capacity of the station increases the economic and social vitality of the neighborhood as a whole; reconfiguration of the locomotive power enables this increased capacity
A.4. Improve Environmental Sustainability	◆	If locomotive power is not provided to future berthing locations, future capacity will be limited, reducing the effectiveness of the station	●	Reconfiguring locomotive power increases the rail capacity of the station, which will help in reducing transportation emissions along the I-5 corridor
B. Cost and Financing				
B.1. Estimated Capital Cost	□	No change	●	Relatively low capital cost relative to other trackwork improvements
B.2. Lifecycle Cost Impacts	◆	If locomotive power is not distributed to future berthing locations, it may be that Amtrak will need to move trains around the station in order to store them before the next trip. This would increase operating costs for Amtrak	●	Low to no operating and maintenance costs
B.3. Cost Risk	□	No change	◆	Contaminated soil or other unknowns from excavating the site could increase cost unexpectedly.
B.4. Financial Leverage	□	Not applicable to rail improvements	□	Not applicable to rail improvements
C. Implementability and Constructability				
C.1. Technical Complexity and Constructability	□	No change	□	Installation of underground utilities throughout storage yard while maintaining passenger service will require a detailed staging plan; relatively low time to construct compared to other track alternatives
C.2. Schedule and Schedule Risk	□	No change	◆	Design schedule risk due to need to define exactly where trains will berth in future; Relatively low schedule risk due to permitting - no change in existing site uses; construction schedule risk due to uncertainties with underground work
C.3. Construction Impact on Passenger and Freight	□	No change	◆	Probable use of utility corridor within reconstructed platforms, which would be a large impact to passenger operations; If combined with

Evaluation Criteria	A	No-Build / Do Not Reconfigure 480V Power	B	Reconfigure 480V Locomotive Power
Rail Operations				platform reconstruction, will be a relatively short component of a longer construction time for platforms; Passenger operations will need to be staged to minimize impacts; Construction must be staged so some tracks remain in operation at all times; Track 5 (freight) must remain open at all times or be provide a shoo-fly track
C.4. Construction Impact on Union Station Tenants	□	No change	□	Low to medium risk of construction noise within yard impacting tenants
C.5. Phasing and Project Segmentation	□	No change	◆	Low ability to phase independent of other track alternatives: recommended to be included as part of utility corridor within new platforms; possible to construct outside of utility corridor in platforms but would impact rail operations more. High cost efficiency if included as part of utility corridor under new platforms
C.6. Risks, Assumptions and Unknowns	□	No change	◆	Medium to high risk of unknown conditions due to underground work; Currently assumed to be within utility duct under new platform; Low ability to mitigate risks due to underground work
D. Environmental Impacts and Approvals				
D.1. Environmental Impacts and Project Classification	□	No change	●	No significant environmental impact; high likelihood of categorical exclusion; minimal risk for NEPA schedule increases
D.2. Historic Impacts and Approvals	□	No change	●	No issues of potential concern to review agencies; no risk associated with historic review
D.3. Decision Making and Approvals	□	No change	◆	High risk of schedule delay due to need for Amtrak to determine final locations of power connections, which could require the train length to be standardized

Source: HDR. 2016.

6.1.15. Stormwater and Sewer System Improvements

This proposed improvement would rehabilitate and/or replace certain elements of the stormwater and sewer system identified as deficient in the Site Utilities Report (HDR, 2015) (Figure 6.1.3-13). This analysis only considers improvements outside the envelope of the existing structures; improvements within the building are covered in Chapter 5 (Buildings Improvements Considered) of this Alternatives Considered report.

Two options were evaluated for stormwater and sewer improvements:

- The No-Build option would leave the existing system in place with no modifications, ongoing maintenance would be necessary; and,
- The build option would implement identified stormwater and sewer system improvements.

The results of the evaluation of the two options are summarized in Table 6.1.3-13.

The scope and estimate for inspecting, cleaning, and connecting the canopy downspouts assumes the presence of the existing canopies. If the canopies are replaced, the estimate will need to be revised to accommodate any changes to the number and/or location of downspouts. Also, the estimate and scope do not take into account the possible addition of a grey water cistern. The addition of a cistern will require coordination and reassessment of the stormwater system.

6.1.15.1 Conceptual Scope

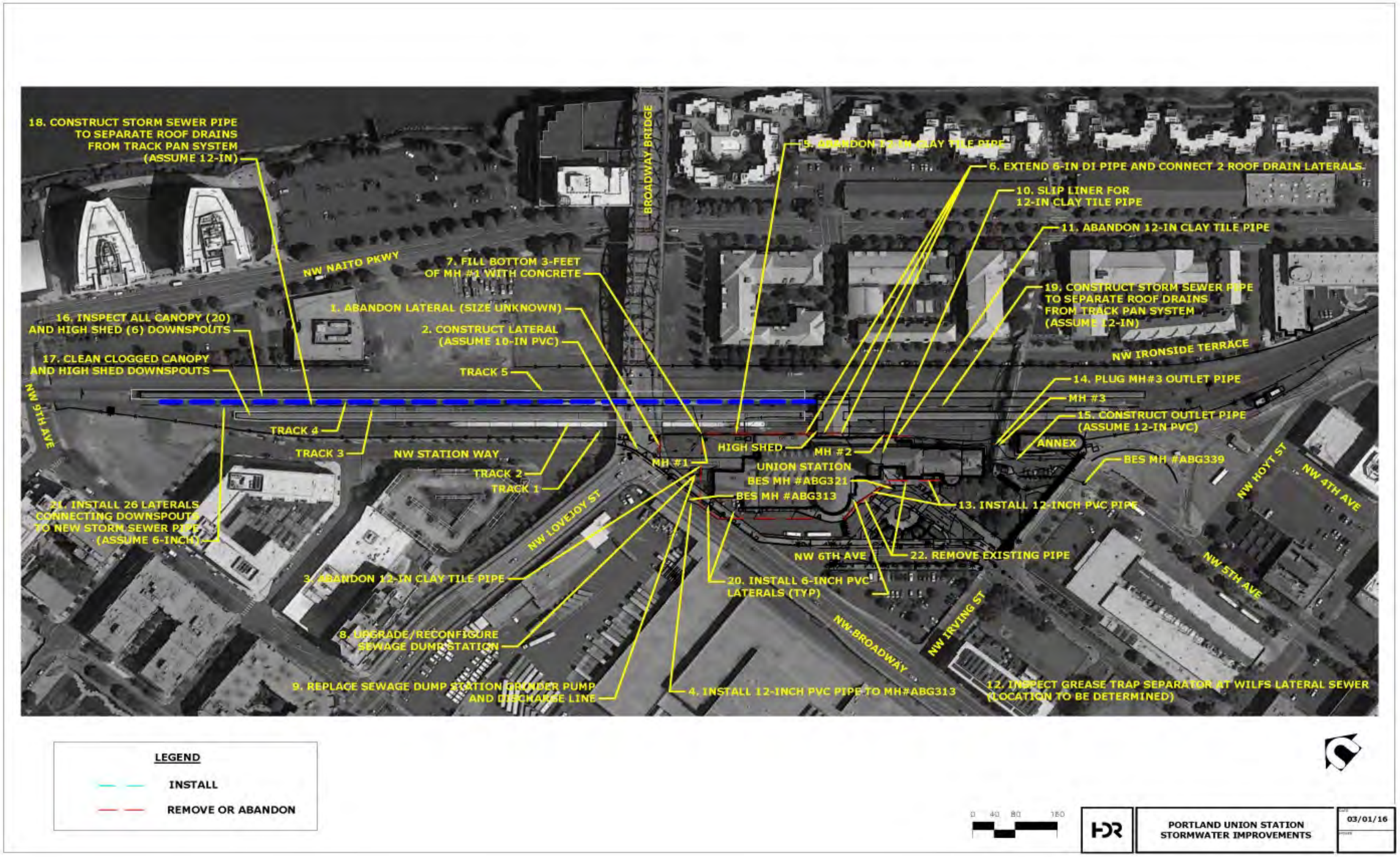
The following are the key conceptual scope elements for the proposed improvements:

- Abandon certain existing pipes
- Replace certain existing pipes
- Install pipe liners in certain pipes
- Inspect and clean canopy downspouts and connect to a new pipe
- Upgrades to sewer dump station, grinder pump and discharge line
- Other improvements noted in Figure 6.1.3-12

6.1.15.2 Recommendation:

The project team recommends constructing the stormwater and sewer system improvements. The existing stormwater system is not adequately sized, includes very old pipes, has been partially removed, is clogged in several places, experiences combined sewage overflows during large storms, and portions connect to the existing track plan system, which was not designed for stormwater flows. The site sees frequent flooding of stormwater into ballast during large rain events, contributing to the soft spots and sink holes seen in the yard in the past.

Figure 6.1.3-13. Stormwater and Sewer Improvements



Source: HDR. 2016.

Table 6.1.3-13. Evaluation of Stormwater and Sewer Improvements Alternatives

Evaluation Criteria	A	No-Build / Do Not Make Any Stormwater & Sewer System Changes	B	Implement Stormwater & Sewer Improvements
A: Ability to Meet Project Goals				
A.1. Accommodate Future Capacity and Operational Needs of Passenger and Freight Rail	□	No change	□	No impact to capacity; Little impact to passenger experience; Little impact to Amtrak operation or design standards; No impact to freight; no impact to safety or security
A.2. Preserve and Protect the Historic Character of Union Station	□	No change	●	No impact to historic character or finishes
A.3. Improve Economic and Social Vitality	◆	High probability that not implementing improvements will result in higher operating costs for maintenance on existing system over time	●	Little to no impact to surrounding neighborhood; Option reduces the chance of surcharge at manholes during rain events, as well as reduces maintenance costs, improving building efficiency and marketability of leased spaces
A.4. Improve Environmental Sustainability	◆	Not implementing option means system will continue to experience surcharge at manholes during rain events, causing raw sewage to flood the surrounding area	●	No impact on LEED certification; No reduction in energy use or consumption; Implementation lessens chance of surcharge at manholes, reducing environmental impacts due to sewage exposure.
B. Cost and Financing				
B.1. Estimated Capital Cost	□	No change	◆	Low to medium capital costs compared to other track alternatives, including rerouting pipes, adjusting elevation of manholes, lining 120+ year old clay pipes, replacing clay pipe laterals, etc.
B.2. Lifecycle Cost Impacts	◆	High probability that not implementing improvements will result in higher operating costs for maintenance on existing system over time	●	High probability in reduction in operating costs by reducing maintenance issues involving clogs and overflowing pipes.
B.3. Cost Risk	◆	If clay pipe under Union Station fails before being lined, repairing it could be much more expensive than lining it.	□	Medium risk of cost uncertainty due to underground work; Risk of design delay if clay-tile pipes are deemed too degraded to line
B.4. Financial Leverage	□	No change	□	Not applicable to rail improvements
C. Implementability and Constructability				
C.1. Technical Complexity and Constructability	◆	Not implementing improvements may prove to be not viable due to occasional manhole surcharges causing sewage overflows on site	◆	Medium risk for design delay due to need to slip line existing clay-tile pipes - pipes may be determined to not be good candidates for slip lining, or could be determined to be too degraded for slip lining; Relatively short construction time frame compared to other track alternatives

Evaluation Criteria	A	No-Build / Do Not Make Any Stormwater & Sewer System Changes	B	Implement Stormwater & Sewer Improvements
C.2. Schedule and Schedule Risk	◆	Due to occasional manhole surcharge causing sewage overflows, project may not be permissible without correcting this issue	□	Relatively short timeframe for design and approvals due to relatively small extent of work; High risk of delays during construction due to unforeseen conditions underground
C.3. Construction Impact on Passenger and Freight Rail Operations	□	No change	◆	Medium probability of staged track closure due to construction near building and reconnection of canopy downspouts; High probability of impacts to passenger operations near building entrance/exit to yard - detailed staging plans will be required; High probability of reduction in trackside capacity (Track 1) during construction
C.4. Construction Impact on Union Station Tenants	□	No change	◆	High potential for displacement of tenants to reroute laterals to internal site drains; High probability of construction noise expected
C.5. Phasing and Project Segmentation	□	No change	□	Medium to high ability to phase work to spread costs, performing work within track area at separate time from work near building; High ability to accomplish work independent of other improvements; Cost and schedule efficiencies available through staging work with other underground track options (i.e.: water improvements)
C.6. Risks, Assumptions and Unknowns	◆	Not implementing stormwater improvements assumes that existing pipes, including original clay-lined pipes, will not fail; No implementation assumes project will be able to obtain permits for other work without improvements to system; Risks can be mitigated by implementing improvements	◆	High probability of contaminated soils being exposed due to underground construction; Medium to High probability of encountering unforeseen conditions, including unknown existing utilities, during construction; Low to no risk to historic features; Low ability to minimize underground risk of contaminated materials
D. Environmental Impacts and Approvals				
D.1. Environmental Impacts and Project Classification	◆	The existing system experiences surcharge at manhole MH-2 during rain events, causing raw sewage spills in the area; The existing downspouts from canopies and sheds are disconnected, leading to poor drainage in track areas, which degrades track	●	Lessens chance of surcharge at manholes, reducing environmental impacts due to sewage exposure; High likelihood of categorical exclusion; Low to no risk due to NEPA process
D.2. Historic Impacts and Approvals	□	No change	●	No issues of concern to historic review agencies
D.3. Decision Making and Approvals	◆	Due to occasional manhole surcharge causing sewage overflows at MH-2, project may not be permissible without correcting this issue	●	Low risk of delay due to need for approval of stormwater management plan and permits from City; Permits needed from City include Site Development Plan, Erosion Control Plan, and stormwater management report

Source: HDR. 2016.

6.1.16. Water System Improvements

This proposed improvement would replace, rehabilitate, and upgrade the existing potable water delivery system within the yard and station area, and new sprinkler supply lines to the annex and main terminal buildings (Figure 6.1.3-14).

This option does not consider any water or Fire / Life Safety improvements within either of the buildings on site (the main terminal or annex); however, it does consider service stubs to each building for sprinklers and water service.

Two options were evaluated for stormwater and sewer improvements:

- The No-Build option would leave the existing system in place with no modifications; and,
- The build option would implement identified water system improvements.

The results of the evaluation of the two options are summarized in Table 6.1.3-14.

6.1.16.1 Conceptual Scope

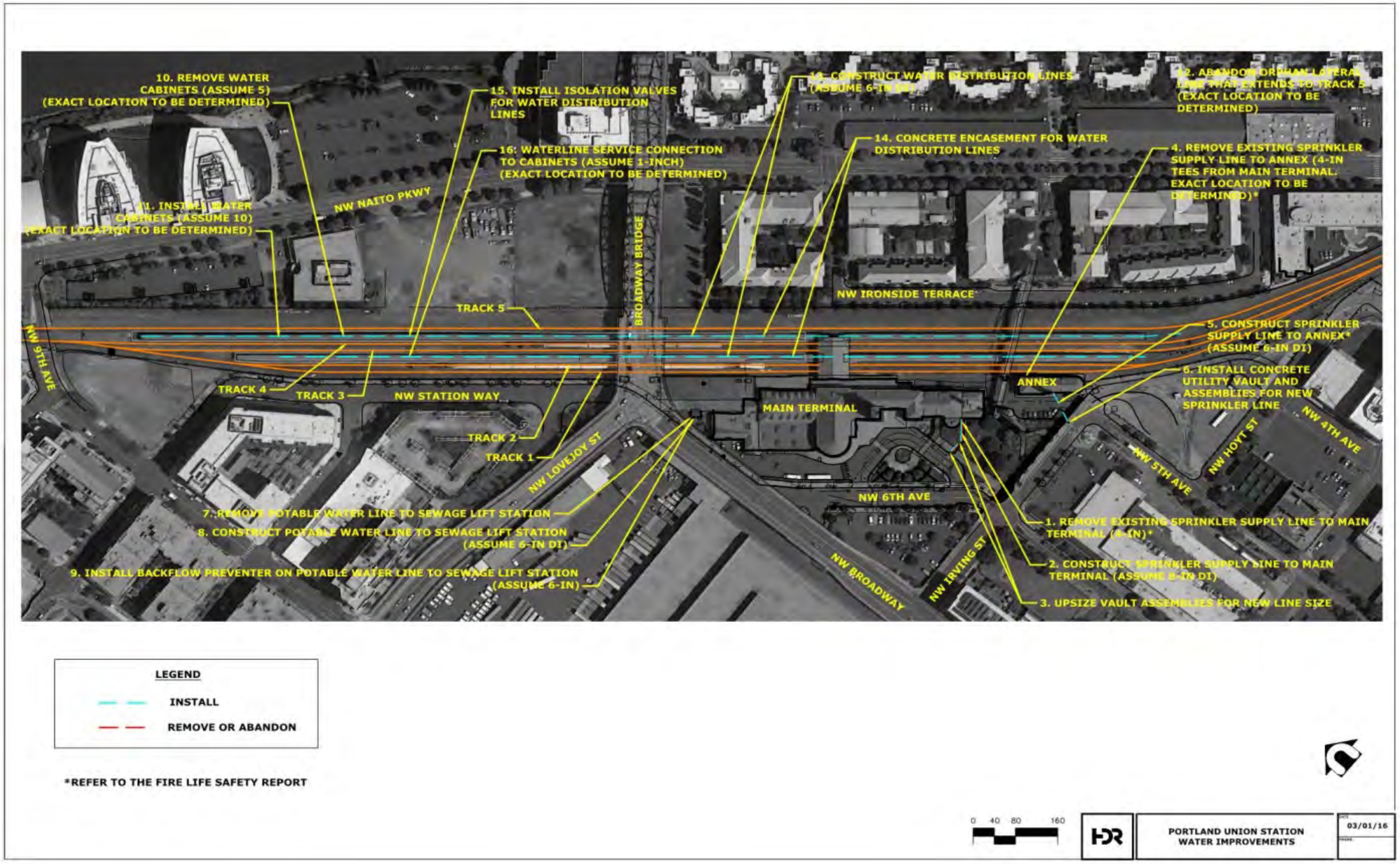
The following are the key conceptual scope elements for the proposed improvements:

- Install new water cabinets on platforms
- Install supply piping and valve fixtures for new water cabinets
- Removal and replacement of some existing water lines
- Concrete encasement for some water lines
- Other noted improvements in Figure 6.1.3-14

6.1.16.2 Recommendation

The project team recommends constructing the water system improvements to accommodate the anticipated 2035 passenger volumes, and/or prior to new platform construction.

Figure 6.1.3-14. Water System Improvements



Source: HDR. 2016.

Table 6.1.3-14. Evaluation of Water System Improvements Alternatives

Evaluation Criteria	A	No-Build / Do Not Implement Water System Improvements	B	Implement Water System Improvements
A: Ability to Meet Project Goals				
A.1. Accommodate Future Capacity and Operational Needs of Passenger and Freight Rail	◆	If berthing layout is modified to accommodate future rail capacity, current potable water cabinets will not be in the proper location to service trains	●	Implementation will meet operating needs of Amtrak; no impact to passengers; Implementation will meet design and operating standards of Amtrak; no impact to freight; no impact to seismic or security; Implementation will separate potable from non-potable sources, improving public health
A.2. Preserve and Protect the Historic Character of Union Station	□	No change	●	No impact to historic features or finishes
A.3. Improve Economic and Social Vitality	□	No change	□	No impact to economic viability of neighborhood; No improvement to building management or operation
A.4. Improve Environmental Sustainability	□	No change	□	No impact to LEED certification; No reduction in water or energy consumption; No impact to greenhouse gas emissions; No impact to stormwater
B. Cost and Financing				
B.1. Estimated Capital Cost	□	No change	◆	Low to medium cost relative to other track alternatives; Capital costs include new potable water system, RV dump station redesign to bring up to code
B.2. Lifecycle Cost Impacts	□	No change	●	No significant lifecycle cost impacts
B.3. Cost Risk	□	No change	◆	Low to medium cost risk due to unforeseen conditions underground
B.4. Financial Leverage	□	No change	□	Not applicable to rail improvements
C. Implementability and Constructability				
C.1. Technical Complexity and Constructability	□	No change	□	Low technical complexity using standard designs and materials; Medium construction timeframe relative to other track alternatives due to staging requirements with respect to passengers and platforms
C.2. Schedule and Schedule Risk	□	No change	◆	Relatively low time frame for design and approvals; Medium risk of delay during construction due to need to have train length and berthing locations defined and agreed upon by Amtrak, WSDOT, and ODOT
C.3. Construction Impact on Passenger and Freight Rail Operations	□	No change	◆	High degree of disruption to rail operations and passengers expected during construction due to utility placement within platform - detailed staging plans will be required; High probability of reduction in trackside capacity during construction; no impacts to freight rail

Evaluation Criteria	A	No-Build / Do Not Implement Water System Improvements	B	Implement Water System Improvements
C.4. Construction Impact on Union Station Tenants	☐	No change	●	No significant impact on tenants; Low construction noise expected since work will be in train yard
C.5. Phasing and Project Segmentation	☐	No change	●	High ability to phase work to spread costs; High ability to accomplish work independent of other track alternatives; Definite cost and schedule efficiencies available if coordinated with other utility, platform, and canopy work
C.6. Risks, Assumptions and Unknowns	◆	The existing system includes potable and non-potable water systems not appropriately separated, increasing risk of contamination of potable water - continued use of system may not be permitted	◆	High likelihood of unforeseen conditions due to underground work, including unknown utilities and contaminated soil; Little to no risk of damage to historic features; Little ability to minimize risk of unforeseen conditions due to underground work
D. Environmental Impacts and Approvals				
D.1. Environmental Impacts and Project Classification	☐	No change	●	No significant environmental impact; high likelihood for categorical exclusion; Low to no risk for delay due to NEPA process
D.2. Historic Impacts and Approvals	☐	No change	☐	No issues of concern to historic review agencies
D.3. Decision Making and Approvals	◆	The existing system includes potable and non-potable water systems not appropriately separated, increasing risk of contamination of potable water - continued use of system may not be permitted	◆	Final water cabinet locations will depend on agreement between Amtrak, ODOT, WSDOT on design train length for Cascades service - agreement could be difficult to achieve and could delay design schedule; little to no permitting or regulatory requirements from City or State

Source: HDR. 2016.

6.1.17. Electrical System Improvements

This proposed improvement would replace the existing electrical ductbank on the north end of the terminal with a new line to a new electrical vault located north of the terminal (Figure 6.1.3-15). The existing line would be abandoned in place.

Two options were evaluated for stormwater and sewer improvements:

- The No-Build option would leave the existing system in place with no modifications; and,
- The build option would replace the existing electrical system line and vault.

The results of the evaluation of the two options are summarized in Table 6.1.3-15.

6.1.17.1 Conceptual Scope

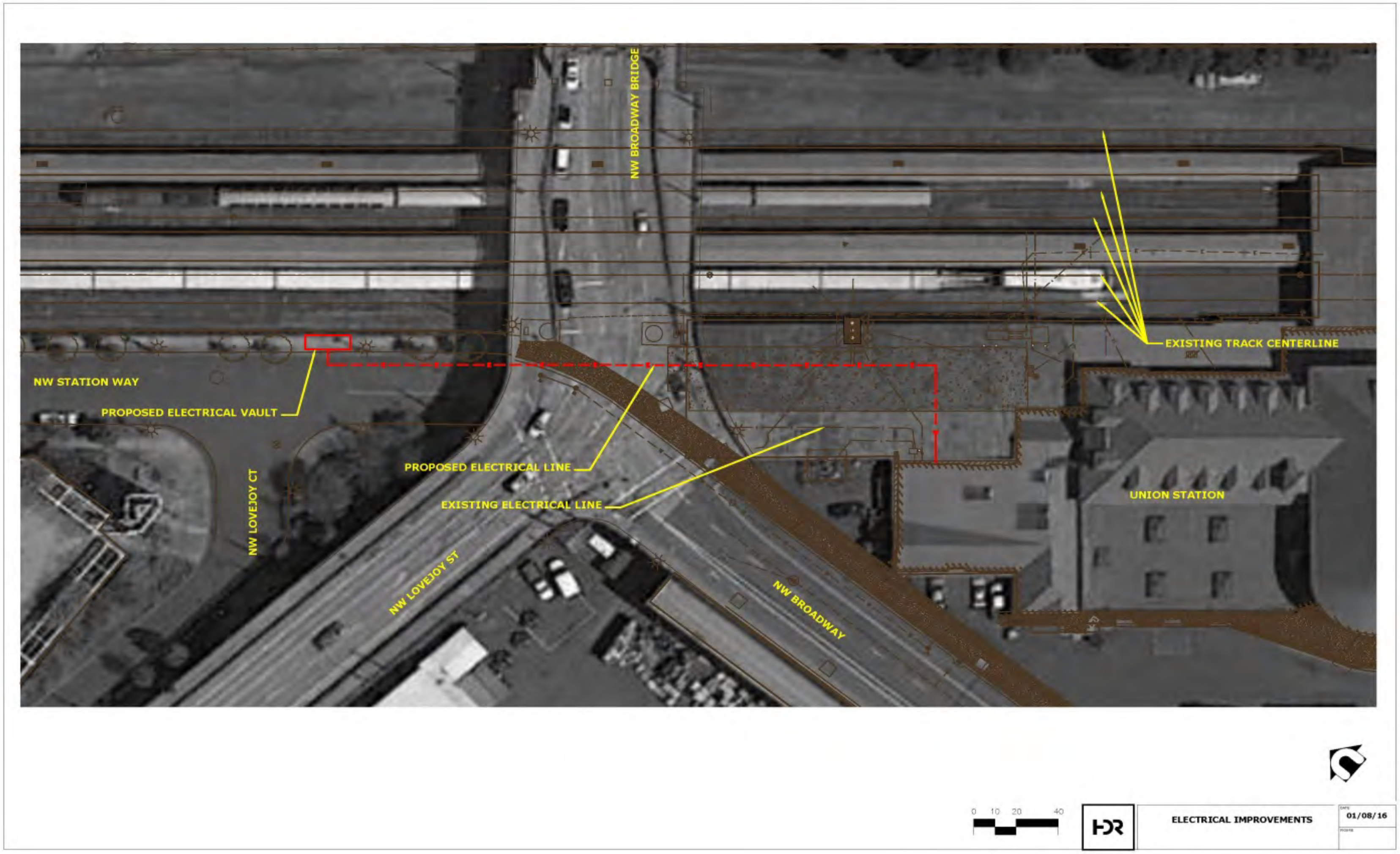
The following are the key conceptual scope elements for the proposed improvements:

- Construct new electrical feed and new vault
- Abandon existing electrical feed

6.1.17.2 Recommendation

The project team recommends constructing the electrical system improvements to accommodate the anticipated 2035 passenger volumes, and/or prior to new platform construction.

Figure 6.1.3-15. Electrical System Improvements



Source: HDR. 2016.

Table 6.1.3-15. Evaluation of Electrical System Improvements Alternatives

Evaluation Criteria	A	No-Build / Do Not Implement Electrical System Improvements	B	Implement Electrical System Improvements
A: Ability to Meet Project Goals				
A.1. Accommodate Future Capacity and Operational Needs of Passenger and Freight Rail	◆	Not implementing could mean that the existing service will be unreliable and not able to support the increased loads that the 2035 passenger train volumes will call for	□	Implementation will allow for the 2035 passenger train volumes by providing improved reliability and the needed capacity for increased train idling; no impact to passenger experience; Abandonment and replacement will mean the terminal and yard feed no longer originate or cross PTRR property; no impact to safety or security
A.2. Preserve and Protect the Historic Character of Union Station	□	No change	●	No impact to historic character, materials or finishes
A.3. Improve Economic and Social Vitality	◆	Not implementing could mean that the existing service will be unreliable and not able to support the increased loads that the 2035 passenger train volumes will call for, restricting the potential improvements to the economic vitality of the neighborhood	●	Implementation will support the desired increase in passenger train volumes, improving economic vitality of the neighborhood; No impact to marketability of leased spaces; no impact to building efficiency
A.4. Improve Environmental Sustainability	◆	Not implementing could mean that the existing service will be unreliable and not able to support the increased loads that the 2035 passenger train volumes will call for, restricting the potential to reduce emissions on the I-5 corridor	●	No impact to LEED rating; No reduction in energy consumption; Implementation will support the desired increase in passenger train volumes to 2035 levels, increasing the mode share of passenger rail on the I-5 corridor and reducing emission; No improvement to stormwater
B. Cost and Financing				
B.1. Estimated Capital Cost	□	No change	□	Low to medium capital cost relative to other track alternatives
B.2. Lifecycle Cost Impacts	□	No change	□	No significant lifecycle cost impacts
B.3. Cost Risk	□	No change	◆	Low to medium risk of cost uncertainty due to underground work
B.4. Financial Leverage	□	Not applicable to rail improvements	□	Not applicable to rail improvements
C. Implementability and Constructability				
C.1. Technical Complexity and Constructability	□	No change	●	Low risk of delay due to complexity - expect to use standard methods and materials; Low construction timeframe relative to other track alternatives
C.2. Schedule and Schedule Risk	□	No change	□	Low risk to delay due to approvals and permitting - expect to use standard methods and materials; Medium risk of delay due to unforeseen conditions related to underground work

Evaluation Criteria	A	No-Build / Do Not Implement Electrical System Improvements	B	Implement Electrical System Improvements
C.3. Construction Impact on Passenger and Freight Rail Operations	☐	No change	◆	Medium potential for disruption to rail operations due to potential for work underneath tracks; Little disruption to passengers expected; Potential for freight impacts due to work under tracks
C.4. Construction Impact on Union Station Tenants	☐	No change	●	Little impact to union station tenants; Low degree of noise to tenants due to construction in yard
C.5. Phasing and Project Segmentation	☐	No change	●	High ability to phase work related to other track alternatives; High ability to accomplish work independent of other track improvements; Medium potential for efficiencies for coordinating with other work - may be able to take advantage of staging of other underground work in yard
C.6. Risks, Assumptions and Unknowns	☐	No change	◆	High likelihood of risk of unforeseen conditions due to underground work; Design assumes vault placement will be possible in existing sidewalk; No risk of damage to existing historic features; Little ability to minimize risk of unforeseen conditions underground
D. Environmental Impacts and Approvals				
D.1. Environmental Impacts and Project Classification	☐	No change	●	No potential for environmental impacts; High likelihood of categorical exclusion; no risk to schedule due to NEPA process
D.2. Historic Impacts and Approvals	☐	No change	●	No issues of concern for historic review
D.3. Decision Making and Approvals	☐	No change	◆	Permit from City would be required for placing vault in sidewalk; Permitting from PGE required; Little risk to schedule due to permitting - concept uses standard materials and methods

Source: HDR. 2016.

6.1.18. Telephone and Voice System Improvements

This proposed improvement would install a new data and telecommunications line into the main terminal building from the existing vault on NW Irving Street (Figure 6.1.3-16). The design and estimate for this do not consider any improvements within either the main terminal building or the annex.

Two options were evaluated for stormwater and sewer improvements:

- The No-Build option would leave the existing system in place with no modifications; and,
- The build option would construct the proposed data and telecommunications improvements.

The results of the evaluation of the two options are summarized in Table 6.1.3-16.

6.1.18.1 Conceptual Scope

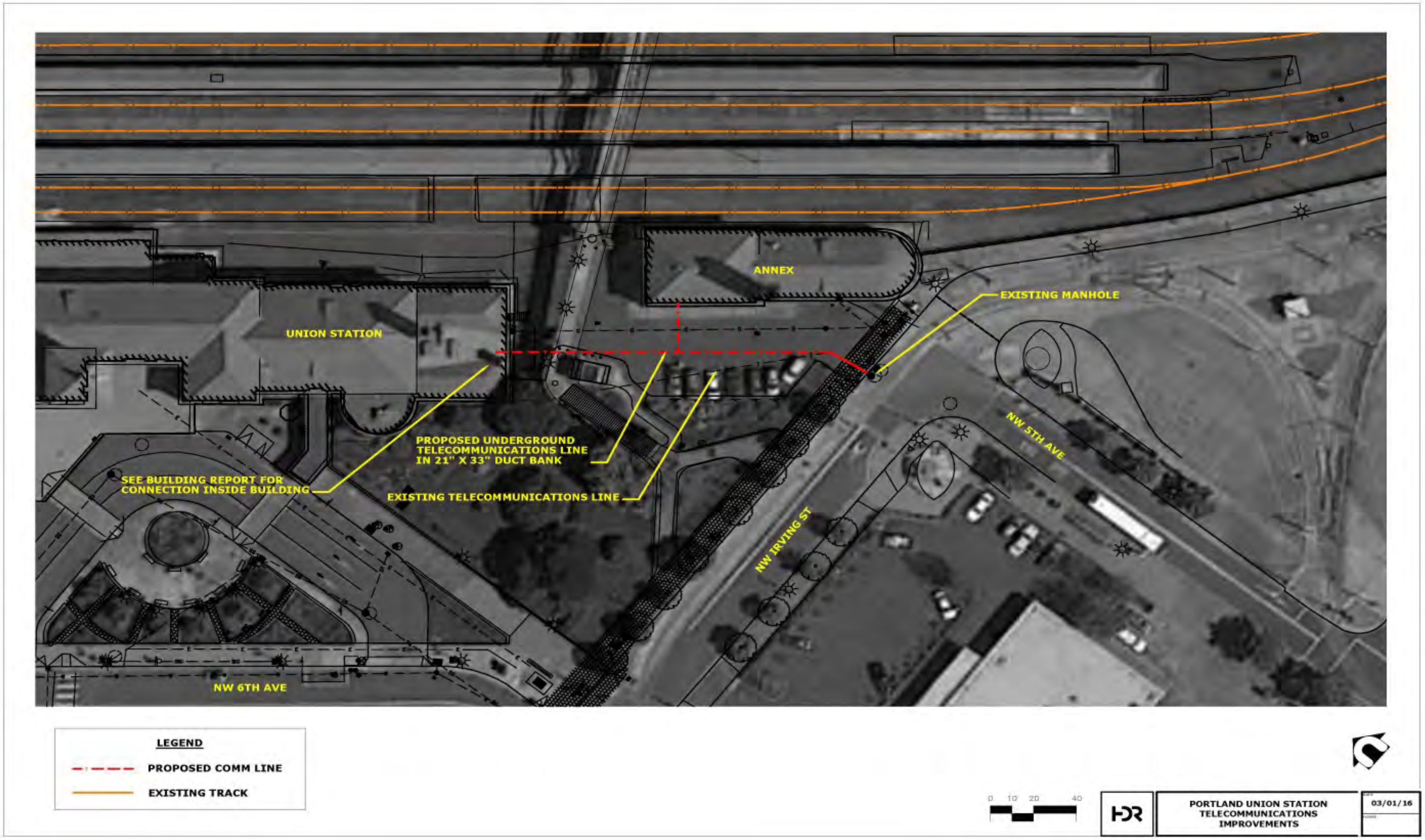
The following are the key conceptual scope elements for the proposed improvements:

- Install telecommunications ductbank

6.1.18.2 Recommendation

The project team recommends installing the proposed telecommunications and data ductbank to support modern business needs within the main terminal and annex building, as well as to support the installation of on-site yard control.

Figure 6.1.3-16. Telephone and Voice System Improvements



Source: HDR. 2016.

Table 6.1.3-16. Evaluation of Telephone and Voice System Improvements Alternatives

Evaluation Criteria	A	No-Build / Do Not Implement Telecom and Data Improvements	B	Implement Telecom and Data Improvements
A: Ability to Meet Project Goals				
A.1. Accommodate Future Capacity and Operational Needs of Passenger and Freight Rail	☐	No change	☐	Depending on communications use, improvement could be used to enhance site security
A.2. Preserve and Protect the Historic Character of Union Station	☐	No change	☐	No change
A.3. Improve Economic and Social Vitality	◆	Decision to not implement could lead to less desirability for leased space due to limited or out dated communications	●	Implementation will improve marketability of leased tenant space
A.4. Improve Environmental Sustainability	☐	No change	☐	No change
B. Cost and Financing				
B.1. Estimated Capital Cost	☐	No change	●	Low order-of-magnitude capital cost compared to other track alternatives
B.2. Lifecycle Cost Impacts	☐	No change	☐	No impact to operations or maintenance cost
B.3. Cost Risk	☐	No change	◆	Medium to high risk of cost uncertainty due to underground work
B.4. Financial Leverage	☐	Not applicable to rail improvements	☐	Not applicable to rail improvements
C. Implementability and Constructability				
C.1. Technical Complexity and Constructability	☐	No change	●	Low level of technical complexity - standard materials and methods expected; Relatively short timeframe compared to other track alternatives
C.2. Schedule and Schedule Risk	☐	No change	◆	Low risk of delay due to approvals and permitting; Medium to high risk of delay due to unforeseen conditions underground
C.3. Construction Impact on Passenger and Freight Rail Operations	☐	No change	●	Low to no impact to rail operations; Low to no impacts to passengers; no reduction in trackside capacity; no freight impacts
C.4. Construction Impact on Union Station Tenants	☐	No change	●	Low impact to tenants based on construction noise outside building
C.5. Phasing and Project Segmentation	☐	No change	●	High ability to phase work independently of other utility alternatives; High ability to accomplish work independent of other alternatives; High likelihood of efficiency through combination with other underground work

Evaluation Criteria	A	No-Build / Do Not Implement Telecom and Data Improvements	B	Implement Telecom and Data Improvements
C.6. Risks, Assumptions and Unknowns	☐	No change	☐	Medium to high risk of unknown conditions due to underground work; no critical assumptions; low risk of damage to historic features; low ability to mitigate risk of underground work
D. Environmental Impacts and Approvals				
D.1. Environmental Impacts and Project Classification	☐	No change	●	No potential adverse effects; High likelihood for categorical exclusion; No risk to schedule due to NEPA process
D.2. Historic Impacts and Approvals	☐	No change	●	No issues of potential concern to historic review agencies
D.3. Decision Making and Approvals	☐	No change	●	No key stakeholder decisions required; No permitting/regulatory requirements anticipated

Source: HDR. 2016.

6.1.19. Compressed Air System Improvements

This proposed improvement would reconfigure the compressed air system within the yard to accommodate the 2035 passenger train schedule, and resulting berthing locations for the trains.

The new compressed air piping is assumed to run within a utility ductbank in the new, 15" high platforms; however, replacement of the platforms is not required for the installation of the new air system; the piping could be run within the yard (Figure 6.1.3-17).

Two options were evaluated for stormwater and sewer improvements:

- The No-Build option would leave the existing system in place with no modifications; and,
- The build option would implement the identified compressed air system improvements.

The results of the evaluation of the two options are summarized in Table 6.1.3-17.

6.1.19.1 Conceptual Scope

The following are the key conceptual scope elements for the proposed improvements:

- Install new air piping system
- Install new air stanchions on the platform

6.1.19.2 Recommendation

The project team recommends construct the air system improvements to accommodate the anticipated 2035 passenger volumes, and/or prior to new platform construction.

Figure 6.1.3-17. Compressed Air System Improvements

Source: HDR. 2016.

Table 6.1.3-17. Evaluation of Compressed Air System Improvements Alternatives

Evaluation Criteria	A	No-Build / Use Existing Compressed Air Locations	B	Reconfigure Compressed Air System
A: Ability to Meet Project Goals				
A.1. Accommodate Future Capacity and Operational Needs of Passenger and Freight Rail	◆	Decision to not implement will reduce the ability to increase passenger train volumes in the station to desired 2035 volumes; Not reconfiguring the compressed air system will not meet Amtrak operational or design needs	●	Alternative will enable the desired increase in passenger train volumes to Union Station; No impact to experience of passengers; Alternative will meet Amtrak operational and design standards; No impact to freight; no impact to ADA; No impact to seismic or safety
A.2. Preserve and Protect the Historic Character of Union Station	□	No change	□	No impact to historic character of station; no impact to historic finishes
A.3. Improve Economic and Social Vitality	◆	Decision to not implement will reduce the ability of Amtrak/ODOT/WSDOT to increase passenger train volumes in the station, reducing the ability to increase the economic viability of the neighborhood as well as the ability to increase the marketability of the station leased spaces	●	Alternative will enable the desired increase in passenger train volumes to Union Station, increasing the economic vitality of the neighborhood; No impact to existing reusable space; Increased passenger train traffic will increase marketability of Station leased spaces; no impact to building management
A.4. Improve Environmental Sustainability	◆	Decision to not implement will reduce the ability of Amtrak/ODOT/WSDOT to increase passenger train volumes in the station, reducing the ability to increase mode share by rail along the I-5 corridor	●	No impact to LEED certification; No impact to energy use or trash generation; Alternative will enable increase in passenger train volumes, increasing the mode share of passenger rail along the I-5 corridor and reducing emissions; No impact to hazardous materials or stormwater management
B. Cost and Financing				
B.1. Estimated Capital Cost	□	No change	●	Low level of cost relative to other track alternatives
B.2. Lifecycle Cost Impacts	□	No change	●	No lifecycle cost impact for Amtrak
B.3. Cost Risk	□	No change	◆	Medium to high risk to design cost due to need for final train berthing locations based on agreed-upon design train length between Amtrak, ODOT, and WSDOT
B.4. Financial Leverage	□	No change	□	Not applicable to rail improvements
C. Implementability and Constructability				

Evaluation Criteria	A	No-Build / Use Existing Compressed Air Locations	B	Reconfigure Compressed Air System
C.1. Technical Complexity and Constructability	☐	No change	●	Low level of complexity associated with proposed design; Relatively short timeframe for construction relative to other track alternatives
C.2. Schedule and Schedule Risk	☐	No change	◆	Medium to high schedule risk for design of final locations for air connections due to need for agreement on design train length between Amtrak, ODOT and WSDOT; Low risk of delay due to need for underground work
C.3. Construction Impact on Passenger and Freight Rail Operations	☐	No change	☐	Low to medium duration of track closures due to implementation - would require detailed construction staging plans to implement; Low impacts to passenger operations; Low to medium duration for reduction in trackside capacity; No freight rail impacts
C.4. Construction Impact on Union Station Tenants	☐	No change	●	Low level of disruption to Union Station tenants due to relatively short construction duration; Little to no impacts on ability of tenants to conduct business
C.5. Phasing and Project Segmentation	☐	No change	●	High level of ability to phase underground work with other track projects; High ability to phase work independent of other track projects, but efficiencies can be gained by grouping instead; High probability of cost and schedule efficiencies by coordinating with other track options
C.6. Risks, Assumptions and Unknowns	☐	No change	●	Low to medium risk due to need for underground work; Design will require decision regarding train berthing locations and an agreed-upon design train length between Amtrak, ODOT and WSDOT; High ability to minimize risk by coordination between agencies
D. Environmental Impacts and Approvals				
D.1. Environmental Impacts and Project Classification	☐	No change	●	No environmental impacts; High likelihood for categorical exclusion; No risk to schedule or implementation due to NEPA
D.2. Historic Impacts and Approvals	☐	No change	●	Little to no issues of concern for review agencies; No risk associated with historic review; No impacts to process and schedule
D.3. Decision Making and Approvals	☐	No change	☐	Decision to implement will depend on agreement between Amtrak, ODOT, and WSDOT to increase passenger train volumes; Timing of implementation will depend on Amtrak schedule and berthing location updates; Little to no permitting or regulatory requirements

Source: HDR. 2016.

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7. Preliminary Preferred Alternative

The building and rail yard improvements comprising the preliminary preferred alternative recommended by the project team are summarized below.

7.1. Building

The project team's recommended improvements to the Union Station buildings and site are summarized in Table 7.1-1.

Table 7.1-1. Preliminary Preferred Alternative: Building and Site Improvements

Improvement	Project Team Recommendation
Vertical Circulation and Access	The project team recommends implementing Alternative B with the two-elevator configuration with an enclosed stair to the second and third floors (Figure 5.1-2). The two-elevator approach avoids the potential historic impact of the mezzanine connector bridge on the main concourse. The stairway and elevator configuration would be the most compatible with proposed main floor and upper floor improvements in Amtrak and other leasable spaces.
Amtrak Operations and Passenger Concourse	The project team recommends implementing Alternative B, the North Foyer Hallway – Configuration 1 (Figure 5.2-2). Creation of a new north foyer hallway would increase train boarding gate capacity for growth in future passenger rail service, and would minimize circulation and quieting conflicts between arriving and departing passenger flows and queues within the main concourse. The configuration of ticketing, baggage, and restrooms in this alternative would meet Amtrak operational and business objectives, and the orientation of passenger services would be the most conducive for arriving and departing passengers. Consolidation of ticketing / baggage functions would increase Amtrak operational efficiency and passenger convenience and would create opportunities to implement accessibility improvements to the customer service counter.
Ticketing Area	The project team recommends preserving the existing, historic walnut ticketing counter to incorporate it as a feature into a new retail concession such as a café (Figure 5.3-1). A café alternative would provide a new passenger amenity and creates a high-quality amenity in a prominent main concourse location. Preservation of the existing walnut ticket counter and other features would honor the historic use of this area and would add interest and character to the space.
South Concourse	The project team recommends implementing Alternative A, which would expand retail concessions and have shared use seating (Figure 5.3-4). This alternative would improve and enhance the south concourse as an amenity for rail passengers, building tenants, and visitors alike. This alternative envisions flexible seating that can be used both by concession patrons and waiting rail passengers, providing flexible capacity during peak periods. Introduction of new retail concessions activates this area is compatible with providing exhibit space as part of the final space configuration.
First Class Lounge	Amtrak has requested that the First Class Passenger Lounge be retained because of its value to its premium customer base such as sleeper car passengers and business class passengers; therefore, the project team recommends implementing Alterative A (Figure 5.5-1). Should Amtrak direction change, the space could be repurposed to accommodate a tenant or amenity as described in Alternative B.
South Main Floor Leasable Spaces	The project team recommends implementing the core and shell only option (Alternative A).The decision about the highest and best use of this space will depend on future market conditions closer to the completion of construction, which is anticipated to be up to five or more years into the future. During this time, market conditions are expected to evolve significantly in the Broadway Corridor, particularly

	with the potential redevelopment of the nearby U.S. Post Office site and other parcels in the immediate vicinity. The core and shell improvement (Alternative A) would accommodate any of the three re-use scenarios presented in Alternatives B through D. Restaurant and/or retail is the preferred re-use option, consistent with the historic uses of the south end of the building as a restaurant and dining hall, and the historical presence of other public services along the south hallway (e.g. barber shop). The refurbishments of this area of the building would require replacement of the floor structure, potential modifications to the ceiling structure, and seismic retrofits of the interior and exterior walls. Code and accessibility requirements would likely result in modification to the existing configuration of interior spaces. The re-designed south floor leasable spaces would incorporate elements of the historic corridor to the extent practical.
Upper Floor Leasable Spaces	The preferred alternative is to reconfigure leasable spaces to create larger floorplates (Alternative B). With this alternative, PDC will preserve the existing character, footprint, and materials of the existing historic corridors, while creating larger footprint leasable spaces that are more financially viable. In the near term, it is expected that leasable spaces will be rehabilitated to a core and shell level following major structural, systems, and vertical circulation improvements. This will maintain flexibility for tenant fit-out in the future. On a case-by-case basis, historic materials and features of leasable areas (e.g. casework, finishes) will be preserved and/or relocated.
Nursery	The project team recommends removing the nursery building (Alternative B). The nursery building is in poor physical and seismic condition, is currently unused, and cannot be occupied in its current state. Damage due to water and mold has compromised the structure, which risks damaging the main structure. The trackside location behind the Amtrak security control line limits the re-use options and potential future public access to any rehabilitated or reconstructed space. In order to preserve the legacy of the WWII era nursery, an interpretive display of the history of Union Station during WWII in a more public area of Union Station could be considered.
Main Building Seismic Strengthening	The project team recommends implementing reinforced concrete shear walls (Alternative A) because, overall, it would be the most efficient option for strengthening the existing station. Reinforced concrete shear walls would provide the most flexibility in layout and would be the easiest to enclose in architectural features so as to avoid a significant impact on the overall appearance of the station. Reinforced concrete walls also provide the greatest amount of stiffness and would limit the amount of work to brace architectural features. There are some locations in the interior of the building near new stair/elevator cores where the recommended option between a braced frame and a concrete shear wall would be determined during the design process. This decision would consider cost, constructability and space planning based on the final stair/elevator core locations.
Diaphragm Alternatives	The project team recommends adding plywood sheathing above or below the existing floor diaphragm (Alternative A). A horizontal truss would reduce the amount of shear walls to be added to the structure, but would be have a significant impact on the ceiling of the station. The horizontal truss would have to be located below the existing floor diaphragm and is not an option in areas where the ceiling is to be preserved. Additionally, reducing the number of shear walls would increase the load to each shear wall and as a result could require a large amount of foundation work.
Out of Plane Strengthening Alternatives	The project team recommends implementing the reinforced concrete shear walls (Alternative A). Reinforced concrete shear walls would be relatively simple to attach to the existing URM brick walls. As part of the lateral system for the structure and as such, concrete shear walls can be used for both in-plane and out-of-plane strengthening. Where historic finishes and materials exist (such as the walls of the main concourse), the concrete shear wall reinforcement can be implemented behind the historic

	material by temporarily removing the marble panels, replacing existing hollow clay tile with a shotcrete shear wall, and replacing the marble panels. This process may result in minor changes to finish room dimensions due to the slight increase in wall thickness, but the restored structural reinforcement will be hidden from view behind the restored marble panels with relatively small permanent dimensional changes anticipated. In less historic locations, such as the baggage room or leasable tenant spaces, the introduction of concrete shear walls on the inside of the existing URM wall would result in an increase in the overall wall thickness. However unlike braced framing, there is no risk of steel structural members blocking existing historic windows. The use of concrete shear walls would also create opportunities to introduce new building insulation, acoustic window treatments, and mechanical/electrical conduit within new the wall system. These opportunities would be explored in preliminary design. In certain locations, the steel tube strongback system may be considered as an alternative base. Exceptions to the use of concrete shear walls would be further explored in preliminary design based on overall architectural and structural design considerations.
Tower Unreinforced Masonry (URM) Strengthening	The project team recommends implementing a combination of reinforced concrete shear walls in the lower levels and steel braced frames in the upper levels (Alternative A). The light weight of the braces in the upper levels would provide lateral resistance without adding a significant amount of mass. Reinforced concrete shear walls would anchor the braces from above and at the same time can be used to provide lateral support to the main station structure.
Tower Overturning Resistance	The project team recommends implementing the addition of piles to the existing pile cap (Alternative A). Drilled pile foundations can be challenging to construct, but the work would be concentrated to a small area. Additionally, by adding the piles below the tower, the lateral elements of the tower can be used to support the main station. Without the addition of these piles, the loads from the tower would have to be redistributed to the rest of the station.
Main Building Chimney	The project team recommends adding a pipe column inside the chimneys (Alternative A). This would have no permanent impact on the exterior appearance of the chimney structures. The chimneys are non-functional, and therefore the primary objective for a structural/seismic retrofit is to preserve their historic appearance and character.
Platform Canopies	The project team recommends implementing the contemporary umbrella canopies with high shed (Alternative B) (Figure 5.10-2). This alternative provides the essential benefits for rail operations (increased clearances and improved weather protection) while preserving the historic form of the existing umbrella canopy/high shed system. The capital cost of this alternative would be lower than Train Shed Alternatives C and D, while still providing sufficient area for a photovoltaic system, if desired. In terms of constructability and maintenance of rail operations during construction, the umbrella canopy would be simpler to implement as part of a staged track reconstruction that upgrades one platform/platform canopy system at a time. It is anticipated that a contemporary platform canopy/high shed design can be developed to capture the positive benefits of a contemporary design approach while honoring the historic platform canopies and adjacent station.
Rail / Building Maintenance and Operations Areas	The project team recommends implementing the new replacement shed with attached gable (Alternative C). This alternative would provide the greatest functional benefit and design flexibility to provide coverage that meets the operations needs of Amtrak. It also would provide the historic benefit of the restored attached gable. The specific sizing requirements and organization of the maintenance area and associated shed structure would be further developed through preliminary engineering.
Annex Plaza	The project team recommends implementing the annex plaza improvements

	(Alternative B) (Figure 5.13-2). This transformation would be consistent with the periodic change and re-purposing of this area over the history of Union Station. It would maximize the potential of the annex while creating a community gathering spot that celebrates Union Station and provides benefits to the broader neighborhood.
Annex Floor Plan	The project team recommends implementing the Single-Story Shell Alternative (Alternative A) for the annex (Figure 5.13-3). This alternative would provide the most flexibility for re-use of the annex building, once the basic building upgrades have been completed and the annex is ready for leasing and fit-out based on future market and neighborhood conditions. The additional cost and space consumption of stair and elevator access to a second floor or mezzanine may not be cost effective for many uses; however, the single story shell alternative could be designed in a manner to accommodate the addition of a second floor mezzanine in the future, if warranted by the tenant.
Annex Chimney	The project team recommends implementing Alternative A, the Full Height Chimney Reconstruction with Reinforced Core (Figure 5.13-6). The annex chimney is evocative of the building's historic use as Union Station's boiler room. The historic benefit of preserving the character-defining annex chimney was the key factor in selecting the chimney preservation alternative. This alternative assumes technical viability of chimney restoration, including but not limited to the ability to salvage existing face brick. Technical feasibility and constructability considerations would continue to be explored in future design phases.

7.2. Rail Yard

The project team's recommended rail yard improvements are summarized in Table 7.2-1.

Table 7.2-1. Preliminary Preferred Alternative: Rail Yard Improvements

Improvement	Project Team Recommendation	Scope of Improvements
Improvements to Existing Trackwork	The project team recommends implementing the proposed track improvements to accommodate the anticipated 2035 passenger volumes. Reduced maintenance and down-time would provide a substantial return–on-investment for this improvement alternative; a focused study on existing and future operating and maintenance costs could be undertaken in preliminary engineering.	Replace existing, old, or broken equipment in the yard with new equipment, install some equipment, and develop an improved maintenance program for tie replacement (Figure 6.1.3-1): Replace 90# rail and Other Trackside Materials (OTM) with heavier, industry standard 115# rail. Weld the existing rail joints Replace existing defective ties within Tracks #1 - Tracks #4 with new wood ties and formalize an ongoing tie replacement program Replace the drip pan on the south end of Track #3 with a new, HDPE pan Replace the No. 7 turnout at the south end of the yard (between Tracks 1 and 2) with a No. 9 turnout *<u>if the geometry will allow this without extensive rework</u>*. The decision to replace the No. 7 with a No. 9 would need to be determined in Preliminary Engineering Replace existing turnouts in kind Replace the existing switch machines on the south end of tracks 1-4 Install switch machines at the two turnouts leading to Track #1 south

Improvement	Project Team Recommendation	Scope of Improvements
		Install correct voltage power to all switch machines
Signalize and Remotely Control All Tracks	The project team recommends implementing the centralized traffic control improvements. Though higher in capital cost than other track alternatives, signalization will be necessary for implementing the 2035 passenger train volumes and has been characterized as necessary by the FRA.	Signalize the tracks using Centralized Traffic Control. This would require installing communications conduit from a central control point to the north and south switches, as well as installing switch point indicators and other infrastructure needed for a fully signalized system (Figure 6.1.3-2): Install signal conduit Install signal houses Detail wiring diagrams Develop and coordinate an operating plan with all parties
Fuel Delivery System	The project team recommends implementing the new fueling system option, as the existing system is unsustainable from an operations and maintenance standpoint.	Construct a new fueling system to replace the existing method of stretching hoses across the tracks from the Portland Terminal Railroad (PTRR) access road (Figure 6.1.3-3). Fueling would occur entirely within the PDC-owned site. The system would be designed to be expanded to the south in the future if desired; the expansion south would mirror the north installation in terms of equipment and layout. The system would also accommodate the Diesel Emissions Fluid (DEF) additive required for newer locomotives. Construction of fueling and DEF equipment under the Butler Shed Underground piping with leak detection Piping underneath the existing platforms to hose reel cabinets on-platform
Relocate and Reduce Width of Passenger Crossing	The project team recommends implementing the relocation and reduction of the passenger crossing. Passenger loading south of the passenger crossing must be available in order to achieve the anticipated 2035 train volumes. Several key assumptions regarding train length are driving specifics of this recommendation. The project team recommends the adoption of a system-wide, defined and accepted design train length that all parties can agree upon, a detailed 2035 train schedule showing berthing locations at Union Station, and an accepted operating plan that limits boarding south of the crossing to the northern end of the trains where the tracks are tangent.	Relocate and reduce the width and location of the passenger crossing in order to maximize the available space for trains south of the passenger crossing. Reducing the passenger crossing will allow for the loading of passengers on the *Cascades* routes south of the crossing, increasing overall station capacity (Figure 6.1.3-4). Demolition of existing passenger crossing Reconstruction of the existing passenger crossing in new location farther north
Install Powered Scissor Crossovers	The project team recommends that PDC does not install either crossover at this time. Concerns regarding the safety of installing crossovers within the station limits, the limited space available for	None

Improvement	Project Team Recommendation	Scope of Improvements
	signal buffers, as well as the reliance on train schedule assumptions and no modeling for the station make the installation prohibitive. It is recommended that a detailed, system-wide 2035 schedule be developed and adopted by Amtrak and PDC, including defined train berthing locations within Union Station. An additional recommendation includes acceptance of the use of Track 1 north for maintenance prior to proceeding with future crossover construction.	
Shorten Existing Platforms	The project team recommends shortening both platforms and constructing the baggage cart path. The project team also recommends a design train length be determined and agreed to by all parties. This option also would require an operating plan by Amtrak that does not allow for boarding in Portland in the southern-most cars; this would need to be endorsed by Amtrak.	Shorten the platform to coincide with the limits of straight track and pave a section of track to allow for a baggage cart path to the station (Figure 6.1.3-6): Shorten existing platforms Construct baggage cart path
Construct Track #6	To accommodate the loss in current capacity, and to allow for the most flexible operating plan for passenger trains into and out of the station, the project team recommends construction of Track #6. If the 2035 expected passenger train volumes are realized, all four tracks within the station will be required for passenger trains, no longer allowing for freight traffic on Track #4. Track #6 will also likely be needed for phasing of other track, canopy, and platform improvements. Based on the desire to limit ROW impacts, the project team recommends constructing Track #6 to the west of the Broadway Bridge pier and altering the platform to accommodate the newly constructed Track #6.	Rebuild Track #6, which was removed in the mid - 1990s, allowing for a second freight main adjacent to the station yard (Figure 6.1.3-7). Freight trains would use Tracks #5 and #6 exclusively, and would not need to enter the yard on Track #4, allowing for the increased flexibility needed for increased passenger train volumes. Construct new trackwork (Track #6) Construct special trackwork Shift approximately 1,050 feet of Track #5 to make space for Track #6 Construct bridge pier protection Revise the existing width of the platform between Tracks 4 and 5; Reconfigure existing canopy Reconstruct NW 9th Avenue crossing Signalize trackwork Install noise mitigation in nearby residences Other improvements as noted in Figure 6.1.3-7
Raise Platform Heights	If PDC decides to construct Track 6, the project team recommends raising all platforms to 15 inches above TOR. FRA has stated that level boarding implementation is a project requirement. If PDC decides not to construct Track 6, then the project team recommends raising only the platform for Tracks 2 and 3 to 15 inches and raising the platform for Tracks 4 and 5 to 8 inches. Also recommended is development and	Raise the existing two platform heights to 15 inches above top of rail (TOR) (Figure 6.1.3-8). This would enable level-boarding status for the Amtrak Superliner cars and qualify for FRA funding linked to the level boarding requirement. Demolish existing platforms and canopies pending selection of preferred canopy alternative Construct platforms at 15 inches above TOR Construct new canopies (not included in rail estimate)

Improvement	Project Team Recommendation	Scope of Improvements
	implementation of a system-wide design criterion to define the height of the passenger car to be serviced in the future. If a standard height can be agreed upon by all parties, the benefits of level-boarding can be achieved for all car types using the station, not solely the Superliner cars.	Construct utilities within platform Raise Track #5 (see Section 6.1.3.9)
Raise Track #5	If PDC decides to raise the platforms to 15 inches above TOR, the project team recommends implementing the build alternative to raise Track #5 by 7 inches.	Raise Track #5 by 7 inches (through additional ballast and tamping) in order to remove the potential conflict between raising the platforms to 15 inches above TOR and the adjacent freight traffic on Track #5; the maximum height of a platform adjacent to a freight track is 8 inches (Figure 6.1.3-9). Install ballast Surface, Line and Dress ballasted track Reconstruct at grade crossing of NW 9th Avenue
Construct On-Site Yard Control	The project team recommends installation of on-site yard control to support the 2035 passenger train volumes if the yard is signalized and all switches powered up.	Employ a Yardmaster for Union Station in order to coordinate between BNSF and Union Pacific (UP) dispatchers directly, rather than coordination being routed through the Portland Terminal Railroad (PTRR). The Yardmaster would control switching within station limits via a locked control panel located on one of the platforms; this control panel would include phone and/or data lines to communicate with the appropriate dispatch (Figure 6.1.3-10). Construct switching console on the platform between Tracks 4 and 5 Conduit installation (currently assumed to run back to building) Amtrak staffing change to include Yardmaster (not included in the Capital cost estimate)
Reconfigure Drip Pans	The project team recommends replacing the drip pan system. Connection of the platform canopy drainage into the track drip pan system is not good practice, as the pollution control system was not designed to accept that stormwater. This is unnecessary treatment of canopy runoff, and increases the maintenance needs for the oil water separators. Furthermore, as 2035 train volumes are implemented, replacement of the drip pan system will be required.	Replace the existing drip pan system to accommodate the future 2035 train berthing locations, install a new oil water separator for the improved lines, and replace the existing piping as needed to account for the removal of the stormwater feeds from the existing platform canopies into the drip pan system (Figure 6.1.3-11). Replace existing piping Install new oil water separator Other improvements noted in Figure 6.1.3-11
Provide 480V Locomotive Power	The project team recommends constructing a new 480V Locomotive Power to accommodate the anticipated 2035 passenger volumes.	Replace the existing 480V power supply feeds for idling locomotives with new feeds in underground ducts, leading to power stanchions within the yard (Figure 6.1.3-12). Stanchions would be located at berthing locations coordinated with anticipated 2035 passenger train volumes, consists, and

Improvement	Project Team Recommendation	Scope of Improvements
		lengths. The conceptual design considers placement of electrical ducts beneath new, 15-inch high platforms. Construct new electrical ductbank under platform Install new power stanchions within yard
Stormwater and Sewer System Improvements	The project team recommends constructing the stormwater and sewer system improvements. The existing stormwater system is not adequately sized, includes very old pipes, has been partially removed, is clogged in several places, experiences combined sewage overflows during large storms, and portions connect to the existing track plan system, which was not designed for stormwater flows. The site sees frequent flooding of stormwater into ballast during large rain events, contributing to the soft spots and sink holes seen in the yard in the past.	Rehabilitate and/or replace certain elements of the stormwater and sewer system identified as deficient in the Site Utilities Report (HDR, 2015) (Figure 6.1.3-13). This only includes improvements outside the envelope of the existing structures; preferred improvements within the building are covered in Section 7.1 of this Alternatives Considered report. Abandon certain existing pipes Replace certain existing pipes Install pipe liners in certain pipes Inspect and clean canopy downspouts and connect to a new pipe Upgrades to sewer dump station, grinder pump and discharge line Other improvements noted in Figure 6.1.3-12
Water System Improvements	The project team recommends constructing the water system improvements to accommodate the anticipated 2035 passenger volumes, and/or prior to new platform construction.	Replace, rehabilitate, and upgrade the existing potable water delivery system within the yard and station area, as well as new sprinkler supply lines to the annex and main terminal buildings are included in the evaluation matrix (Figure 6.1.3-14). This option does not consider any water or Fire / Life Safety improvements within either of the buildings on site (the main terminal or annex); however, it does consider service stubs to each building for sprinklers and water service. Install new water cabinets on platforms Install supply piping and valve fixtures for new water cabinets Removal and replacement of some existing water lines Concrete encasement for some water lines Other noted improvements in Figure 6.1.3-14
Electrical System Improvements	The project team recommends constructing the electrical system improvements to accommodate the anticipated 2035 passenger volumes, and/or prior to new platform construction.	Replace the existing electrical ductbank on the north end of the terminal with a new line to a new electrical vault located north of the terminal (Figure 6.1.3-15). The existing line would be abandoned in place. Construct new electrical feed and new vault Abandon existing electrical feed
Telephone and Voice System Improvements	The project team recommends installing the proposed telecommunications and data ductbank to support modern business needs within the main terminal and annex building, as well as to support the installation of on-site yard control.	Install a new data and telecommunications line into the main terminal building from the existing vault on NW Irving Street (Figure 6.1.3-16). This does not consider any improvements within either the main terminal building or the annex (preferred building improvements are discussed in Section 7.1). Install telecommunications ductbank

Improvement	Project Team Recommendation	Scope of Improvements
Compressed Air System Improvements	The project team recommends construct the air system improvements to accommodate the anticipated 2035 passenger volumes, and/or prior to new platform construction.	Reconfigure the compressed air system within the yard to accommodate the 2035 passenger train schedule, and resulting berthing locations for the trains. The new compressed air piping is assumed to run within a utility ductbank in the new, 15" high platforms; however, replacement of the platforms is not required for the installation of the new air system; the piping could be run within the yard (Figure 6.1.3-17). Install new air piping system Install new air stanchions on the platform

7.3. Next Steps

With the identification of a preliminary preferred alternative, ODOT and the PDC will conduct a more extensive public outreach program in compliance with Section 106 and FRA guidance to provide the public and other interested parties the opportunity to review the preliminary preferred alternative and provide feedback on possible adverse effects and their resolution, and will consider any feedback received in the refinement of the preferred alternative.

Recommended refinements will be reviewed by key stakeholders including SHPO, ODOT, and Amtrak for previously unidentified conflicts with evaluation criteria, Purpose and Need, and Goals and Objectives. Prior to submittal to FRA for approval of any refinements to the preliminary preferred alternative, PDC's internal Union Station Design Review Committee will review the recommended refinements.

For more details about public involvement for this proposed project, please see Chapter 8 of this Alternatives Considered Report.

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8. Coordination and Consultation

8.1. Public Involvement

8.1.1. Project Initiation and Section 106

Through the alternatives development and evaluation phase of the project, ODOT and the PDC engaged in a robust process with the Oregon State Historic Preservation Office (SHPO) to determine the most appropriate scope of improvements for Union Station, a National Register of Historic Places (NRHP)-listed resource. ODOT and the PDC considered preserving the stature and integrity of this Section 106 resource was a significant priority. The two agencies conducted limited outreach with the public and other community stakeholders. In addition, they were working closely with the Oregon SHPO to determine the scope of improvements for Union Station. Also during the alternatives development and evaluation phase, ODOT and PDC consulted extensively with Amtrak regarding building and rail yard improvements. Based on this consultation, ODOT and the PDC evaluated a range of building and rail improvement alternatives against the project's Purpose and Need, and Goals and Objectives (PNGO). In May 2016, ODOT and the PDC identified a preliminary preferred alternative that most effectively met the project's PNGO and preserve Union Station's historic integrity.

In addition to the robust process with SHPO and Amtrak, PDC engaged in other project communications and coordination with a range of stakeholders and interested parties. These outreach efforts, key issues raised, and resolution of issues related to the project are summarized in Table 8.1-1.

8.1.2. Preliminary Preferred Alternative Review

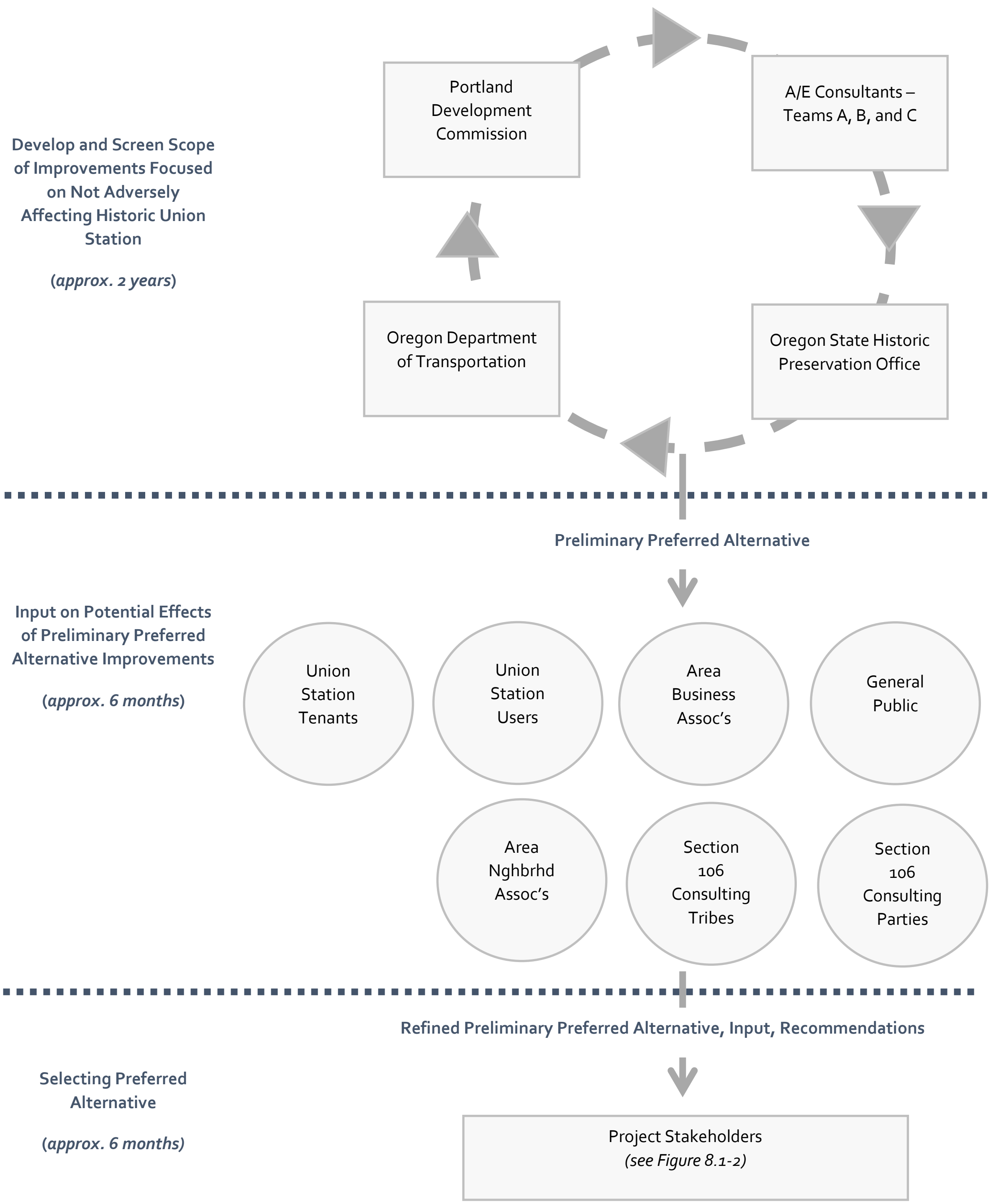
With the identification of a preliminary preferred alternative, ODOT and the PDC will conduct a more extensive public outreach program in compliance with Section 106 to provide the public and other interested parties the opportunity to review the preliminary preferred alternative and provide feedback on possible adverse effects and their resolution, and will consider any feedback received in the refinement of the preferred alternative (Figure 8.1-1).

Other interested parties include consulting parties identified by the Oregon SHPO: Cowlitz Indian Tribe, The Confederated Tribes and Bands of the Yakama Nation, The Confederated Tribes of the Grand Ronde Community of Oregon, The Confederated Tribes of Siletz, The Confederated Tribes of the Warm Springs Reservation of Oregon, Pacific Northwest Chapter of the National Railway Historical Society, Oregon Rail Heritage Foundation, Architectural Heritage Center, Restore Oregon, Pacific Coast Chapter of the Railway and Locomotive Historical Society, Minnesota Historical Society (repository for Northern Pacific Railway and James J. Hill historical documents), Railroad Station Historical Society, Northern Pacific Railway Historical Association, SP&S Railway Historical Society (Spokane, Portland and Seattle Railway), Union Pacific Historical Society, Oregon Historical Society, Association of Oregon Rail and Transit Advocates (AORTA), American Institute of Architects Historic Resources Committee (HRC), and Portland Terminal Railroad.

Outreach opportunities will be publicly noticed and include statements identifying the proposed action as a federally funded action and that the outreach is in compliance with Section 106.

ODOT and the PDC will make project documents available for review by the public and other interested parties. Project documents would include the revised Determination of Eligibility (2016), any technical studies conducted, the Alternatives Considered report, and the Finding of Effects document. The public and other interested parties will be provided the opportunity to express their views on the proposed action, the possible adverse effects on the historic resource, and alternatives to resolving adverse effects. Feedback will be reviewed by PDC's team of consultants for possible adverse effects or refinement of the preliminary preferred alternative. Recommended refinements will be reviewed by SHPO, ODOT, and Amtrak for previously unidentified conflicts with evaluation criteria, Purpose and Need, and Goals and Objectives.

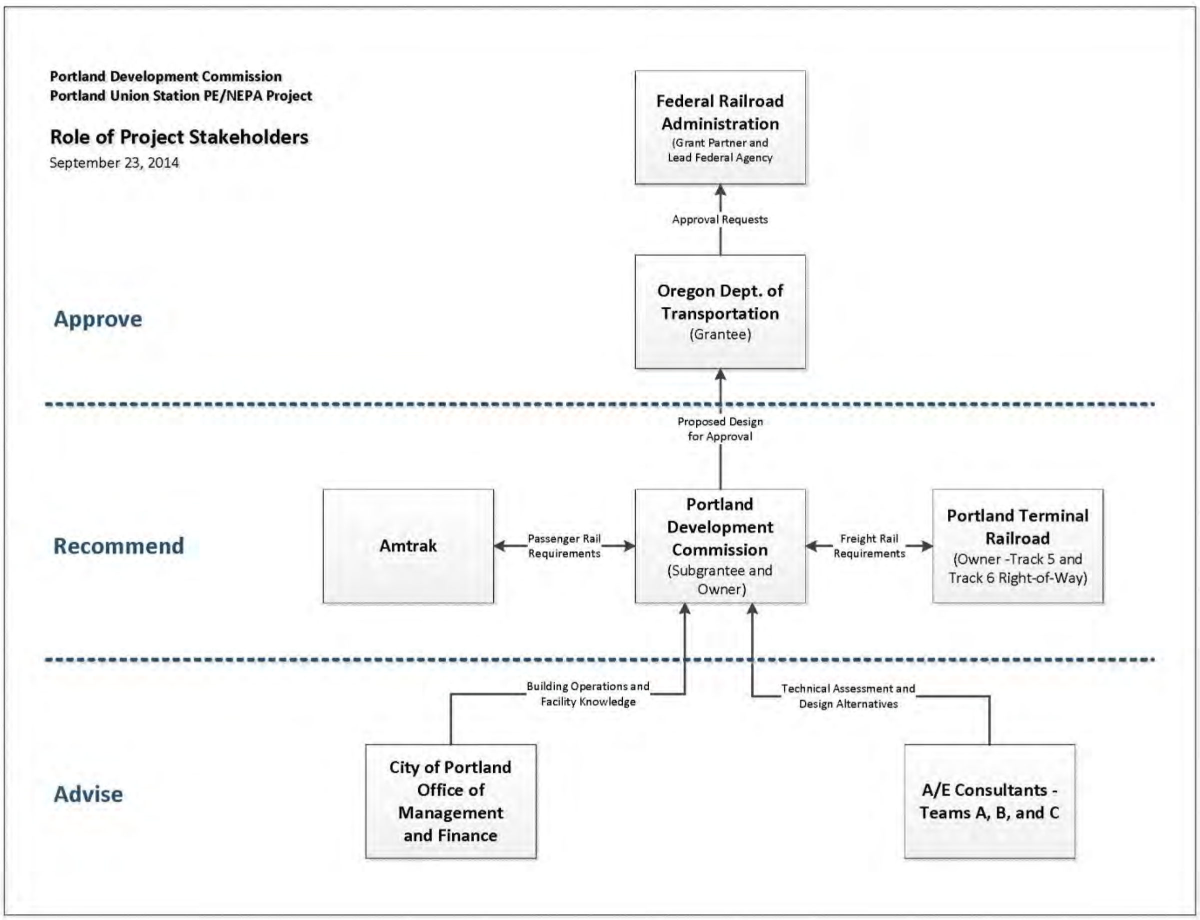
Figure 8.1-1. Identifying Preliminary Preferred Alternative



8.1.3. Selecting Preferred Alternative

Project stakeholders will consider the findings of study documents, the refined preliminary preferred alternative, all feedback received during the public outreach, and project team recommendations before selecting a preferred alternative. Additionally, stakeholders may suggest refinements before advancing the preferred alternative to the preliminary engineering phase (Figure 8.1-2). Prior to submittal to FRA for approval of any refinements to the preferred alternative, PDC's internal Union Station Design Review Committee will review the recommended refinements. An analysis of any refinements not selected by this Committee will be included in the documents submitted to FRA.

Figure 8.1-2. Role of Project Stakeholders



Source: PDC. 2014.

8.2. Agency Coordination

Between February 2015 and April 2016, ODOT and the PDC have engaged in a robust process in coordinating closely with the Oregon SHPO to determine the most appropriate scope of improvements to Union Station, an NRHP-listed Section 106 resource, and to reach an anticipated No Adverse Effect determination under Section 106 and no use of Section 4(f) resources.

On June 15, 2016, with the identification of a preliminary preferred alternative, ODOT and PDC requested SHPO concurrence on a revised Area of Potential Effect (APE).

With the identification of a preliminary preferred alternative, ODOT and PDC anticipate conducting a more robust outreach process that will include project communications and coordination with other agencies including, but not limited to:

- State Historic Preservation Office
- Portland Housing Bureau / U.S. Housing and Urban Development
- City of Portland Office of Management and Finance
- City of Portland Mayor's Office

8.3. Tribal Consultation

In coordination with SHPO, ODOT and PDC have identified the following Tribes as possible consulting parties for the proposed project:

- Cowlitz Indian Tribe
- The Confederated Tribes and Bands of the Yakama Nation
- The Confederated Tribes of the Grand Ronde Community of Oregon
- The Confederated Tribes of Siletz
- The Confederated Tribes of the Warm Springs Reservation of Oregon.

As of the drafting of this report, only one communication has been sent to any of the identified Tribes:

- On September 24, 2014, FRA sent project notification to the five Tribes identified as consulting parties regarding geotechnical investigations.
- On September 29, 2014, ODOT received a response from the Confederated Tribes of the Warm Springs Reservation of Oregon recommending that a professional archaeologist monitor all geotechnical and environmental borings. The recommended monitoring occurred during the geotechnical and environmental borings and a report was prepared.

With the identification of a preliminary preferred alternative, ODOT and PDC anticipate conducting a more robust outreach process that will include project communications and notices to the Tribes.

Table 8.1-1. Summary of Public Involvement Events, Key Issues and Project Resolution

Date	Activity / Event	No. of Participants (does not include staff or consultant team)	Key Issues	Project Resolution
6/25/13	Stakeholder Meeting: Review Detailed Work Plan	4	• Initial kick-off meeting to review the overall project objectives, schedule, and discuss the key improvements included in the scope of work.	Feedback incorporated into Detailed Work Plan; Additional round of review and feedback on revised draft completed via email (7/25/13)
8/19/14	Meeting with PTRR	2	• Project scope of work for Track 6; Considerations for Track 5 and freight utilization	PTRR expressed concerns re: environmental due diligence on PTRR owned property. Scope of work modified to remove these elements.
9/23/14	Stakeholder Meeting: Project Orientation & Risk Management Workshop	4	• Project Background, Overview, Schedule • Role of the Stakeholder Advisory Committee • Discussion: Project Goals, Objectives and Stakeholder Expectations • Discussion: Risk Management and Mitigation Strategy	Established draft Project Goals to be utilized in evaluating project alternatives. Feedback incorporated into Risk Management and Mitigation Strategy
11/11/14	Meeting with Amtrak – Tracks & Platforms	4	• Future Rail Operations Needs and Capacity: Operational Goals, Future Service Levels and Ridership, Consist Length • Platform Design Issues: Shifting Location of the High Shed Crossing, ADA Accessibility, Maintenance and Inspections, Track 1 North Platform, Other Terminal Reconfiguration • Train Servicing: Servicing Equipment Inventory, 480 Volt Power, 120 Volt Power, Yard Air, Potable and Non-Potable Water, Fueling, Septic Service • Other Design Issues: Wireless Ticketing, Trash and Recycling, Parking, Security, Lighting	Feedback on Amtrak needs and preferences incorporated into conceptual design considerations
2/4/15	Meeting with Amtrak & DRUMAC – Building & Tracks/Platforms	8	• Confirm understanding of Amtrak and DRUMMAC's operational needs. • inventory of train servicing elements • inspections performed at station • fueling requirements	Feedback on Amtrak needs and preferences incorporated into conceptual design considerations
3/6/15	Portland Historic Landmarks Commission briefing	unknown	• Briefing to Historic Landmarks Commission regarding PDC-led historic preservation projects, including Union Station	Addressed questions regarding various project activities

Date	Activity / Event	No. of Participants (does not include staff or consultant team)	Key Issues	Project Resolution
	(public meeting)		• Overview of Union Station history, investments to-date, and current scope of work/schedule.	
4/29/15 – 4/30/15	King Street Station best practices workshop	5	• King Street Station Facility Tour: Amtrak Operations and Administrative Facilities, Passenger Amenities, Seismic Upgrades, Systems Upgrades, Fire/Life Safety, Rail & Platform configurations • Sequencing Construction Work while Maintaining Amtrak Operations: Lessons learned, Strategies for Union Station • Space Planning Session: passenger flow, consolidation of Amtrak functions, platforms, baggage/ticketing	Feedback on Amtrak needs and preferences incorporated into conceptual design considerations
5/5/15	Meeting with Amtrak – Conditions Assessment	8	• Briefing on preliminary Union Station conditions assessment findings and site tour for orientation and discussion of key issues. Discuss feedback and identify role for Amtrak in the design and decision making process moving forward. • Conditions Assessment Overview: Scope of the Conditions Assessment, Amtrak Operational Needs and Station Program/Planning, Rail Capacity and Operations • Union Station Walking Tour and Discussion: Passenger main concourse/Customer Service Functions, Back Office – Baggage, Commissary, Maintenance etc., Rail Operations - Tracks and Platforms • Involvement of Amtrak Corporate in Design Phase	Feedback on Amtrak needs and preferences incorporated into conceptual design considerations
6/15/15	Broadway Corridor Stakeholder Advisory Committee (SAC) Mtg #1	13	• Meeting of Advisory Committee for Broadway Corridor redevelopment strategy. Study area includes Union Station. • SAC Charter & Project Schedule • Overview of Project Background & Existing Conditions • Site Walk	Information sharing regarding study area and SAC roles & responsibilities

Date	Activity / Event	No. of Participants (does not include staff or consultant team)	Key Issues	Project Resolution
			• SWOT analysis	
6/16/15	Broadway Corridor Technical Advisory Committee (TAC) Mtg #1	7	• Meeting of Advisory Committee for Broadway Corridor redevelopment strategy. Study area includes Union Station. • Overview of Project Background & Existing Conditions • SWOT Analysis	Information sharing regarding study area and TAC roles & responsibilities
6/30/15	Broadway Corridor Stakeholder Advisory Committee (SAC) / Technical Advisory Committee (TAC) Joint Mtg #2	19	• Meeting of Advisory Committees for Broadway Corridor redevelopment strategy. Study area includes Union Station. • Revisit SWOT Analysis • Work session regarding guiding principles for the study area and future redevelopment	Developed draft guiding principles for study area
6/30/15	Broadway Corridor Public Open House #1	~50	• Public open house for Broadway Corridor redevelopment strategy. Study area includes Union Station. • Provide input on project goals & objectives	Addressed project questions; Received feedback to inform revisions to draft guiding principles and project goals
7/16/15	Portland Development Commission Board Briefing – Broadway Corridor (public meeting)	unknown	• Briefing regarding Broadway Corridor redevelopment strategy. Study area includes Union Station. • Project overview • SWOT analysis • Guiding principles for the study area and future redevelopment • Relevant case studies • Strategic vision for redevelopment area	Information sharing; Addressed project questions
7/17/15	Amtrak Update on Conceptual Engineering Alternatives	7	• Project Status Update • Tracks and Platforms - Conceptual Design Alternatives; Key Requirements Driving Track/Platform Design; Design Alternatives for Tracks 5 & 6 • Amtrak Interior Spaces - Conceptual Design Alternatives; Amtrak Program Assumptions;	Feedback on Amtrak needs and preferences incorporated into conceptual design considerations

Date	Activity / Event	No. of Participants (does not include staff or consultant team)	Key Issues	Project Resolution
			Passenger Concourse/Customer Interfaces, Amtrak Back Office and Support Spaces	
7/19/15	Broadway Corridor On-line Survey #1	328 visits; 130 responses	• On-line survey regarding the vision and guiding principles for redevelopment of the Broadway Corridor study area, which includes Union Station	Received feedback to inform revisions to draft guiding principles
7/20/15	Broadway Corridor Technical Advisory Committee (TAC) Mtg #3	5	• Meeting of Advisory Committees for Broadway Corridor redevelopment strategy. Study area includes Union Station. • Strategic vision for redevelopment area • Market assessment • USPS site concept alternatives workshop	Information sharing; received feedback to inform refinement of conceptual development framework
7/21/15	Broadway Corridor Stakeholder Advisory Committee (SAC) Mtg #3	13	• Meeting of Advisory Committee for Broadway Corridor redevelopment strategy. Study area includes Union Station. • Strategic vision for redevelopment area • Market assessment • USPS site concept alternatives workshop	Information sharing; received feedback to inform refinement of conceptual development framework
7/21/15	Broadway Corridor Public Open House #2	~50	• Public open house for Broadway Corridor redevelopment strategy. Study area includes Union Station. • Project overview • Provide feedback on preliminary development concept alternatives and preferences	Information sharing; received feedback to inform refinement of conceptual development framework
8/10/15	Broadway Corridor On-line Survey #2	974 visits; 289 responses	• On-line survey regarding the preliminary development concepts for redevelopment of the Broadway Corridor study area, which includes Union Station	Information sharing; received feedback to inform refinement of conceptual development framework
8/25/15	Broadway Corridor Technical Advisory Committee (TAC) Mtg #4	10	• Meeting of Advisory Committee for Broadway Corridor redevelopment strategy. Study area includes Union Station. • Preview preliminary development concepts and financial findings	Information sharing; received feedback to inform preferred conceptual development framework
9/4/15	Broadway Corridor	6	• Meeting of Advisory Committee for Broadway	Information sharing; received feedback to inform

Date	Activity / Event	No. of Participants (does not include staff or consultant team)	Key Issues	Project Resolution
	Technical Advisory Committee (TAC) Mtg #5		Corridor redevelopment strategy. Study area includes Union Station. • Stakeholder input received to-date • Project status / timeline • Vision Statement • Development phasing • Revised development concepts & preferences	preferred conceptual development framework and measures of success
9/8/15	Broadway Corridor Stakeholder Advisory Committee (SAC) Mtg #4	6	• Meeting of Advisory Committees for Broadway Corridor redevelopment strategy. Study area includes Union Station. • Strategic Framework, Guiding Principles, District Urban Design Framework • USPS Site Concept Refinement and Evaluation, Transportation Evaluation, Financial Feasibility • USPS Preferred Concept and Implementation Metrics	Information sharing; received feedback to inform preferred conceptual development framework & measures of success
9/8/15	Broadway Corridor Public Open House #3	~50	• Public open house for Broadway Corridor redevelopment strategy. Study area includes Union Station. • Project overview • Strategic Framework, Guiding Principles, District Urban Design Framework • USPS Site Concept Refinement and Evaluation, Transportation Evaluation, Financial Feasibility • USPS Preferred Concept and Implementation Metrics	Information sharing; received feedback to inform preferred conceptual development framework & measures of success
9/9/15	Portland Business Alliance Central City Committee – Broadway Corridor	unknown	• Briefing on redevelopment potential of the Broadway Corridor area, including role of Union Station as anchor to development and importance of station access & activation.	Information sharing; Answered questions regarding project
9/9/15	Portland Development Commission Board Briefing – Broadway Corridor (public	unknown	• Briefing regarding Broadway Corridor redevelopment strategy. Study area includes Union Station.	Information sharing; Answered questions regarding project

Date	Activity / Event	No. of Participants (does not include staff or consultant team)	Key Issues	Project Resolution
	meeting)		• Stakeholder feedback • Strategic vision, vision statement, guiding principles • Development concept refinement; Preferred Concept • Financial findings • Measures of success	
9/11/15	Portland City Council Work Session – Broadway Corridor (public meeting)	unknown	• Briefing regarding Broadway Corridor redevelopment strategy. Study area includes Union Station. • Stakeholder feedback • Strategic vision, vision statement, guiding principles • Development concept refinement; Preferred Concept • Financial findings • Measures of success	Information sharing; Answered questions regarding project
9/21/15	Amtrak Update on Conceptual Engineering Alternatives	5	• Tracks, scissor crossings, signalization, projected utilization, platform/level-boarding considerations • Fueling options and requirements • Building conceptual design, security, circulation, Amtrak administrative operations, public spaces, ticketing/baggage/boarding	Feedback on Amtrak needs and preferences incorporated into conceptual design considerations
9/22/15	Planning & Sustainability Commission briefing (public meeting) – Broadway Corridor	unknown	• Briefing on redevelopment potential of the Broadway Corridor area, including role of Union Station as anchor to development and importance of station access & activation.	Information sharing; Answered questions regarding project
9/30/15	Broadway Corridor Public Realm Survey	169 responses	• "In the field" surveys conducted in multiple languages and throughout the broader Portland area along transit lines and in public parks, focused on what elements make for inclusive public spaces and neighborhoods. Surveys were conducted to inform the Broadway Corridor Framework Plan.	Feedback will inform evolving public realm design and programming considerations USPS site and connections to and activation of Union Station

Date	Activity / Event	No. of Participants (does not include staff or consultant team)	Key Issues	Project Resolution
			The Framework Plan study area includes Union Station.	
10/14/15	Portland Development Commission Board adoption of Broadway Corridor Framework Plan (public meeting)	unknown	• Portland Development Commission adoption of the Broadway Corridor Framework Plan. Framework Plan evaluates redevelopment potential and urban design framework of the Broadway Corridor area, including role of Union Station as anchor to development and importance of station access & activation.	Adoption of Broadway Corridor Framework Plan
11/5/15	City Council adoption of Broadway Corridor Framework Plan (public meeting)	unknown	• Portland City Council adoption of the Broadway Corridor Framework Plan. Framework Plan evaluates redevelopment potential and urban design framework of the Broadway Corridor area, including role of Union Station as anchor to development and importance of station access & activation.	Adoption of Broadway Corridor Framework Plan
11/10/15	Pearl District Business Association briefing – Broadway Corridor	~50	• Briefing on redevelopment potential of the Broadway Corridor area, including role of Union Station as anchor to development and importance of station access & activation.	Information sharing; Answered questions regarding project
12/1/15	Old Town Chinatown Open House	~20	• Overview of development and tenanting opportunities in Old Town Chinatown neighborhood. Included overview of current Union Station scope of work and interest in station activation	Information sharing; Answered questions regarding project
12/2/15	Old Town Chinatown Community Association briefing – Broadway Corridor & Union Station revitalization	~40	• Briefing on redevelopment potential of the Broadway Corridor area, including role of Union Station as anchor to development and importance of station access & activation. • Overview of Union Station history, investments to-date, and current scope of work/schedule.	Information sharing; Answered questions regarding project
12/4/15	Meeting with Amtrak – Scissor Crossing	7	• Rationale for scissor crossing recommendation • Future Conditions • Operating procedures	Feedback on Amtrak needs and preferences incorporated into conceptual design considerations

Date	Activity / Event	No. of Participants (does not include staff or consultant team)	Key Issues	Project Resolution
12/9/15	Track 6 – Amtrak, UP, BNSF	8	• Existing Conditions – Tracks 4, 5 & 6 (ROW) • Future Conditions – increased passenger rail utilization • Potential Track 6 requirements and considerations	Feedback on Amtrak and PTRR needs and preferences incorporated into conceptual design considerations
12/15/15	AIA Urban Design Forum briefing – Broadway Corridor	~15	• Briefing on redevelopment potential and urban design vision for the Broadway Corridor area, including role of Union Station as anchor to development and importance of station access & activation.	Information sharing; Answered questions regarding project
1/19/16	Conceptual Engineering Alternatives Review	13	• Objective: Review Conceptual Engineering alternatives for Portland Union Station track and building improvements. Obtain stakeholder feedback on preferred alternatives, and discuss future design refinement during the Preliminary Engineering phase. • Review Track Scope of Improvements and Alternatives • Review Building Scope of Improvements and Alternatives	Feedback on Amtrak needs and preferences incorporated into conceptual design considerations
3/22/16	Northwest Evaluation Association briefing		• Presentation to staff of larger employer near Union Station regarding PDC-sponsored activities in the area. • Overview of Union Station history, investments to-date, and current scope of work/schedule.	Information sharing; Answered questions regarding projects
4/14/16	Meeting with Amtrak – Tracks, Canopies, Platform	7	• Train Lengths: Current operations; Future operations • Maintenance and Layovers • Canopy Alternates • Northern Shed	Feedback on Amtrak needs and preferences incorporated into conceptual design considerations
6/7/16	Meeting with Amtrak – Progress Update		• Track and Rail Design Review: Track 6 Design Options, Future Train Schedule, Fueling Design, Inspections • Exterior Rail/Building Maintenance Area, Key	Feedback on Amtrak needs and preferences incorporated into conceptual design considerations

Date	Activity / Event	No. of Participants (does not include staff or consultant team)	Key Issues	Project Resolution
			Operational Requirements, Space Configuration, Gable Roof Restoration and Shed Coverage, Perimeter Security Fence and Gate • Amtrak Interior Spaces, north foyer Passenger Services, Baggage Room/Operations Support (First Floor), District Office (Second Floor)	
6/16/16	eROI		• Presentation to staff of employer near Union Station regarding PDC-sponsored activities in the area. • Overview of Union Station history, investments to-date, and current scope of work/schedule.	Information sharing; Answered questions regarding projects

Source: PDC. 2016.

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Appendix A: Acronyms, Abbreviations and Glossary

This appendix includes acronyms, terms and abbreviations that may be used in this Alternatives Considered report, supporting documentation or reference documents.

Acronyms and Abbreviations

	°C	degree(s) Celsius
	°F	degree(s) Fahrenheit
	µg	microgram
	µT	microtesla
A	AAI	All Appropriate Inquiry
	AASHTO	American Association of State Highway and Transportation Officials
	ac	acres(s)
	AC	alternating current
	ACHP	Advisory Council on Historic Preservation
	ACM	asbestos-containing material
	ACS	U.S. American Community Survey
	ADA	Americans with Disabilities Act
	ADRP	archeological data recovery program
	ADT	average daily traffic
	aka	also known as
	ANSI	American National Standards Institute
	APCD	air pollution control district
	APE	area of potential effect

	API	Area of potential impact
	APTA	American Public Transportation Association
	AQMD	air quality management district
	AREMA	American Railway Engineers and Maintenance of Way Association
	ARPA	Archaeological Resources Protection Act
	AST	aboveground storage tank
	ASTM	American Society for Testing and Materials
	ATC	automatic train control
	ATCM	Airborne Toxic Control Measure
B	B.P.	year(s) before the present
	BACT	best available control technology
	bgs	below ground surface
	BIOS	Biogeographic Information and Observation System
	BLM	Bureau of Land Management
	BMP	best management practice
	BNSF	Burlington Northern & Santa Fe Railway
	Btu	British thermal unit
C	C&D	construction and demolition
	CAA	Clean Air Act
	CDP	census designated place
	CDSM	cement deep soil mixing
	CEQ	Council on Environmental Quality
	CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
	CFC	chlorofluorocarbon
	CFR	Code of Federal Regulations
	CH_4	methane

	CHA	collision hazard analysis
	CIDH	cast-in-drill hole
	cm	centimeter(s)
	CNG	compressed natural gas
	CO	carbon monoxide
	CO_2	carbon dioxide
	CO_2e	carbon dioxide equivalents
	COG	Council of Governments
	CSHP	construction safety and health plan
	CWA	Clean Water Act
D	dB	decibel(s)
	dBA	A-weighted decibel(s)
	DC	direct current
	DCE	dichloroethylene
	DDD	dichlorodiphenyldichloroethane
	DDE	dichlorodiphenyldichloroethylene
	DDT	dichlorodiphenyltrichloroethane
	DE	diesel exhaust
	DHS	U.S. Department of Homeland Security
	DOT	U.S. Department of Transportation
	DPM	diesel particulate matter
	DWP	Detailed work plan
E	EDMS	Emission and Dispersion Modeling System
	EDR	Environmental Data Resources, Inc.
	EIR	environmental impact report
	EIS	environmental impact statement

	EJ	environmental justice
	ELF	extremely low frequency
	EMF	electromagnetic field
	EMFAC	emission factors model
	EMI	electromagnetic interference
	EMT	emergency medical technician
	EMU	electric multiple unit
	EO	Executive Order
	EOP	emergency operating procedure
	EPA	U.S. Environmental Protection Agency
	ESA	Environmental Site Assessment
	ESRP	Endangered Species Recovery Program
	ESU	evolutionary significant unit
F	FAA	Federal Aviation Administration
	FCC	Federal Communications Commission
	Fed. Reg.	Federal Register
	FEMA	Federal Emergency Management Agency
	FERC	Federal Energy Regulatory Commission
	FESA	Federal Endangered Species Act
	FHWA	Federal Highway Administration
	FIRE	finance, insurance, and real estate
	FLSP	fire/life safety program
	FPPA	Farmland Protection Policy Act
	FRA	Federal Railroad Administration
	ft	foot (feet)
	FTA	Federal Transit Administration

	FTIP	Federal Transportation Improvement Programs
G	g	acceleration of gravity
	G	gauss
	GAMAQI	Guide for Assessing and Mitigating Air Quality Impacts
	GC	general conformity
	GHG	greenhouse gas
	GHz	gigahertz
	GIS	geographic information system
	GNIS	geographic names information system
	gpd	gallon(s) per day
	gpm	gallon(s) per minute
	GPS	global positioning system
	GWh	gigawatt-hour
	GWP	global warming potential
H	HABS	Historic American Building Survey
	HAER	Historic American Engineering Record
	HALS	Historic American Landscape Survey
	HASR	Historic Architectural Survey Report
	hazmat	hazardous material
	HCM	Highway Capacity Manual
	HCP	habitat conservation plan
	HF	high frequency
	HFE	hydrofluorinated ether
	HMF	heavy maintenance facility
	HMMP	Habitat Mitigation and Monitoring Plan
	HOV	high-occupancy vehicle

	hp	Horsepower
	HPSR	Historic Properties Survey Report
	HR	hydrologic region
	HS	high speed
	HSR	Historic Structure Report
	HST	high-speed train
	HUD	U.S. Department of Housing and Urban Development
	Hz	hertz
I	I	interstate
	IBC	International Building Code
	ICC	International Code Council
	IEEE	Institute of Electrical and Electronic Engineers
	IRIS	Integrated Risk Information System
	ISR	Indirect Source Review
K	kHz	kilohertz
	km	kilometer(s)
	kph	kilometer(s) per hour
	kV	kilovolt
	kV/m	kilovolt(s) per meter
	KVP	key viewpoint
	KWH	kilowatt hour
L	LBP	lead-based paint
	L_{dn}	day-night sound level, dBA
	LEDPA	least environmentally damaging practicable alternative
	LEED	Leadership in Energy and Environmental Design
	LEP	limited English proficiency

	L_{eq}	equivalent sound level, dBA
	L_{eq}(h)	equivalent sound level for a 1-hour period, dBA
	LESA	land evaluation and site assessment
	L_{max}	maximum sound level, dBA
	LOS	level of service
	LPG	liquefied petroleum gas
	LT	long-term measurement
	LUST	leaking underground storage tank
	LWCF	Land and Water Conservation Fund
M	M^3	cubic meter(s)
	MAP-21	Moving Ahead for Progress in the 21st Century Act
	MBTA	Migratory Bird Treaty Act
	MCL	maximum contaminant level
	mG	milligauss
	mgd	million gallon(s) per day
	MM	mitigation measure
	MMBtu	million Btu
	MMcf	million cubic feet
	MMRP	Mitigation Monitoring and Reporting Program
	MMT	million metric tons
	MOA	memorandum of agreement
	MOU	memorandum of understanding
	MOWF	maintenance-of-way facility
	MPE	maximum permissible exposure
	mpg	miles per gallon
	mph	mile(s) per hour

	MPO	Metropolitan Planning Organization
	MRF	materials recovery facility
	MRI	magnetic resonance imaging
	MRZ	mineral resource zone
	MSAT	mobile-source air toxics
	MTBE	methyl tertiary butyl ether
	MW	Megawatt
N	N_2O	nitrous oxide
	NAAQS	National Ambient Air Quality Standards
	NAC	noise abatement criteria
	NAVD 88	North American Vertical Datum of 1988
	NEPA	National Environmental Policy Act
	NESHAP	National Emissions Standards for Hazardous Air Pollutants
	NF_3	nitrogen trifluoride
	NFPA	National Fire Protection Association
	NHL	National Historic Landmark
	NHPA	National Historic Preservation Act
	NMFS	National Marine Fisheries Service
	NMR	nuclear magnetic resonance
	NO	nitric oxide
	NO_2	nitrogen dioxide
	NOA	naturally occurring asbestos
	NOAA	National Oceanic and Atmospheric Administration
	NOD	Notice of Determination
	NOI	Notice of Intent
	NO_x	nitrogen oxide(s)

	NPDES	National Pollutant Discharge Elimination System
	NPL	National Priorities List (Superfund)
	NPPA	Native Plant Protection Act
	NPS	National Park Service
	NRCS	Natural Resources Conservation Service
	NRHP	National Register of Historic Places
	NRPA	National Recreation and Park Association
	NWI	National Wetlands Inventory
	NWR	National Wildlife Refuge
O	O_3	ozone
	OCS	overhead contact system
	ODOT	Oregon Department of Transportation
	OSHA	Occupational Safety and Health Administration
	OXY	Occidental Petroleum Corporation
P	PA	programmatic agreement
	PAH	polycyclic aromatic hydrocarbon
	Pb	lead
	PCB	polychlorinated biphenyl
	PCE	perchloroethylene (synonym: tetrachloroethene)
	PDC	Portland Development Commission
	PEC	potential environmental concern
	PFC	perfluorocarbon
	PGA	peak ground acceleration
	PHA	preliminary hazard analysis
	PIM	public information meeting
	PL	public law

	PM	particulate matter
	PM_{10}	particulate matter smaller than or equal to 10 microns in diameter
	$PM_{2.5}$	particulate matter smaller than or equal to 2.5 microns in diameter
	ppm	part(s) per million
	PPV	peak particle velocity
	PRM	paleontological resources monitor
	PRMMP	Paleontological Resource Monitoring and Mitigation Plan
	PRS	paleontological resources specialist
	PTC	Positive Train Control
	PTE	permission to enter
	PTO	permit to operate
	PTRR	Portland Terminal Rail Road Company
Q	QI	Qualified Investigator
R	RCRA	Resource Conservation and Recovery Act
	RF	radio frequency
	RFI	radio frequency interference
	RIMS	Regional Input-Output Modeling System
	RMS	root mean square
	ROD	Record of Decision
	ROG	reactive organic gas
	RP	responsible party
	RRP	restoration and revegetation plan
	RSA	Resource Study Area
	RSAC	Railroad Safety Advisory Committee
	RTIP	Regional Transportation Improvement Program
	RTP	Regional Transportation Plan

	RTPA	Regional Transportation Plan Agency
S	SAFETEA-LU	Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users
	SCS	Soil Conservation Service
	SCS	sustainable communities strategy
	SEL	sound exposure level
	SEM	scanning electron microscope
	SEMS	Standardized Emergency Management System
	SF_6	sulfur hexafluoride
	SFHA	Special Flood Hazard Area
	SHPO	State Historic Preservation Officer
	SIP	State Implementation Plan
	SLIC	spills, leaks, investigations, and cleanup
	SO_2	sulfur dioxide
	SOI	Sphere of Influence
	SOI	Secretary of Interior
	SOP	standard operating procedure
	SO_X	sulfur oxide
	SPCC	spill prevention, containment, and control
	SR	State Route
	SSP	system security plan
	SSPP	system safety program plan
	ST	short-term measurement
	STIP	State Transportation Improvement Program
	STU	shovel test unit
	SVE	soil-vapor extraction
	SVF	South Valley Floor

	SWPPP	Stormwater Pollution Prevention Plan
T	T	tesla
	TAC	toxic air containment
	TCE	trichloroethene
	TCP	traditional cultural property
	TDM	Transportation Demand Management
	TEM	transmission electron microscope
	TERPS	Terminal Instrument Procedure Surfaces
	TIP	Transportation Improvement Plan
	TMDL	total maximum daily load
	TOD	transit-oriented development
	TOG	total organic gas
	TPH	total petroleum hydrocarbon
	TPS	traction power substation
	TPSS	traction power supply system
	TSA	(U.S.) Transportation Security Administration
	TVA	threat and vulnerability assessment
U	U.S. EPA	U.S. Environmental Protection Agency
	U.S.C.	U.S. Code
	ULSD	ultra-low sulfur diesel fuel
	UPRR	Union Pacific Railroad
	URBEMIS	Urban Emissions Model
	USACE	U.S. Army Corps of Engineers
	USDA	U.S. Department of Agriculture
	USFWS	U.S. Fish and Wildlife Service
	USGS	U.S. Geological Survey

	USPS	U.S. Postal Service
	UST	underground storage tank
V	V/C	volume to capacity ratio (used to help define the level of service or operating condition)
	VdB	vibration velocity level
	VHF	very high frequency
	VHS	very high speed
	VMT	vehicle miles traveled
	VOC	volatile organic compound
	VSA	vibration sensitive area
W	WCD	Water Conservation District
	WiFi	wireless fidelity
	WiMAX	worldwide interoperability for microwave access
	WSA	water service area
	WWTP	wastewater treatment plant

Glossary

A

Accessibility: The ease with which a site or facility may be reached by passengers and others necessary to the facility's intended function. Also, the extent to which a facility is usable by persons with disabilities, including wheelchair users.

Adverse: Negative or detrimental.

Affected Environment: The physical, biological, social, and economic setting potentially affected by one or more of the alternatives under consideration.

Air Pollution: A general term that refers to one or more chemical substances that degrade the quality of the atmosphere.

Americans with Disabilities Act (ADA): Federal regulation establishing legal requirements for accessibility for those with disabilities.

Area of Potential Effect (APE): The area potentially affected by the construction and operation of the Project; for archaeological properties, considered to be the area of ground proposed to be disturbed during construction of the undertaking, including grading, cut-and-fill, easements, staging areas, utility relocation, borrow pits, and biological mitigation areas; for historic architecture, considered to be the proposed construction footprint and properties near the undertaking where the undertaking would result in a substantial change from the historic use, access, or noise and vibration levels that were present 50 years ago, or during the period of significance of a property, if different.

Area of Potential Impact (API): The area potentially affected by the construction and operation of the Project for all discipline areas under study.

At-Grade: At ground surface level; used to describe roadways, track alignments, and road-track intersections.

Attainment: An air basin is considered to be in attainment for a particular pollutant if it meets the federal or state standards set for that pollutant. See also **Maintenance** and **Nonattainment.**

A-Weighted Sound Level: A measure of sound intensity that is weighted to approximate the response of the human ear so it describes the way sound will affect people in the vicinity of a noise source.

B

Baseline: Foundation or basis to use for comparison purposes.

Best Management Practices (BMPs): Methods designed to minimize adverse effects to the environment. Examples of BMPs include practices for erosion and sedimentation controls, watering for dust control, perimeter silt fences, rice straw bales, and sediment basins.

C

Carbon Dioxide (CO_2): A colorless, odorless gas that occurs naturally in the atmosphere; fossil fuel combustion emits significant quantities of CO_2.

Carbon Monoxide (CO): A colorless, odorless gas generated in the urban environment primarily by the incomplete combustion of fossil fuels in motor vehicles.

Categorical Exclusion (CE): A category of actions which do not individually or cumulatively have a significant effect on the human environment and for which, therefore neither an environmental assessment nor an environmental impact statement is required.

Clean Air Act (CAA): The law that defines the U.S. Environmental Protection Agency's responsibilities for protecting and improving the nation's air quality and the stratospheric ozone layer. The CAA protects the general public from exposure to airborne contaminants that are known to be hazardous to human health.

Construction: The act or process of building.

Corridor: A geographic belt or band that follows the general route of a transportation facility (e.g., highway or railroad).

Council on Environmental Quality (CEQ): The Council on Environmental Quality (CEQ) is a division of the Executive Office of the President that coordinates federal environmental efforts in the United States and works closely with agencies and other White House offices on the development of environmental and energy policies and initiatives.

Criteria Pollutants: Pollutants for which federal and state air quality standards have been established: carbon monoxide (CO), sulfur oxides (SO_x), nitrogen oxides (NO_x), ozone (O_3), particulate matter with a diameter of 10 microns or less (PM_{10}), particulate matter with a diameter of 2.5 microns or less ($PM_{2.5}$), and lead (Pb).

Cultural Resources: Resources related to the tangible and intangible aspects of cultural systems, living and dead, that are valued by a given culture or contain information about the culture. Cultural resources include, but are not limited to, sites, structures, buildings, districts, and objects associated with or representative of people, cultures, and human activities and events.

Cumulative Impact: (1) CEQ — the result of two or more individual impacts that, when considered together, are considerable or that compound or increase other environmental impacts; (2) NEPA — an impact on the environment that results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions.

D

Decibel (dB): A logarithmic measurement of noise intensity.

Degreasers: Chemical products/substances that remove greases and oils from surfaces.

Disproportionately High Adverse Effects: An Environmental Justice term used to describe the unequal treatment to low income and minority populations as a result of a proposed project and action. Executive Order 12898 directs each federal agency to identify and address disproportionately high and adverse human health or environmental effects of its projects and actions.

Disturbance: A discrete natural or human-induced event that causes a change in the condition of an ecological system.

E

Ecosystem: An interconnected network of living organisms, including people, and their local physical environment; often viewed as an ecological unit.

Effect: A change in the condition or function of an environmental resource or environmental value as a result of human activity.

Endangered Species: Any species listed under the federal Endangered Species Act as being in danger of or threatened with extinction throughout all or most of its range.

Environmental Assessment (EA): Documentation required by the National Environmental Policy Act (NEPA) for certain actions when the significance of impacts of a proposed Project is uncertain. An EA is a concise public document for which a Federal agency is responsible that serves to briefly provide sufficient evidence and analysis for determining whether to prepare an environmental impact statement or a finding of no significant impact; aid an agency's compliance with NEPA when no environmental impact statement is necessary; and, facilitate preparation of a statement when one is necessary. An EA includes brief discussions of the need for the proposal, of alternatives considered, of the environmental impacts of the proposed action and alternatives, and a listing of agencies and persons consulted.

Environmental Impact Statement (EIS): Documentation required by the National Environmental Policy Act (NEPA) for certain actions "significantly affecting the quality of the human environment." An EIS is a decision-making tool that presents detailed analysis of a proposed action and alternatives to the proposed action. The EIS presents the project's potential effects – both beneficial and adverse – and any mitigation measures to reduce adverse effects.

Environmental Justice: Identifying and addressing the potential for disproportionately high and adverse effects of programs, policies, and activities on minority and low-income populations.

Ethnicity: A grouping or categorization of people based on shared cultural traits such as ancestral origin, language, custom, or social attitude.

F

Federal Railroad Administration (FRA): An agency within the U.S. Department of Transportation that administers financial assistance programs and regulates the operation and safety of freight and passenger rail throughout the United States.

Footprint: The area covered by a facility or affected by construction activities.

G

General Conformity Rule: The requirement that federal, state, tribal, and local governments in air quality nonattainment or maintenance areas ensure that federal actions conform to the initiatives established in the applicable state implementation plan or tribal implementation plan.

Grade Crossing: The intersection of a railroad and a highway at the same elevation (grade); an intersection of two or more highways; an intersection of two railroads. Same as at-grade crossing.

Greenhouse Gases: A class of air pollutants believed to contribute to the greenhouse global warming effect, including nitrogen oxides (NO_x), hydrocarbons (HC), and carbon dioxide (CO_2).

Groundwater: Water contained and transmitted through open spaces within rock and sediment below the ground surface.

H

Habitat: An environment where plants or animals naturally occur; an ecological setting used by animals for a particular purpose (e.g., roosting habitat or breeding habitat).

Hazardous Materials: Any material that, because of quantity, concentration, or physical or chemical characteristics, poses a significant present or potential hazard to human health and safety, or the environment, if released.

Hazardous Waste: A hazardous material that is no longer of use and will be disposed of. Hazardous waste is regulated by the U.S. Environmental Protection Agency under the Resource Conservation and Recovery Act.

Hydrocarbons: Various organic compounds, including methane, emitted principally from the storage, handling, and combustion of fossil fuels.

I

Impact: A change in the condition or function of an environmental resource or environmental value as a result of human activity.

Indirect Impact: The consequences of a project's direct impacts. These impacts are generally not quantifiable and may occur over a larger area or a longer period.

Infrastructure: The facilities required for a societal function or service (such as transportation and utility infrastructure – roads, bridges, railroads, pipelines, power lines, etc.).

Intermodal: Transportation that involves more than one mode (e.g., walk, bike, auto, transit, taxi, train, bus, and air) during a single journey.

Intermodal Station: A transit station that provides connections among more than one mode of transportation.

L

Lead (Pb): A stable element that can have toxic effects and that persists and accumulates in the environment, humans, or animals.

Lead Agency: The public agency that has the principal responsibility for carrying out or approving a project or action and is responsible for preparing environmental review documents in compliance with CEQ and/or NEPA.

L_{eq}: A measure of the average noise level during a specified period of time.

L_{eq}(h), dBA: Equivalent or average noise level for the noisiest hour, expressed in A-weighted decibels.

M

Maintenance: An air basin that was formerly in nonattainment but now meets the established standards for that pollutant. See also **Attainment** and **Nonattainment**.

Mitigation: Action or measure undertaken to minimize, reduce, eliminate, or rectify the adverse impacts of a project, practice, action, or activity.

Mobility: Movement of people across areas.

N

National Ambient Air Quality Standards (NAAQS): Federal standards stipulating the allowable ambient concentrations of specific criteria pollutants.

National Environmental Policy Act (NEPA): Federal legislation that establishes national policies and goals for the protection of the environment and requires federal agencies to consider the environmental impacts of major federal projects or decisions, to share information with the public, to identify and assess reasonable alternatives, to identify appropriate measures to mitigate potential impacts, and to coordinate efforts with other planning and environmental reviews taking place. Codified at: 42 U.S.C.A. § 4331 et seq.

Nitrogen Oxides (NO_x): A class of pollutant compounds that include nitrogen dioxide (NO_2) and nitric oxide (NO), both of which are emitted by motor vehicles. See **Criteria Pollutants**.

Nonattainment: An air basin that exceeds federal or state standards for a particular pollutant. See also Attainment and Maintenance.

O

Ozone (O_3): A photochemical oxidant that is a major cause of lung and eye irritation in urban environments.

P

Particulate Pollution: Air pollution such as dust, soot, and smoke that is irritating but usually not poisonous. Particulate pollution also can include bits of highly toxic solid or liquid substances. Of particular concern are particles smaller than, or equal to, 10 microns (PM_{10}) or 2.5 microns ($PM_{2.5}$) in size.

Phase II Investigation: Part of an Environmental Site Assessment, which assesses whether identified historic on-site or off-site hazardous uses have impacted the soil and/or groundwater conditions beneath a property.

Potentially Contaminated Site: Land that may contain substances in or under the land that are potentially hazardous to health or the environment, but have not been tested yet for contamination.

Poverty Level: The income at which a family or individual is considered poor. In 2009 the U.S. Census Bureau defined the poverty level for a family of four as an income of $21,954 or less.

Practicable: Available and capable of being done after taking into consideration cost, existing technology, and logistics in light of overall project purposes.

Purpose and Need: The reason(s) why a project or action is undertaken, and the need(s) it is intended to meet or fulfill.

R

Reasonably Foreseeable Future Action: Those future actions that are likely to occur or probable, rather than those that are merely possible. Used in determining indirect and cumulative impacts for a Proposed Action.

Right-of-Way: A legal right of passage over a defined area of real property. In transit usage, the corridor along a roadway or railway that is controlled by a transit or transportation agency/authority.

S

Secondary Impact: Reasonably foreseeable indirect consequences to the environment caused by a proposed project that would occur either in the future or in the vicinity of, but not the same location as, the direct impacts associated with the project.

Section 4(f): Provisions originally enacted as Section 4(f) of the U.S. Department of Transportation Act of 1966 codified in 49 United States Code, Subtitle I, Section 303(c). Section 4(f) addresses the potential for conflicts between transportation needs and the protection of land for recreational use and resource conservation by providing protection for publicly owned parkland, recreation areas, and historic sites from use. Specifically, the provisions prohibit the Secretary of Transportation from approving any program or project that would require the use of any publicly owned land from a public park, recreation area, wildlife or waterfowl refuge, or land of an historic site of national significance as determined by the officials having jurisdiction over these lands unless there are no feasible and prudent alternatives to the use of these lands.

Section 6(f): Section 6(f) of the Land and Water Conservation Fund Act of 1964 prohibits the conversion of property acquired or developed with funds granted through the act to a non-recreational purpose without the approval of the National Park Service. Section 6(f) directs the Department of the Interior to ensure that replacement lands of equal value (monetary), location, and usefulness are provided as conditions to such conversions.

Sensitive Receiver: Noise-sensitive locations where increased annoyance can occur, such as residences, schools, hotels/motels, medical facilities, or other vibration-sensitive receivers.

Sensitive Receptors: Locations considered more sensitive to adverse effects from air pollution (e.g., residences; preschools and kindergarten through grade 12 schools; daycare centers; health-care facilities such as hospitals, retirement homes, and nursing homes; and parks and/or playgrounds).

Significant: In CEQ usage, describes an impact that is sufficiently adverse, intense, or prolonged to require mitigation. In NEPA, to determine an impact is significant the context and intensity (the degree to which the effects on quality of human environment are controversial, whether the action threatens a violation of federal, state or local law, and others) of the action must be considered.

Sound Exposure Level (SEL): A time-integrated metric (i.e., continuously summed over a time period) that quantifies the total energy in the A-weighted sound level measured during a transient noise event. SEL accounts for both the duration and the loudness of a noise event.

Sulfur Oxides (SOx): Sulfur-oxygen compounds that include the important criteria pollutants sulfur dioxide (SO_2) and sulfur trioxide (SO_3).

T

Train set: A complete single train, including engine(s) and cars.

Travel Time: The time spent traveling from a place of origin to a place of destination. Total travel time includes the time required to reach a station or an airport, time spent waiting for the next scheduled train or flight, time spent getting to the boarding area, time spent checking and retrieving luggage, time spent getting a rental car or taxi, as well as time spent to reach the final destination.

V

Vehicle Maintenance Facility (VMF): A dedicated facility for vehicle fueling, maintenance, repair and washing.

Vibration: A rapid linear motion of a particle or of an elastic solid about an equilibrium position.

Volatile Organic Compounds (VOCs): Colorless gaseous compounds originating, in part, from the evaporation and incomplete combustion of fuels. In the presence of sunlight VOCs react to form ozone, a pollutant regulated by the Clean Air Act Amendments.

Appendix B: Agency Communications

This appendix contains copies of key communications with agencies for this proposed project, in chronological order. This appendix contains:

- Federal Railroad Administration Categorical Exclusion Worksheet, Union Station Roof Replacement, August 26, 2011 Approval (first page only, full content of worksheet is available at PDC, up on request).
- Letter to Christine Curran, Oregon State Historic Preservation Office, from David Valenstein, Federal Railroad Administration, re: Request for Concurrence on Finding of No Adverse Effect for Geotechnical and Environmental Investigations, October 3, 2014.
- Letter to Christine Curran, Oregon State Historic Preservation Office, from David Valenstein, Federal Railroad Administration, re: Authorizing ODOT to Initiate Section 106 Consultations with SHPO, December 9, 2015.
- Memo to Laura Shick, Federal Railroad Administration, re: NEPA classification for Union Station Tracks and Building Project, July 5, 2016.
- Letter to David Valenstein, Federal Railroad Administration, from Ian Johnson, Oregon State Historic Preservation Office, re: Concurrence with Revised Determination of Eligibility Document for Union Station, April 15, 2016.

Federal Railroad Administration Categorical Exclusion Worksheet, Union Station Roof Replacement, August 26, 2011 Approval (first page only, full content of worksheet is available at PDC, up on request)

Federal Railroad Administration (FRA)
CATEGORICAL EXCLUSION WORKSHEET

Note: The purpose of this worksheet is to assist proposal sponsors in gathering and organizing materials for environmental analysis required under the National Environmental Policy Act (NEPA), particularly for proposals, which may qualify as Categorical Exclusions and to assist the FRA in evaluating requests from project sponsors for categorical exclusion determinations. Categorical Exclusions are categories of actions (i.e. types of projects) that the FRA has determined, based on its experience, typically do not individually or cumulatively have a significant effect on the human environment and which generally do not require the preparation of either an environmental impact statement or an environmental assessment.

Submission of the worksheet by itself does not meet NEPA requirements. FRA must concur in writing with the proposal sponsor's Categorical Exclusion recommendation for NEPA requirements to be met. Please complete this worksheet using compatible word processing software and submit and transmit the completed form in electronic format.

For Agency Use		*Date Received:*
Reviewed By: C.Mcwan *Date:* 8/25/11	*Recommendation for action:* ☒ *Accept* ☐ *Return for Revisions* ☐ *Not Eligible*	
Comments:		
Concurrence by Counsel: ☐ *Accept Recommendation* ☐ *Return with Comments*	*Reviewed By:* [signature] *Date:* 8/26/11	
Comments:		
Concurrence by Approving Official: [signature]	*Date:* 8/26/11	

I. **PROPOSAL DESCRIPTION**

Proposal Sponsor	**Date Submitted**	**FRA Identification Number (if any)**
Oregon Department of Transportation	8/05/2011	FR-HSR-0010-10-01-00
Proposal Title		
Union Station Roof Replacement		
Location (Include Street Address, City or Township, County, and State)		
Union Station, 800 NW Sixth Avenue, Portland, Multnomah County, Oregon		
Contact Person	**Phone**	**E-mail Address**
Betsy Imholt	503.986.4077	betsy.imholt@odot.state.or.us

Note: Fully describe the proposal including specifics that may be of environmental concern such as: widening an embankment to stabilize roadbed; repairing or replacing bridge piers foundations, including adding rip-rap in a waterway; earthwork and altering natural (existing) drainage patterns and creating new water discharge; contaminated water needing treatment; building a new or adding on to a shop building; fueling or collection of fuel or oil and contaminated water; building or extending a siding; and building or adding on to a yard.

Description of Proposal

Maintenance and repair of Union Station, including: in-kind-replacement of severely deteriorated metal roof tiles, gutters, downspouts; partial seismic stabilization where allowed by roof repairs; and repair and/or in-kind-replacement of windows and doors as dictated by severity of individual existing conditions. Construction activities will occur exclusively on the station building and annex. Staging will be located on or within the station or annex building, or on adjacent developed property of the same owner. No temporary facilities, disposal or borrow sites, right-of-way acquisitions, utility relocations, or road closures or detours will be necessary. All activities except for additional asbestos abatement were approved by FRA CE Dated 3/26/10(attached).

Letter to Christine Curran, Oregon State Historic Preservation Office, from David Valenstein, Federal Railroad Administration, re: Request for Concurrence on Finding of No Adverse Effect for Geotechnical and Environmental Investigations, October 3, 2014

U.S. Department of Transportation

Federal Railroad Administration

1200 New Jersey Avenue, SE
Washington, DC 20590

OCT 0 3 2014

Christine Curran
Associate Deputy State Historic Preservation Officer
State Historic Preservation Office
725 Summer Street NE, Suite C
Salem, OR 97310-1271

Subject: Request for Concurrence
Finding of No-Adverse Effect
(Archaeology and Built Environment)
Portland Union Station Tracks and Building Project:
Geotechnical and Environmental Investigations
Portland, Multnomah County, Oregon
ODOT Key No. 18074
ID# FR-HSR-0094-01-01

Dear Ms. Curran:

The Federal Railroad Administration (FRA), in partnership with the Oregon Department of Transportation (ODOT) and the Portland Development Commission (PDC), prepared the following letter in compliance with Section 106 of the National Historic Preservation Act. The project's federal nexus is funding from the Federal Railroad Administration. The letter includes a combined Finding of No-Adverse Effect (built environment and archaeological resources) for the Portland Union Station Tracks & Building Project's geotechnical and environmental investigations phase, which precedes the project's engineering design phase.

Project Description:
The proposed Portland Union Station Tracks and Building Project would stabilize and rehabilitate Union Station and repair the adjoining tracks in the City of Portland, Multnomah County, Oregon (T1N, R1E, Section 34); Figure 1). Geotechnical and environmental investigations must be undertaken prior to project design to ascertain subsurface characteristics, presence of hazardous building materials, and structural integrity of the station.

The geotechnical investigations will involve excavating 18 borings and two cone penetration tests (Figure 2). The environmental tests for soil and water contamination are proposed in 44 areas (Figure 3). Testing will be accomplished with a track mounted two and one-quarter inch outer diameter push probe

The proposed project will also sample up to 50 locations for hazardous building materials and up to 20 locations for lead paint. The project also proposes in-plane sheer testing of Union Station brick, reattaching one or more marble wall panels in the main waiting room, and sample steel from outside canopy columns.

Identified Consulting Parties:
Cowlitz Indian Tribe
The Confederated Tribes and Bands of the Yakama Nation
The Confederated Tribes of the Grand Ronde Community of Oregon
The Confederated Tribes of Siletz
The Confederated Tribes of the Warm Springs Reservation of Oregon

Summary of Resources Present:

Built Environment:
The project is located in and around Portland's Union Station, which was listed in the National Register of Historic Places in 1975. The station opened on February 14, 1896. Previously, in 1882, the firm of McKim, Mead, and White had completed preliminary plans on a much larger station, but it never came into being. They later designed New York's Pennsylvania Station. The architectural firm of Van Brunt and Howe of Kansas City, Missouri, designed the present station, which sits on river dredgings over what locals called "Couch Lake," named after Captain John H. Couch, who platted land in northwest Portland, north of W. Burnside, from the Willamette River to NW 23rd Ave.

One reviewer characterized Union Station as "modified Romanesque of extremely ornamental exterior, with stone and terra cotta, art moulded bricks, pressed bricks and carved stone." The building is an asymmetrical group of hip-roofed blocks arranged longitudinally with a central 150-foot clock tower.

Union Station's interior originally contained a two-story wood-paneled and beamed ceiling waiting room with Romanesque columns and flat-iron scrollwork. It also had an assortment of other rooms on the main floor for various functions associated with train travel. Upper floors in the wings contained office space. In 1930, the station owners contracted with the up and coming Portland architect Pietro Belluschi, of the firm of A. E. Doyle, to remodel the waiting room. He removed all of the Romanesque elements and replaced them with marble floors, walls and fixtures, and a bronze-beamed and coffered ceiling in the Neo-Classical style. Office spaces remained unchanged. The tower received its iconic "Go By Train" and "Union Station" neon signs in 1948.

Portland's Union Station is the only major railroad station built in Oregon and one of the only extant major stations on the West Coast. The station has had several owners over the years. Since 1971, it has provided passenger facilities only for Amtrak trains. In 1987, the Portland Terminal Railroad Company transferred ownership of the station and surrounding land to the Portland Development Commission. Recent projects have replaced failing metal roof tiles and roof membranes, repointed masonry, and rebuilt several sets of oak doors.

Union Station possesses high integrity for location, design, materials, workmanship, feeling, and association. It has suffered some setting encroachments from residential development on land formerly part of the train yard. Union Station is significant under National Register Criterion C for architecture and under National Register Criterion A for its role in passenger rail transportation in the Pacific Northwest.

Archaeology:
Two previous archaeological surveys have been conducted that overlap the current project area (Iverson et al. 2000; Murphy et al. 2000). Neither survey identified historic properties in the vicinity of the current project area nor have other cultural resources have been recorded.

Historic-era archaeological materials were allegedly encountered during road construction at the Station in recent years. However, no site form was submitted to SHPO and the find was not formally reported. SHPO staff alerted PDC to the alleged finds.

Finding of Effect:

Effects to the Built Environment
Hazardous Building Material Testing
As proposed, the project's geotechnical and environmental investigations phase will collect from Union Station up to 50 samples for suspected asbestos-containing materials and up to 20 paint samples for lead. The project will likely not test the roof, since it was replaced in 2011/2012. Specialists may conduct asbestos-containing material sampling in any and all areas of the building's interior and exterior spaces. However, care will be taken to collect samples, which are about the size of a quarter, in unobtrusive areas. When the same material is present in both a public area and a private area, samples will be collected in the private area only; those samples will be considered representative of the same material in the public area. The project will repair sampling sites so as not to leave a cosmetic defect where specialists collected samples.

Specialists may conduct lead testing in any and all areas of the building interior and exterior. They will conduct most lead testing with hand-held x-ray fluorescence (XRF) analyzers, direct-reading instruments that precludes the need to collect a physical sample. They may collect limited paint chip samples, however, to confirm the accuracy of the XRF analyzer. The project will repair paint sampling sites by touching up the sampling site with paint.

The project will carry out hazardous building material testing in a way that it will preserve those materials, features, finishes, spaces, and spatial relationships that, together, give Union Station its historic character. **The hazardous building material work will have No-Adverse Effect (Built Environment) on those features that make Union Station significant.**

Interior Structural Testing
The project proposes to conduct in-plane brick shear tests to check mortar strength. These are local tests that affect a small area (about 3 feet x 3 feet). Test locations will be chosen based on least impact to historic materials and away from public areas. The project also proposes to remove and re-attach one or more of the1930s marble panel in the main waiting room to determine how they are attached to the wall and the condition of the attachment. Specialists will choose locations based on the least impact to building operations. The project also proposes to sample the steel from a few of the canopy columns along the walkways outside of the station. The project will repair columns that specialists sampled. Finally, the project proposes to remove and replace existing building materials at discrete locations to gain visual access to the hidden structure behind. Specialists will chose locations that avoid impacts to historic finishes and building operations.

The project will carry out interior structural testing in a way that it will minimize impacts to those materials, features, finishes, spaces, and spatial relationships that, together, give Union Station its historic character. **Interior structural testing will have a Finding of No-Adverse Effect (Built Environment) on those features that make Union Station significant.**

Effects to Archaeological Resources

While no archaeological sites have been recorded with the current project area, the project setting, historic land use and alleged, unreported artifacts being recovered during previous subsurface construction, suggest that buried cultural materials may exist. Given the predominance of impervious surfaces present in the project area, traditional archaeological site identification techniques are not viable. Therefore, ODOT recommends that a professional archaeologist monitor all geotechnical and environmental borings to determine the presence or absence of cultural materials. A SHPO excavation permit must be issued to the monitoring archaeologist prior to all boring activities. **As there is no known archaeological site present, the geotechnical and environmental investigations will have a Finding of No Historic Properties Affected (Archaeology).**

Conclusion

Application of Section 106 Criteria for Identification and Evaluation of Historic Properties (36 CFR 800.4 and 5) indicates a Finding of No-Adverse Effect for the Portland Union Station Tracks and Building Project's Geotechnical and Environmental Investigations phase. ODOT, acting as an agent for the Federal Rail Administration, requests your concurrence with a FINDING OF NO –ADVERSE EFFECT (Archaeology and Built Environment) for the Portland Union Station Tracks and Building Project: Geotechnical and Environmental Investigations. All supporting documentation is attached.

If you have any questions about the proposed project, please contact Tobin C. Bottman, M.S., RPA, ODOT at (503) 986-3783 or Robert W. Hadlow, Ph. D., ODOT at (503) 731-8239. Jennifer Papazian, USDOT, at (617) 494-3913.

Sincerely,

David Valenstein
Division Chief
Environmental and System Planning

The State Historic Preservation Office concurs that the Portland Union Station Tracks & Building Geotechnical Investigations project will have No Effect on Historic Properties (Archaeology).

SHPO Official (Archaeology)	**Date**

The State Historic Preservation Office concurs that the Portland Union Station Tracks & Building Geotechnical Investigations project will have a No-Adverse Effect on Historic Properties (Built Environment).

____

SHPO Official (Built Environment **Date**

Copies to:

Casey Barney, Confederated Tribes and Bands of the Yakama Nation
James Gordon, Cowlitz Indian Tribe
Dustin Kennedy, Confederated Tribes of the Grand Ronde Community of Oregon
Robert Kentta, Confederated Tribes of Siletz
Melissa Liebert, Confederated Tribes of the Warm Springs Reservation of Oregon
Jennifer Papazian, Federal Railroad Administration
Elise Hendrickson, Portland Development Commission
Tobin C. Bottman, ODOT Archaeologist
Robert W. Hadlow, Ph.D., ODOT Senior Historian
Michael Holthoff, ODOT Environmental Project Manager

Key # 18074, File Type C

References:

Hartwig, Paul

1975 National Register of Historic Places Nomination, Union Station, Portland, Multnomah County, Oregon. NRIS 75001595.

Iverson, David R., Laura R. Murphy, Leonard A. Forsman, Lynn L. Larson, Jason B. Cooper

2000 Field Reconnaissance of Alternate Routes for the Proposed Fiber Optic Line Between Portland and Seattle Project, Cowlitz County Washington and Multnomah and Columbia Counties, Oregon. LAAS Technical Report #2000-11. Prepared for Jones & Stokes Associates, Inc. by Larson Anthropological Services Limited, Gig Harbor.

Murphy, Laura R., Dennis E. Lewarch, Leonard A. Forsman, Michael J. Madson, David R. Iversen, Lynn L. Larson

2000 Fiber Optic Line Between Portland and Seattle Cultural Resources Assessment, Clark, Cowlitz, Lewis, Thurston, Pierce and King Counties, Washington, and Multnomah County, Oregon. LAAS Technical Report #2000-08. Prepared for Jones & Stokes Associates, Inc. by Larson Anthropological Services Limited, Gig Harbor.

Figure 1. Project area location.

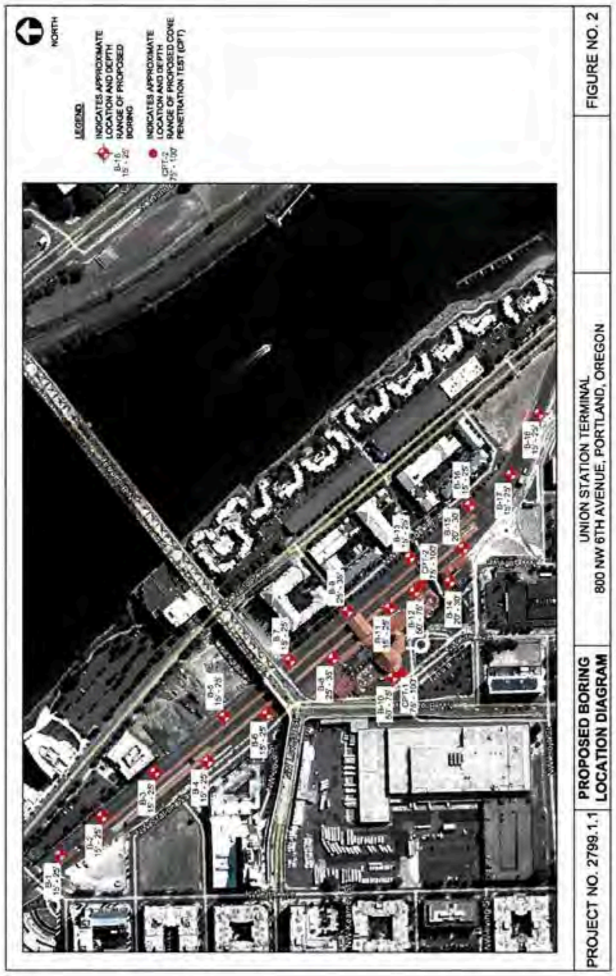


Figure 2. Proposed locations of geotechnical borings and cone tests.

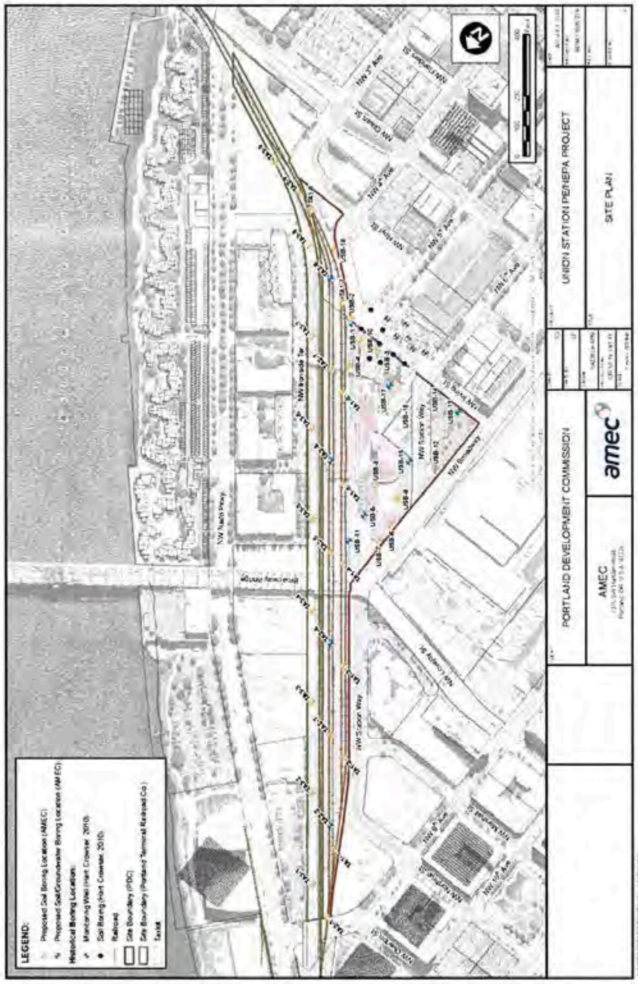


Figure 3. Proposed locations of environmental borings.

Letter to Christine Curran, Oregon State Historic Preservation Office, from David Valenstein, Federal Railroad Administration, re: Authorizing ODOT to Initiate Section 106 Consultations with SHPO, December 9, 2015

U.S. Department
of Transportation

**Federal Railroad
Administration**

1200 New Jersey Avenue, SE
Washington, DC 20590

DEC 09 2015

Christine Curran
Associate Deputy State Historic Preservation Officer
State Historic Preservation Department
725 Summer Street NE, Suite C
Salem, OR 97310-1271

Dear Ms. Curran:

The Oregon Department of Transportation (ODOT) has received and continues to receive financial assistance from the Federal Railroad Administration (FRA) to conduct planning studies for and/or to implement a variety of railroad improvement projects. To facilitate timely completion of the required environmental reviews for these activities, the FRA has authorized ODOT to initiate consultations with your office regarding consistency with the National Historic Preservation Act (NHPA). This authorization is in accordance with the NHPA regulations for the protection of historic properties at 36 CFR Section 800.2(c)(4). By way of this letter, the FRA is extending previous authorizations; ODOT is hereby authorized to initiate consultations with your office through December 31, 2016. The FRA has been and will continue to monitor ODOT's consultations with your office to ensure they are carried out in accordance with the requirements of Section 106 of the NHPA. The FRA may terminate this authorization in writing if we believe those requirements are not being met.

If you or your staff have any concerns about the ODOT activities receiving financial assistance from the FRA or any of the information or documents submitted to your office by ODOT for purposes of Section 106 compliance for these activities, please contact Laura Shick of my staff at laura.shick@dot.gov or (202) 366-0340. The FRA appreciates your cooperation in satisfying the requirements of the NHPA.

Sincerely,

for David Valenstein
Division Chief, Environmental & Corridor Planning

cc: Jim Cox, ODOT
Michael Holthoff, ODOT
Kurt Roedel, ODOT

Memo to Laura Shick, Federal Railroad Administration, re: NEPA classification for Union Station Tracks and Building Project, July 5, 2016

Memorandum

To: Laura Shick, Environmental Protection Specialist, FRA, Washington, DC

From: Elise Hendrickson, Construction Services Coordinator, PDC
Michael G. Holthoff, Environmental Project Manager, ODOT, Salem
Lynda Wannamaker, Principal Environmental Consultant, Wannamaker Consulting

Cc: Jina Bjelland, Director, Real Estate and Lending, PDC
Robert W. Hadlow, Ph.D., ODOT, Region 1, Portland
Sarah Harpole, Senior Project / Program Manager, PDC
Tova R. Peltz, Geo-Environmental Manager, ODOT, Region 1, Portland
John Schnaderback, High-Speed Rail Engineer, ODOT, Salem

Date: July 5, 2016

RE: NEPA Classification for Union Station Tracks and Building Project
Portland, Multnomah County, Oregon
ODOT Key No. 18074
FRA No. FR-HSR-0094

On May 25, 2016, representatives from the Federal Railroad Administration (FRA), the Oregon Department of Transportation (ODOT) and the Portland Development Commission (PDC) met to review the preliminary preferred alternative for the Union Station Tracks and Building Project. During that meeting and in subsequent meetings there was discussion regarding the National Environmental Policy Act (NEPA) classification for the environmental review of the proposed action. As a result of those discussions, ODOT and the PDC have considered the factors in determining the required level of environmental review for the proposed action and recommend that the FRA assign a NEPA classification for the project of "Categorical Exclusion."

Elements of Proposed Action

Construction of Portland's Union Station began in 1892 and it opened for service on February 14, 1896. From 1896 to 1927, the main terminal building received some modifications. However, from 1927 to 1930,the main terminal building received some major renovations, especially in the waiting room and adjacent spaces.. During World War II, the station saw the addition of two new structures, with one surviving into the twenty-first century. In 1975, the station was placed on the National Register of Historic Places (NRHP). Between 1947 and 2007, serial renovations and modifications have altered the station and associated buildings, platforms and canopies. Despite these renovations, the building and its associated facilities have deteriorated. Additionally, over the past 70 years, significant changes have occurred in building code requirements and in the nature of freight and passenger rail operations which, combined, are the impetus for the 2007 rehabilitation program initiated by the PDC.

Key elements of the proposed action include:

- Building Improvements
  - Structural / seismic code requirements
  - Fire / Life safety code requirements

  - Mechanical, electrical, and plumbing systems' upgrades
- Architectural / Operational Improvements
  - ADA / Accessibility
  - Amtrak Operations
  - Passenger Circulation, Usability, Comfort and Security
  - Leasable Tenant Spaces Access, Circulation, Function and Security
  - Historic Preservation
  - Architectural Preservation of Annex
- Railside Improvements
  - ADA / Accessibility
  - Amtrak Operations
  - Passenger Circulation and Safety
  - Freight and Passenger Rail Operations and Maintenance

Preliminary Preferred Alternative

Through the alternatives development and evaluation phase of the project, ODOT and the PDC engaged in a robust process with the Oregon State Historic Preservation Office (Oregon SHPO) to determine the most appropriate scope of improvements for Union Station, a National Register of Historic Places (NRHP)-listed resource. ODOT and the PDC considered preserving the stature and integrity of this Section 106 resource was a significant priority. The two agencies conducted limited outreach with the public and other community stakeholders. In addition, they were working closely with the Oregon SHPO to determine the scope of improvements for Union Station. Also during the alternatives development and evaluation phase, ODOT and PDC consulted extensively with Amtrak regarding building and rail yard improvements. Based on this consultation, ODOT and the PDC evaluated a range of building and rail improvement alternatives against the project's Purpose and Need, and Goals and Objectives (PNGO). In May 2016, ODOT and the PDC identified a preliminary preferred alternative that most effectively met the project's PNGO and preserve Union Station's historic integrity.

FRA's Categorical Exclusion Categories

The proposed action meets the FRA criteria for environmental review under the Categorical Exclusion (CE) classification for the following CE categories outlined in the FRA Categorical Exclusion Worksheet [FRA F 217 (08/15)] as follows:

> 16) Minor rail line additions including construction of side tracks, passing tracks, crossovers, short connections between existing rail lines, and new tracks within existing rail yards, provided that such additions are consistent with existing zoning, do not involve acquisition of a significant amount of right of way, and do not substantially alter the traffic density characteristics of the existing rail lines or rail facilities. [64 FR 28545 (May 26, 1999); 78 FR 2713 (January 14, 2013)]

19) Improvements to existing facilities to service, inspect, or maintain rail passenger equipment, including expansion of existing buildings, the construction of new buildings and outdoor facilities, and the reconfiguration of yard tracks. [64 FR 28545 (May 26, 1999); 78 FR 2713 (January 14, 2013)]

21) Alterations to existing facilities, locomotives, stations and rail cars in order to make them accessible for the elderly and persons with disabilities, such as modifying doorways, adding or modifying lifts, constructing access ramps and railings, modifying restrooms, and constructing accessible platforms. [78 FR 2713 (January 14, 2013)]

24) Installation, repair and replacement of equipment and small structures designed to promote transportation safety, security, accessibility, communication or operational efficiency that take place predominantly within the existing right-of-way and do not result in a major change in traffic density on the existing rail line or facility, such as the installation, repair or replacement of surface treatments or pavement markings, small passenger shelters, passenger amenities, benches, signage, sidewalks or trails, equipment enclosures, and fencing, railroad warning devices, train control systems, signalization, electric traction equipment and structures, electronics, photonics, and communications systems and equipment, equipment mounts, towers and structures, information processing equipment, and security equipment, including surveillance and detection cameras. [78 FR 2713 (January 14, 2013)]

26) Assembly or construction of facilities or stations that are consistent with existing land use and zoning requirements, do not result in a major change in traffic density on existing rail or highway facilities and result in approximately less than ten acres of surface disturbance, such as storage and maintenance facilities, freight or passenger loading and unloading facilities or stations, parking facilities, passenger platforms, canopies, shelters, pedestrian overpasses or underpasses, paving, or landscaping.[78 FR 2713 (January 14, 2013)]

Consideration of Potential "Extraordinary Circumstances" and FRA criteria for CEs
The proposed action further meets the FRA criteria for environmental review under the CE classification under Section 4(e)(1)-(7) [64 FR 28545 (May 26, 1999) [FRA Environmental Procedures]]:

(1) The action is not judged to be environmentally controversial from the point of view of people living within the environment affected by the action or controversial with respect to the availability of adequate relocation housing;

- During the alternatives development and evaluation phase of the project, ODOT and the PDC worked directly with the Oregon SHPO and Amtrak to determine the most appropriate scope of improvements to Union Station, an NRHP-listed Section 106 resource. They also conducted public outreach that included briefings at public meetings held by the Portland Historic Landmarks Commission, the Portland Development Commission Board, the Broadway Corridor Stakeholder Advisory Committee, the Broadway Corridor Technical Advisory Committee, the Portland Business Alliance Central City Committee, Portland City Council, Portland Planning &

Sustainability Commission, Pearl District Business Association, Old Town / Chinatown Community Association, and the American Institute of Architects Urban Design Forum for the Broadway Corridor; presentations at the Broadway Corridor Public Open Houses and Old Town / Chinatown Open House; presentations to operators and area employers such as Amtrak, Union Pacific Railroad, Burlington Northern Santa Fe Railway, Portland Terminal Railroad, Northwest Evaluation Association, and eROI; and, on-line and in-field surveys. Outreach to the broader public has thus far been limited. The PDC and ODOT have not received any feedback about the project that could be judged to be controversial.

- The proposed action will not displace nor require relocation housing for residential units.
- With the identification of the preliminary preferred alternative and following the formal initiation of the Section 106 process on June 15, 2016, the PDC and ODOT will implement a more extensive public outreach program for project stakeholders and the interested public (including consulting parties determined by the Oregon SHPO) to review the preliminary preferred alternative and provide feedback. The PDC and ODOT will consider any feedback received in the refinement and selection of the preferred alternative.

(2) The action is not inconsistent with any Federal, State, or local law, regulation, ordinance, or judicial or administrative determination relating to environmental protection;

- The proposed action would take place within an existing rail yard and station that has been in active use as a rail corridor. ODOT and the PDC conducted a preliminary review of environmental conditions during the development of the project's Detailed Work Plan (2013). They conducted additional environmental investigations during the alternatives development phase. Based on the preliminary environmental review and subsequent environmental investigations, the PDC and ODOT believe that the proposed project is consistent with Federal, State and local laws and regulations relating to environmental protection.

(3) The action will not have any significant adverse impact on any natural, cultural, recreational, or scenic environment(s) in which the action takes place, or on the air or water quality or ambient noise levels of such environment(s);

- Based on the preliminary environmental review and subsequent environmental investigations, the PDC and ODOT believe that the proposed project would not create any significant adverse impacts to the human or natural environment. Additional environmental investigations will be prepared to demonstrate that the conditions and criteria for the CE are satisfied and that significant adverse effects will not result from the proposed action.

(4) The action will not: use properties protected under Section 4(f) of the US Department of Transportation Act or adversely affect properties protected under Section 106 of the National Historic Preservation Act (NHPA); involve new construction located in a wetlands area; or affect a base floodplain;

- Since 2014, ODOT and the PDC have worked closely with the Oregon SHPO to determine the most appropriate scope of improvements to Union Station, an NRHP-listed Section 106 "historic property." After public outreach (including consulting parties identified by the Oregon SHPO) and the refinement of the preferred alternative, ODOT and the PDC will prepare a Section 106 Finding of Effect for impacts to Union Station. ODOT and the PDC anticipate that the level of effect will not be adverse and that the Oregon SHPO will concur on a Finding of No Adverse Effect.
- ODOT anticipates no Section 4(f) "use" of Union Station, which is a "historic site" as defined in 23 CFR 774.17 and a "historic transportation facility" as defined in 23 CFR 774.13(a). A proposed action with No Adverse Effect upon a historic transportation facility is not a Section 4(f) use of that historic site.
- The proposed action would not involve construction in wetland areas or affect a base floodplain.

(5) The action will not cause a significant short-or long-term increase in traffic congestion, or other significant adverse environmental impact on any mode of transportation;

- The proposed action would cause the temporary closure of NW 9th Avenue during track construction, which would be mitigated through traffic control Best Management Practices (BMPs).
- The proposed action would cause some delays – but no closures - to freight and passenger rail, which would be mitigated through rail traffic control BMPs.
- ODOT and the PDC do not anticipate a significant increase in short- or long-term increases in traffic congestion or other significant adverse effects on any mode of transportation.

(6) The action is not an integral part of a program of actions which, when considered separately, would not be classified as major FRA actions, but when considered together would be so classified; and

- The proposed action is comprised of several actions which individually and cumulatively are not anticipated to have a significant adverse effect on the environment and would, therefore, meet the FRA criteria for environmental review under the CE classification.

(7) Environmental assessment or documentation is not required by any Federal law, regulation, guideline, order, or judicial or administrative determination other than these Procedures.

- No Federal law, regulation, guideline, order or other determination requires an Environmental Assessment or other documentation for the proposed action.

Conclusion and Request for Concurrence

With the identification of a preliminary preferred alternative, ODOT and the PDC have considered the factors in determining the required level of environmental review and have concluded that the proposed action is eligible for environmental review as a Categorical Exclusion in compliance with FRA's Procedures for Considering Environmental Impacts [64 FR 28545 (May 26, 1999) [FRA Environmental

Procedures]], FRA's Updated Procedures for Considering Environmental Impacts by adding categorical exclusions [78 FR 2713 (January 14, 2013)], and the Council on Environmental Quality's (CEQ) National Environmental Policy Act (NEPA) implementing regulations (40 CFR §§ 1500-08). Our conclusion is based on:

- The preliminary environmental review and subsequent environmental investigations have not revealed any new environmental information or concerns or potential for significant adverse effects.
- ODOT and the PDC have engaged in a robust process in coordinating closely with the Oregon SHPO to determine the most appropriate scope of improvements to Union Station, an NRHP-listed Section 106 resource, and to reach an anticipated No Adverse Effect determination under Section 106 and no Section 4(f) use.
- ODOT and the PDC will conduct an assessment of potential noise and vibration impacts on existing residential units which abut the Union Station rail yard. ODOT and the PDC do not anticipate any significant impacts because of the residential units' proximity to the existing rail yard. Even so, ODOT and the PDC plan to mitigate impacts, as appropriate.
- ODOT and the PDC will conduct a more extensive public outreach program in compliance with Section 106 to provide the public and other interested parties the opportunity to review the preliminary preferred alternative and provide feedback on possible adverse effects and their resolution, and will consider any feedback received in the refinement of the preferred alternative.
- Other interested parties include consulting parties identified by the Oregon SHPO: Cowlitz Indian Tribe, The Confederated Tribes and Bands of the Yakama Nation, The Confederated Tribes of the Grand Ronde Community of Oregon, The Confederated Tribes of Siletz, The Confederated Tribes of the Warm Springs Reservation of Oregon, Pacific Northwest Chapter of the National Railway Historical Society, Oregon Rail Heritage Foundation, Architectural Heritage Center, Restore Oregon, Pacific Coast Chapter of the Railway and Locomotive Historical Society, Minnesota Historical Society (repository for Northern Pacific Railway and James J. Hill historical documents), Railroad Station Historical Society, Northern Pacific Railway Historical Association, SP&S Railway Historical Society (Spokane, Portland and Seattle Railway), Union Pacific Historical Society, Oregon Historical Society, Association of Oregon Rail and Transit Advocates (AORTA), American Institute of Architects Historic Resources Committee (HRC), and Portland Terminal Railroad.
- Outreach opportunities will be publicly noticed and include statements identifying the proposed action as a federally funded action and that the outreach is in compliance with Section 106.
- ODOT and the PDC will continue to conduct and document environmental investigations, the project process and decisions, and feedback received during the public outreach process. This additional documentation and these technical studies will be included with the CE to

demonstrate that the conditions and criteria for the CE are satisfied and that significant adverse effects will not result from the proposed action.

- ODOT and the PDC will make project documents available for review by the public and other interested parties. Project documents would include the revised Determination of Eligibility (2016), any technical studies conducted, the Alternatives Analysis report, and the Finding of Effects document. The public and other interested parties will be provided the opportunity to express their views on the proposed action, the possible adverse effects on the historic resource, and alternatives to resolving adverse effects.

ODOT and the PDC request FRA's concurrence to continue to review the proposed action as a Categorical Exclusion supported by the documentation described in this memo.

If you have any questions or would like additional information, please contact Michael G. Holthoff, ODOT, at (503) 986-3428 or Elise Hendrickson, PDC, at (503) 823-3214.

Letter to David Valenstein, Federal Railroad Administration, from Ian Johnson, Oregon State Historic Preservation Office, re: Concurrence with Revised Determination of Eligibility Document for Union Station, April 15, 2016

Oregon

Kate Brown, Governor

Parks and Recreation Department
State Historic Preservation Office
725 Summer St NE Ste C
Salem, OR 97301-1266
Phone (503) 986-0690
Fax (503) 986-0793
www.oregonheritage.org

April 15, 2016

Mr. David Valenstein
Federal Railroad Administation
1200 New Jersey Avenue, SE
Washington, DC 20590

RE: SHPO Case No. 14-1679
Portland Union Station Tracks and Building Project ODOT Key 18074
Station Rehab and Track Repair
1N 1E 34, Portland, Multnomah County

Dear Mr. Valenstein:

The Oregon SHPO appreciates your agency's complete evaluation of Union Station in Portland, OR listed in the National Register of Historic Places in 1975. As noted, the 1975 nomination document and subsequent amendment failed to provide a clear definition of the historic property or fully evaluate its significance. These issues are resolved by the provided information, and our office supports the document's conclusions.

The Oregon SHPO concurs with your agency's finding that the period of significance for the property is 1893 through 1950, reflecting the importance of train travel under Criterion A, and the original design of the resource and subsequent modifications and additions that have acquired significance in their own right under Criterion C. We further agree that the enlarged boundary now encompasses all historic resources related to the main station building during the period of significance, including the Main Terminal and Nursery (Diaper Depot) addition; Annex Building and associated Front Yard Landscape; Interlocking Tower; Tracks 1 through 4, counted as a single resource; Platform Canopies 1 and 2; High Shed; and Block Y Island and associated parking area. While acknowledging the "serial modification" of the tracks, platform canopies, and train shed, we believe that these resources yet retain sufficient historic integrity to be contributing resources, but that these structures are not individually eligible for listing due to alterations and a lack of individual significance. We also concur that the Butler Building and Pedestrian Arch Bridge are not eligible for listing.

Our office finds that the evaluation of key character-defining features for each contributing resource, including the identification of primary, secondary, tertiary, and non-historic interior spaces to be complete and reflective of both the physical historic integrity and significance of the resource. Our office expects that preservation efforts will focus on the main contributing buildings and primary and secondary interior spaces; however, we encourage the retention of historic features, materials, and details wherever they exist in order to potentially mitigate for necessary alterations expected as part of future planned facility improvements. The Oregon SHPO looks forward to working with your office and other partner agencies on this project. Please contact me with any further questions, comments, or concerns.

Sincerely,

Ian P. Johnson, M.A.
Associate Deputy SHPO
(503) 986-0678

OREGON INVENTORY OF HISTORIC PROPERTIES

SECTION 106 DOCUMENTATION FORM

Individual Properties

Property Name: UNION STATION	Street Address: 800 NW 6th Avenue	City, County: Portland, Multnomah, OR
Project Name: Portland Union Station Tracks and Building Project		Agency project #: ODOT Key No. 18074
Agency: Portland Development Commission (PDC)		SHPO Case#:
Location Coordinates (to sixth decimal place): Latitude: 45.529100° Longitude: -122.676756°		Is the property listed in the National Register of Historic Places? ☑ YES – Individually ☐ NO ☐ YES – In a district

Union Station, Looking NE from NW Station Way & NW Irving St, April 2015

Surveyor: George Kramer, Heritage Research (for Portland Development Commission)	Date Recorded: Aug 2015
National Register Findings: ☑ **Eligible:** ☑ Individually ☐ As part of District NR Criteria: ☑ A ☐ B ☑ C ☐ D ☐ **Not Eligible:** ☐ Irretrievable integrity loss ☐ Not 50 Years ☐ Fails to meet NR Criteria	

State Historic Preservation Office Comments – *Official Use Only*:

Eligibility: ☐ **Concur** ☐ **Do Not Concur:**

RECEIVED STAMP RECEIVED

Signed Ian P. Johnson Date 4/15/16 MAR 18 2014

OR SHPO CONTACT INFORMATION STAMP
IAN JOHNSON
503-986-0678
Ian.Johnson@oregon.gov

Comments:

See comments dated 4/15/16

Appendix C: Public Involvement Materials

This appendix contains examples of public involvement materials used during the early phase of this proposed project. The full content of outreach materials used is available for review at the Portland Development Commission, upon request and advance notice.

This appendix contains:

- Email from Sarah Harpole, PDC Project Manager, to Stakeholder Committee members re: Union Station Phase III Kick-off, June 13, 2013.
- Union Station PE/NEPA Project, Stakeholder Advisory Meeting #1 and Risk Management Workshop Agenda, September 23, 2014.
- Sample slides from Broadway Corridor presentation, June 15, 2016.
- Boards from Broadway Corridor Open House, June 15, 2106

Email from Sarah Harpole, PDC Project Manager, to Stakeholder Committee members re: Union Station Phase III Kick-off, June 13, 2013.

OUTLOOK EMAIL:

From: Harpole, Sarah
Sent: Thursday, June 13, 2013 1:26 PM
To: GOODMAN Cary (Cary.GOODMAN@odot.state.or.us); Buscemi, Tony (BUSCEMA@amtrak.com); apyedlick@up.com; Coker, Jim
Cc: Obern, David; David.Knowles@CH2M.com; Darren.Muldoon@CH2M.com
Subject: Meeting Invite: Union Station Phase III Kick-Off

Hello all—

The Federal Railroad Administration (FRA), through the Oregon Department of Transportation (ODOT), has awarded the Portland Development Commission (PDC) with grant funds to complete preliminary design and environmental review work for a number of improvements to the Union Station building and rail yard. This is Phase III of improvements to Union Station.

To begin this work, PDC and our consultant team, led by CH2M Hill, would like to meet with you to discuss the project. **This kick-off will include a general meeting and individual work sessions on June 25th**: The meetings will be held at Union Station, 800 NW 6th Ave, Portland. (Specific meeting locations details to be determined).

Our schedule for the day is as follows:

- **Kick-off Meeting – all Stakeholders:** 10:30 – 12:00
- Lunch on your own: 12:00 – 1:00
- **Individual Work Sessions:**
  - **Tracks/Platforms:** 1:00 – 3:00 (Attendees: ODOT Rail, PTRR, Amtrak, OMF)
  - **Building:** 3:00 – 5:00 (Attendees: Amtrak, OMF, ODOT Rail - optional)

The purpose of the initial kick-off meeting is to review the overall project objectives, schedule, and generally discuss the key improvements included in the scope of work. In the individual work sessions we will solicit more detailed input on specific aspects of the project and our work plan. Additional meeting details will be provided in advance.

Please confirm your availability for the above sessions, including the names and titles of anticipated attendees from your agency, by Thursday, June 20. Thank you in advance for your assistance. Please feel free to contact me with any questions.

Thanks,
Sarah

Sarah Harpole
Senior Project Manager
Portland Development Commission
222 Northwest Fifth Avenue
Portland, Oregon 97209
tel. 503.823.3337 fax. 503.865.3682

Union Station PE/NEPA Project, Stakeholder Advisory Meeting #1 and Risk Management Workshop Agenda, September 23, 2014.

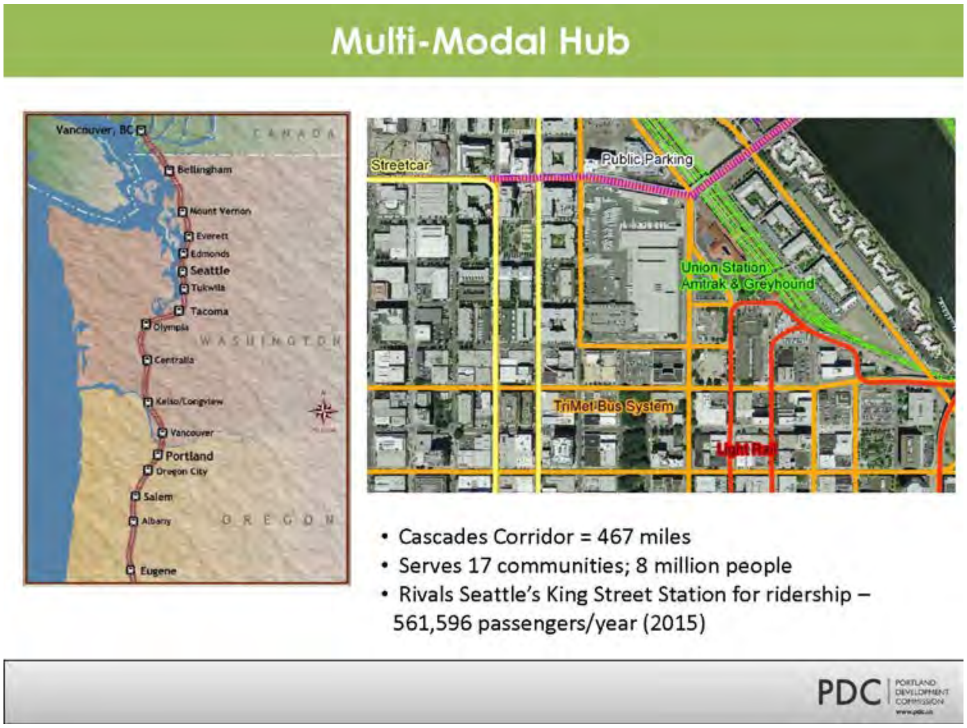
Union Station PE/NEPA Project
Stakeholder Advisory Meeting #1 and Risk Management Workshop

Agenda

September 23, 2014, 1:00-3:00 pm, Green Room, PDC

1. **Introductions**
2. **Project Background and Overview**
   - Project background and objectives
   - Phase 1 work status and schedule
3. **Role of the Stakeholder Participants**
   - Role of Participants
   - Stakeholder Meetings
4. **Discussion: Project Goals, Objectives and Stakeholder Expectations**
   - Review draft project goals and objectives
   - Stakeholder expectations and definitions of success
   - Specific issues, opportunities, or concerns to address
5. **Discussion: Risk Management and Mitigation Strategy**
   - Risk Management process overview
   - Discussion: Identifying and mitigating project risks
6. **Next Steps**
   - Next Stakeholder Check-in
   - Upcoming technical activities and milestones
   - Other action Items

Sample slides from Broadway Corridor presentation, June 15, 2016.



History

the oldest major passenger terminal on the West Coast

•Opened in1896 & Listed on the National Register of Historic Places

• Last major renovation was in 1927 – 1930 which significantly modified interior

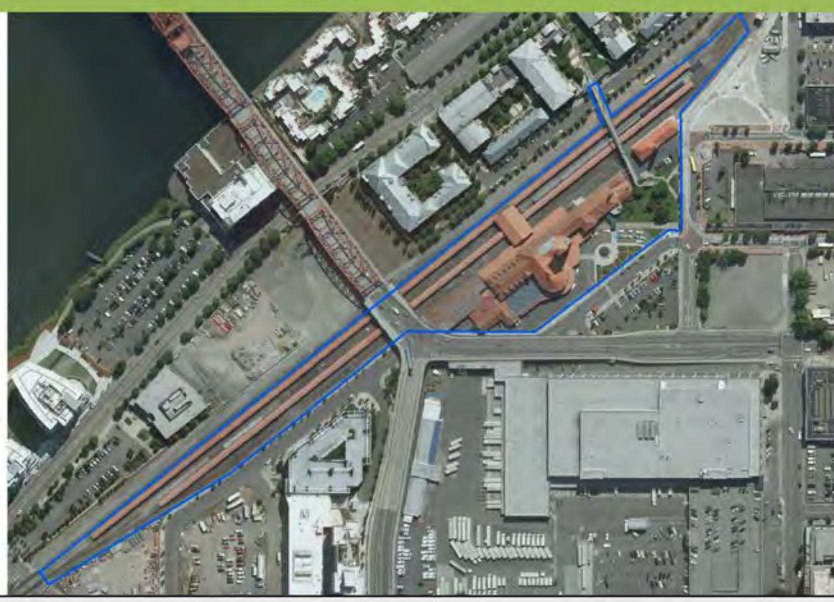
• Acquired by the Portland Development Commission in 1987 from Portland Terminal Railroad

• Managed by Office of Management & Finance since 1999

• Currently home to Amtrak, Wilf's Restaurant, and approximately 22 small office tenants

PDC PORTLAND DEVELOPMENT COMMISSION

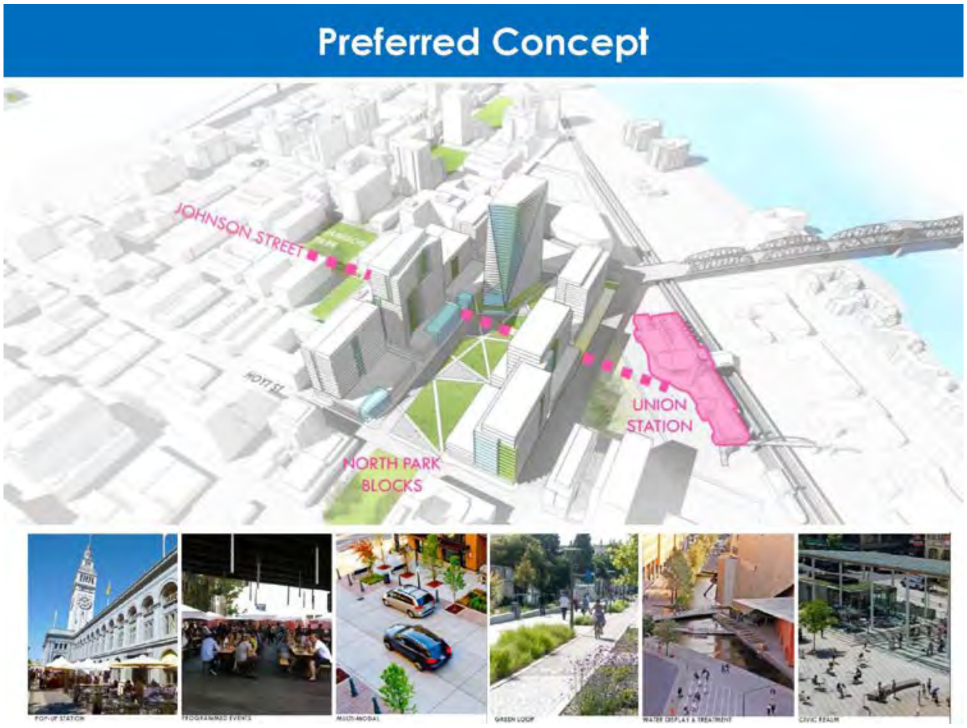
Union Station Property



PDC PORTLAND DEVELOPMENT COMMISSION

Union Station – Phase III: PE/NEPA

UNION STATION REVITALIZATION



Preferred Concept
JOHNSON STREET
HOYT ST
NORTH PARK BLOCKS
UNION STATION
POP-UP STATION
PROGRAMMED EVENTS
MULTI-MODAL
GREEN LOOP
WATER DISPLAY & TREATMENT
CIVIC REALM

Strategic Framework
CASCADE WALK
• GREENLOOP GATEWAY
• OVERLOOK
BROADWAY BRIDGE
GO BY TRAIN
WILLAMETTE RIVER
TO PEARL DISTRICT
EXCHANGE PLACE
• MIXING ZONE
• TRANSIT PLAZA
• EVENTS
• FARMERS MARKET
NORTH LAWN
• ARTS PARK
• FLEX EVENT SPACE
NORTH PARK BLOCKS
TO OLD TOWN / CHINA TOWN
PNCA
23
PDC

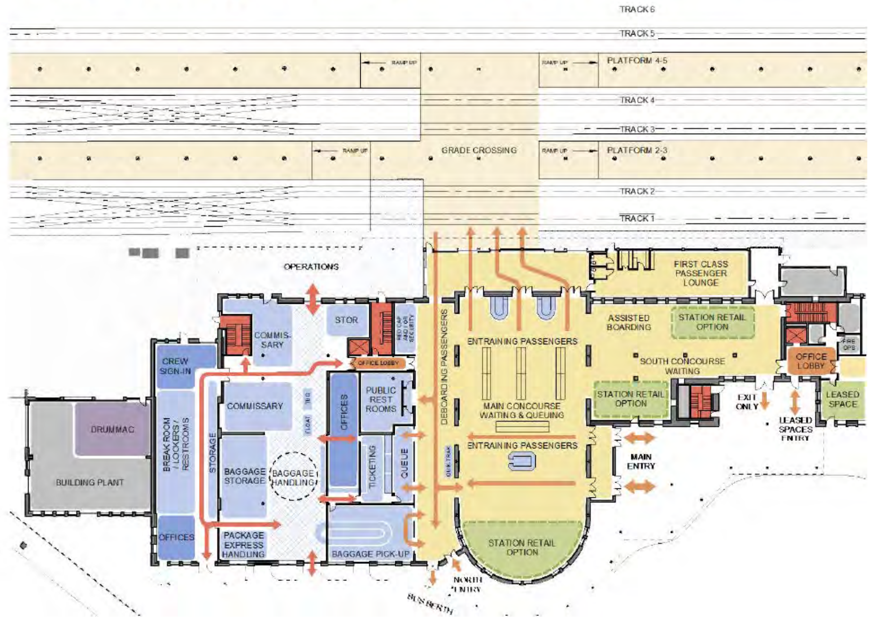
Framework Plan

15 PDC PORTLAND DEVELOPMENT COMMISSION www.pdc.us

New Platform Canopies and High Shed Concept

Conceptual Rendering – Not Reflective of Final Design or Materials

Amtrak/Passenger Concourse Improvements



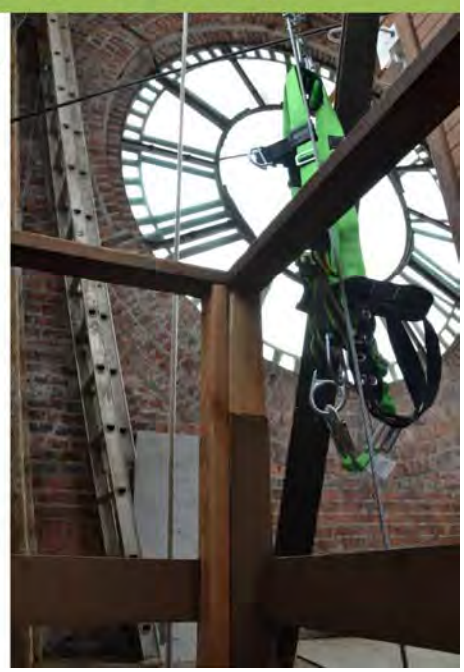
Union Station Phase III - Underway

2015: Conditions assessment & develop conceptual alternatives to address opportunities and deficiencies

Early 2016: Evaluate conceptual alternatives against project goals

2016: Prepare preliminary engineering design and environmental documentation for the preferred alternatives

2017: Update the construction cost estimate and schedule; seek future funding for implementation



Union Station Phased Improvements

Phase	Funding Source	Amount	Timing	Scope of Work
1	ODOT (FHWA), PDC	$1.4M	FY 07/08	COMPLETE: Replaced portions of the roof and completed limited exterior and interior repairs
2A/B	ODOT (FHWA/FRA), PDC	$9M	FY 09/10 – 12/13	COMPLETE: Completed remaining roof repairs, seismic anchors, window repairs, interior and exterior repairs etc.
3A/B	ODOT (FRA), PDC	$5M	FY 12/13 – 16/17	UNDERWAY: Preliminary engineering of remaining station needs and portions of track/platform upgrades; Evaluation of public realm & transportation hub enhancements.
4+	TBD	TBD	TBD	FUTURE: Final design and construction of remaining station needs, track/platform upgrades

PDC's commitment of $1.7M has leveraged $12.3M in grant funding over the past 5 years.

Union Station Phased Improvements

Facility Improvements	2007 est.
Exterior Envelope: Roof, Gutters & Downspouts, Windows & Doors, etc	$8.4M
Other Exterior Elements: Masonry, Lighting, Stormdrain Drainage, etc	$3.5M
Interior Areas & Finishes	$4.3M
Elevators (North & Tower) & Tower Stair	$1.1M
Concourse Furnishings	$0.4M
ADA Restroom Upgrades	$0.2M
Insulation	$0.1M
Seismic Upgrades	$7.1M
Chimney, Marble Veneer	$0.4M
Electrical Power Distribution	$2.1M
Lighting	$3.4M
Telcom/Data	$0.5M
Emergency Power	$0.1M
Fire Protection	$0.7M
Fire Alarm	$0.5M
HVAC Systems	$4.9M
Plumbing	$0.5M
TOTAL	$38.4M

Track Improvements
Stormwater drainage
Continuous welded rail
Ground power/main electrical
Potable water system
ADA improvements
Power-operate all switches in station complex
Alternative fueling options
Reinstate Track 6

Boards from Broadway Corridor Open House, June 15, 2106

PORTLAND UNION STATION PRELIMINARY ENGINEERING/NEPA PROJECT

▲ Since it's construction in 1896, the area surrounding Union
▼ Station has evolved from industrial to mixed-use development.

▲ There is a tremendous opportunity to re-connect Union Station to the rest of the Broadway Corridor.

IBI + PDC | PORTLAND DEVELOPMENT COMMISSION

The Portland Union Station PE/NEPA project supports the revitalization of Union Station as a landmark transportation gateway to the City of Portland that serves the needs of future travelers, honors and reflects its historic character, contributes to the economic and social vitality of the City, and is financially and environmentally sustainable.

Portland Union Station is:

- A registered National Historic Landmark
- A celebrated City of Portland icon
- A gateway to the City of Portland for visitors and residents alike
- Served by Amtrak's Cascades service and long-distance trains (Coast Starlight and Empire Builder)
- Comparable to Seattle's King Street Station with 585,000 passenger/year (2014)
- One of the City of Portland's two designated multimodal transportation hubs, connecting rail, intercity bus, and transit

PORTLAND UNION STATION
PRELIMINARY ENGINEERING/NEPA PROJECT

▲ The last major renovation of Union Station was in 1927-30, which gave much of the interior its current look.

▲ Union Station is a multi-model hub and an icon for surrounding neighborhoods.

▲ After 120 years of continuous service, Union Station requires critical upgrades to meet the needs of future passengers.

The Opportunity:

- Preserve and enhance the historic character of Union Station
- Upgrade Union Station to accommodate the future needs of the growing Amtrak Cascades rail corridor
- Improve the passenger and visitor experience through improved amenities, safety, comfort, and accessibility
- Strengthen Union Station's position as a multi-modal transportation hub
- Implement critical structural, seismic, life safety, and mechanical upgrades to the 120-year-old facility
- Support the evolution of the surrounding area from industrial uses to vibrant mixed-use urban neighborhoods
- Improve the economic and social vitality of Union Station as a civic landmark and anchor for the Broadway Corridor

PE/NEPA Project Process and Timeline:

- Spring 2015 - Develop Conceptual Engineering alternatives to address opportunities and deficiencies
- Fall 2015 - Evaluate Conceptual Engineering alternatives against project goals and objectives
- Early 2016 - Prepare Preliminary Engineering design and environmental documentation for the preferred alternatives
- Late 2016/2017 - Update the construction cost estimate and schedule, and seek future funding to implement improvements.

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Appendix D: Portland Union Station Building Conceptual Design Report

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Portland Union Station PE/NEPA Project

Portland Union Station Building Conceptual Design Report

Submitted to Portland Development Commission
by Dull Olson Weekes - IBI Group Architects, Inc.
July 2016

Table of Contents

1. Introduction

1.1. Overview

The Portland Development Commission (PDC) and the Oregon Department of Transportation (ODOT) are currently investigating infrastructure and operating improvement options for Portland's Union Station. This includes reviewing options to upgrade and renovate the existing buildings, as well as to improve and increase the amount of passenger rail trains served daily at the station, both in the near term (2017) and the long term (2035).

This document summarizes the conceptual design alternatives and proposed scope of building improvements for Union Station. These were developed by the project team in response to the issues and requirements identified during the Conditions Assessment and through discussions with building occupants and project stakeholders. The Conditions Assessment phase identified deficiencies in the existing condition and functionality of existing Union Station facilities, as well as key requirements to meet the need of future rail operations, passengers, tenants, and visitors to Union Station.

ODOT and the PDC evaluated the range of conceptual design building and rail improvement alternatives against the project's Purpose and Need, and Goals and Objectives (PNGO). In May 2016, ODOT and the PDC identified a preliminary preferred alternative that most effectively met the project's PNGO and preserved Union Station's historic integrity.

In many cases, ODOT and the PDC considered multiple and mutually exclusive alternatives to address the needs of Union Station's owner, operators, and tenants. In these cases, the goal of the alternatives analysis was to identify a preliminary preferred alternative that would be reviewed by the public and project stakeholders and, as appropriate, refined as part of project development.

With the identification of a preliminary preferred alternative, ODOT and the PDC will conduct a more extensive public outreach program in compliance with Section 106 of the National Historic Preservation Act (NHPA). This outreach effort will provide the public and other interested parties the opportunity to review the preliminary preferred alternative and provide feedback on possible adverse effects and their resolution. ODOT and the PDC will consider all feedback received in the refinement of the preferred alternative.

After public and stakeholder review of the preliminary preferred alternative, the narrowed range of conceptual alternatives will be combined into one design approach which will allow for design refinement and cost estimating based on one confirmed design approach.

1.2. Project Overview and Background

Portland Union Station is a historic and operational inter-city passenger rail facility serving Portland (Multnomah County), Oregon. Construction of Union Station began in 1890, and the facility opened for service on February 6, 1896. The facility has been in continuous use as a passenger rail station and gateway to the City of Portland ever since.

In 1975, Union Station was placed on the National Register of Historic Places. It is one of the most architecturally prominent and recognized structures in the City of Portland.

Amtrak is the principal tenant at Union Station, which currently ranks as Amtrak's 16th busiest station nationally. Over 650,000 riders pass through Union Station annually, comparable to the passenger volumes of Seattle's King Street Station. Union Station is served by Amtrak Cascades intercity services, connecting Portland to cities in the Pacific Northwest, as well as long-distance Amtrak services to Los Angeles and Chicago. Union Station is a key anchor of the United States Department of Transportation's (USDOT's) Pacific Northwest high speed rail corridor (Eugene-Portland-Seattle-Vancouver, BC).

The PDC, the urban renewal and economic development agency of the City of Portland, acquired Union Station and Tracks 1-4 in 1987. The Portland Terminal Railroad (PTRR) owns the adjacent Track 5 and the right-of-way of the former Track 6. Since assuming ownership in 1987, the PDC has implemented multiple phases of improvements to both buildings and tracks.

After nearly 120 years of continuous passenger railroad service, Union Station is in need of critical repairs and upgrades to preserve Union Station's historic integrity, meet the future demands of intercity passenger rail service, and position Union Station as an economically and socially vital landmark into the future.

In 2014, PDC retained architectural and engineering (A/E) consultant teams to perform a conditions assessment of Union Station as part of the Portland Union Station PE/NEPA project. Through the Union Station PE/NEPA project, PDC will complete necessary preliminary engineering work and NEPA environmental review in compliance with FRA's Procedures for Considering Environmental Impacts (64 CFR 28545, May 26, 1999), FRA's Updated Procedures for Considering Environmental Impacts by adding categorical exclusions [78 FR 2713 (January 14, 2013)], and the Council on Environmental Quality's (CEQ) NEPA implementing regulations (40 CFR 5§ 1500-08).

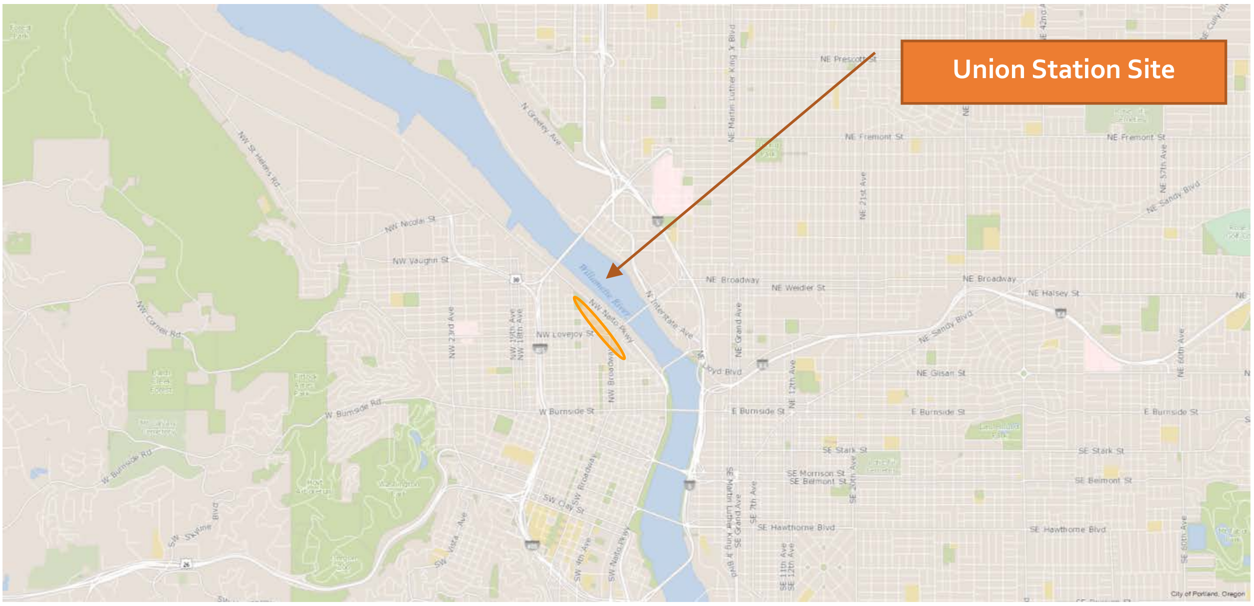
The Union Station PE/NEPA project is funded in part through a grant from the Federal Railroad Administration (FRA) to ODOT. This grant was awarded to ODOT on October 28, 2010 through FRA's High-Speed Intercity Passenger Rail Program.

The PDC is the lead agency for the Portland Union Station PE/NEPA project as a grant sub-recipient to ODOT. ODOT and PDC executed an intergovernmental agreement outlining the roles and responsibilities of ODOT and PDC in execution and administration of the FRA grant.

1.3. Project Area Description

Portland's Union Station is located on the west side of the Willamette River in the Old Town / Chinatown section of downtown Portland (Figure 1.3-1). The Union Station site is generally bounded by NW Glisan, Hoyt and Irving Streets on the south, NW Broadway Street and NW Station Way on the west, NW Overton Street and NW Naito Parkway on the north, and NW Ironside Terrace and partially developed industrial and commercial land on the east (Figure 1.3-2).

Figure 1.3-1 Project Vicinity



Source: Portland Maps. www.portlandmaps.com. 2016.

The Union Station site between the Broadway Bridge and south to the intersection of NW Naito Parkway and NW Glisan Street is zoned Central Commerce with a design overlay (CX-d) and between the Broadway Bridge and north to the intersection of NW 9th Avenue and NW Naito Parkway is zoned Central Employment with a design overlay (EX-d). The Central Commerce Zone (CX) is intended to provide for commercial development within the City's most urban and intense areas and allows a broad range of uses. The Central Employment Zone (EX) allows mixed-uses and is intended for areas in the center of the City that have predominantly industrial type development. Zoning of abutting properties is Central Commerce and Central Employment with a design overlay. The surrounding area is comprised of the Broadway and Steel Bridges, market rate and subsidized high density residential development, social services (Bud Clark Commons), transportation services (Greyhound Bus, public parking garages), commercial uses, education (Pacific Northwest College of Art), and government (U.S. Postal Service facility).

Figure 1.3-2 Union Station Project Area

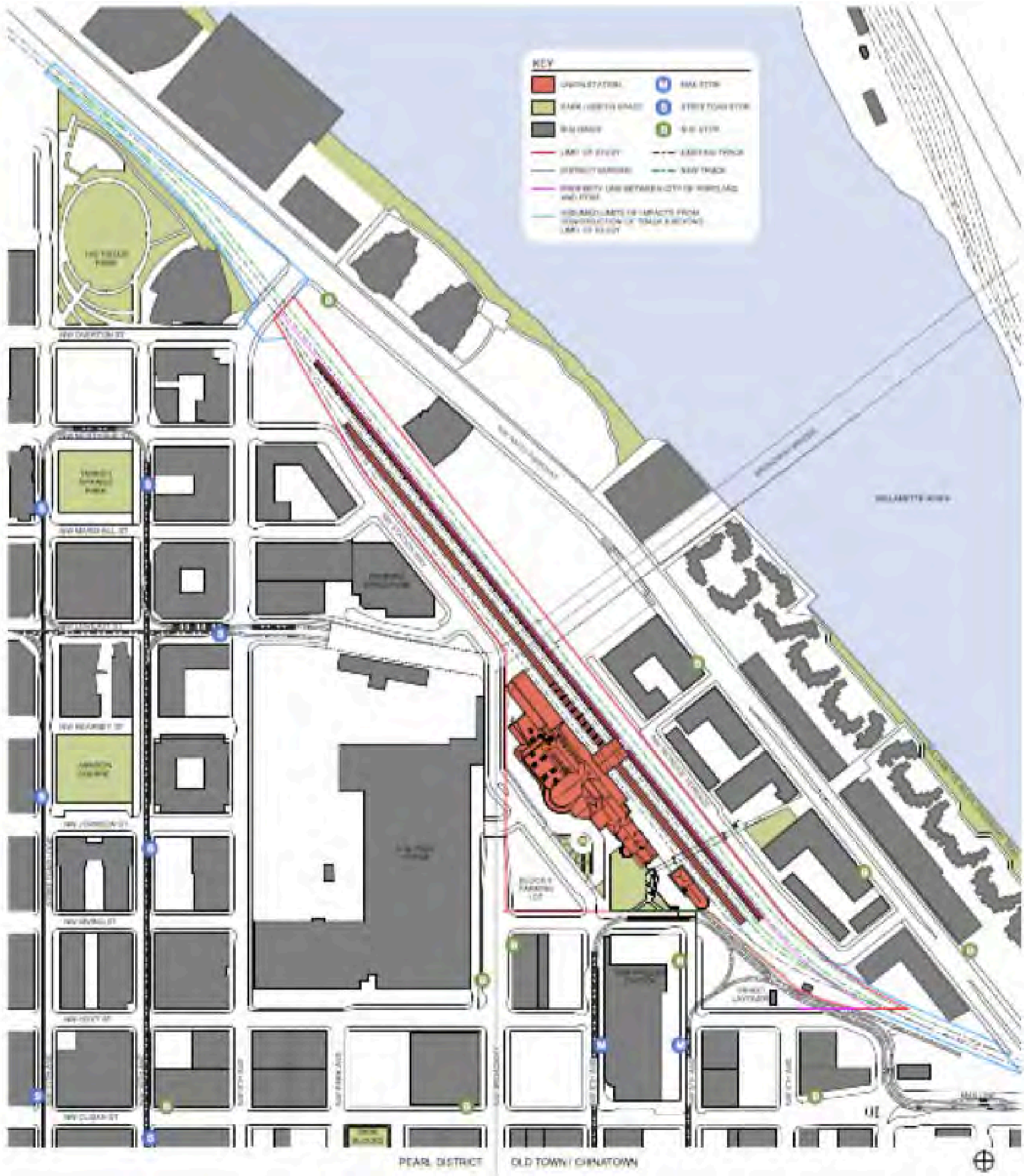


Figure 1.3-3 Union Station Existing Floor Plans - 1st Floor

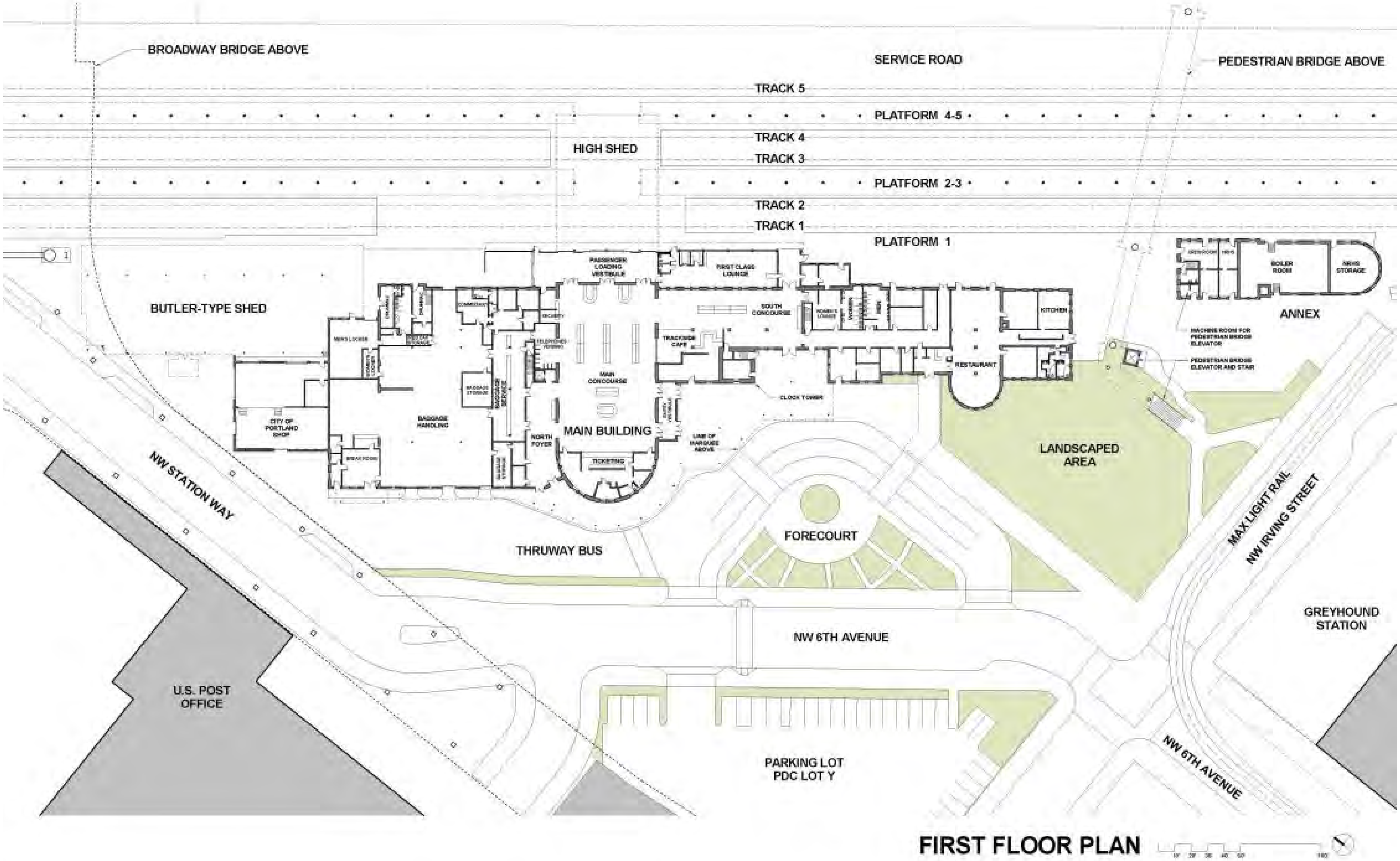
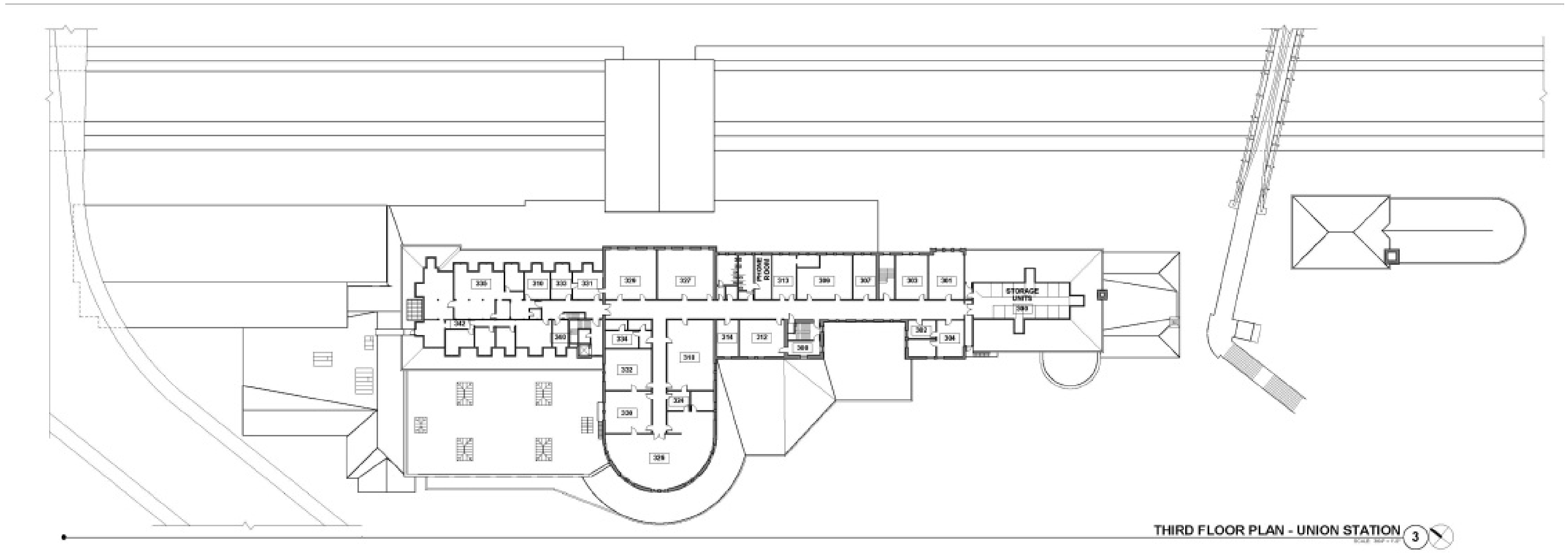
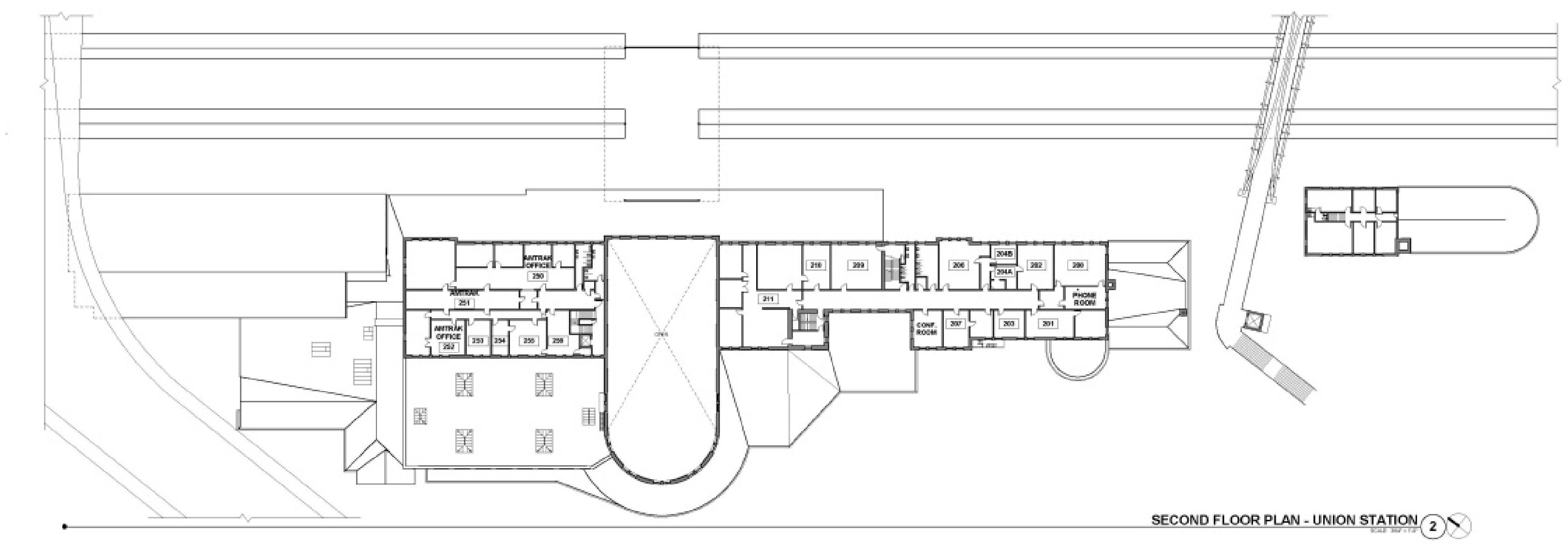


Figure 1.3-4 Union Station Existing Floor Plans - 2nd and 3rd Floors





1.4. Union Station's Evolving Urban Context

The changing urban context of Union Station is an important consideration when developing and evaluating alternatives for Union Station building improvements. As stated in the project goals and objectives, the potential for Union Station to have a positive contribution on the revitalization of the surrounding neighborhood is recognized by the project stakeholders.

When Union Station was completed in 1896, the surrounding area was dedicated to rail and industrial uses, such as yards, roundhouses, freight warehouses, and private commercial/industrial uses (Figure 1.4-1). These uses have gradually evolved over time as the city had developed over time, and as other modes replaces the historical function of certain freight and passenger rail services.

Figure 1.4-1 Union Station Site Context, 1920s

Over the past 20 years, a tremendous transformation has occurred in the vicinity of Union Station with the redevelopment of former rail and industrial facilities into today's Pearl District. Some of the remnants of the rail industrial era, such as freight warehouses, are preserved as repurposed structures situated among the high-rise residential, office, and commercial buildings that continue to be built.

Similarly, the Old Town/Chinatown neighborhood and riverfront parcels along NW Naito Parkway/NW Front Street have experienced increased redevelopment in recent years. The result is a new, urbanized station context consisting of high density, mixed-use development as well as significant investments in public transit, including nearly TriMet MAX and Portland Streetcar services.

The last significant element of this transformation is the 14-acre Post Office site located directly west of Union Station across NW Broadway (Figure 1.4-2). The City of Portland envisions redevelopment of this now-industrial site into a high-density, mixed-use residential neighborhood and employment hub. PDC recently completed a Broadway Corridor Framework Plan outlining a vision for this area, which would transform the public and private realm at the doorstep of Union Station (Figures 1.4-3 and 1.4-4.).

This next phase of urban evolution has important implications for Union Station. First and foremost, it is essential to preserve the function of Union Station as a multi-modal transportation hub. This includes access to the station for Amtrak passengers as well as connections to local transportation options as density and demand on the local transportation network increases.

Second, there is the potential to position Union Station as a landmark and activity hub for the new urban neighborhood, both as a physical landmark (e.g., views of the prominent Clock Tower) as well as through programming and revitalization decisions within Union Station itself. As part of this transformation, the public spaces along NW Station Way and the existing surface parking lot located on Block Y are expected to assume a more plaza-like form, perhaps like other urban squares in the Portland Central City.

These neighborhood-scale effects are considered in many of the Union Station conceptual design alternatives presented in this report. For example, leasable spaces in the building and the repurposing of the Annex could have a direct influence on the revitalization of the neighborhood, and may help to sustain amenities that benefit rail passengers as well and provide an improved rail gateway to welcome arriving train passengers to the City. These opportunities are weighed against other considerations such as supporting future rail operations needs, historic preservation, and long term financial and environmental sustainability.

Figure 1.4-2 Union Station Vicinity Today, Showing Surrounding Redevelopment and Post Office Site

Figure 1.4-3 Broadway Corridor Framework Plan: Vision for Post Office Redevelopment

Figure 1.4-4 Broadway Corridor Framework Plan: Positioning Union Station as a Neighborhood Anchor

1.5. Level of Design Development

The scope of work and design alternatives presented in this document are based on an approximately five percent (5%) level of conceptual architectural and engineering design. This level of effort was undertaken to allow PDC, ODOT, and project stakeholders to compare design alternatives as a basis for decision making, without significant investment in the simultaneous development of multiple alternatives for each improvement.

Because design development, site investigations, stakeholder and public outreach, and definition of requirements is ongoing, it is expected that design alternatives will continue to evolve through Preliminary Engineering, possibly resulting in the development of new or hybridized alternatives. Similarly, the proposed scope of improvements is expected to continue to be refined and adjusted based on design development and outreach.

Capital cost estimates, presented in this document, are notional estimates based conceptual. They are expected to be refined as design development progresses, culminating with the production of a preliminary engineering cost estimate at the conclusion of the preliminary engineering phase. Costs presented in this document do not comprehensively represent all costs of project development and construction that have not been explored in conceptual design.

Conceptual design cost estimates may exclude important cost drivers including but not limited to: remediation or restoration of historic materials and finishes; integration of discrete project elements; construction phasing; risk premiums; cost escalation; tenant fit-out; specialized labor, materials, and equipment; temporary work and shoring; and contingencies.

At this time, a cost estimate for the entire scope of proposed building improvements has not been developed. Conceptual design estimates for individual project components should not be construed as cost estimates to complete the improvements as stand-alone projects or phases. The summation of cost estimates for all project alternatives does not constitute an estimate of the total project cost

1.6. Project Stakeholders

The development of Conceptual Design Alternatives included multiple consultations with Project Stakeholders through the course of alternatives development. The Project Team spent additional time on site evaluating conditions, interviewing station personnel, and observing existing rail and building operations in order to develop and refined alternatives.

Project stakeholders involved in the Conceptual Design process include:

- Portland Development Commission
- Federal Railroad Administration (FRA)
- Oregon Department of Transportation (ODOT)
- Oregon State Historic Preservation Office (SHPO)
- Amtrak
- City of Portland Office of Management and Finance (OMF)
- Portland Terminal Railroad (PTRR)

1.7. Portland Union Station Buildings Project Team

The Portland Union Station Conceptual Design Report and the design alternatives contained within was developed by the following firms:

Buildings Team Participating Firm	Project Role(s)
Dull Olson Weekes- IBI Group Architects, Inc. (IBI Group)	Prime Consultant/Project Management Building Architectural Improvements Urban Design Stakeholder Outreach Track Team/NEPA Team Coordination Conceptual Design Report Development
Peter Meijer Architecture	Historic Preservation and Architecture
KPFF, Inc.	Structural/Seismic Engineering
Glumac	Mechanical, Electrical, Plumbing, and Lighting
Interface Engineering	Fire/Life Safety
Rider Levett Bucknall	Cost Estimation
Convergence Architecture	Annex Team Lead/Annex Architecture
Eleven Engineering	Annex Structural/Seismic Engineering
System Design Consultants	Annex Mechanical, Electrical, Plumbing, and Lighting
EcoReal	Sustainability Consultant

1.8. Report Organization

This report includes the following chapters:

Chapter 1 – Introduction

Chapter 2 – Analysis Framework

Chapter 3 – Scope of Proposed Building Improvements

Chapter 4 – Buildings Alternatives Considered

Chapter 5 – Main Building Architectural Improvements

Chapter 6 – Core Building Alternatives

Chapter 7 – Railside Improvements

Chapter 8 – Union Station Annex Alternatives

Chapter 9 – Summary of Preliminary Preferred Alternatives

2. Analysis Framework

The project team developed an evaluation framework and evaluation criteria to assess conceptual design alternatives against the project's Purpose and Need as well as a range of strategic and practical considerations.

2.1. Purpose and Need

The project's Purpose and Need, and Goals and Objectives (PNGO) guide the development and evaluation of project alternatives. The PNGO is also used in the decision making to select a preferred alternative.

The Purpose and Need is as follows:

> *The Purpose of the Portland Union Station Building and Tracks Improvement Project is to support future Union Station building and adjoining track repairs needed to stabilize and rehabilitate the historically signficiant Union Station and to accommodate existing and future passenger rail traffic at Union Station. The Need for the project is based on: does not meet some current building code requirements and City policies; current passenger service operations are inefficient and outdated; the building and site do not support long term financially and environmental sustainable operations in a manner that supports the vitality of the facility and surrounding area; increasing track congestion diminishes on-time performance of passenger rail service and multi-modal connectivity; existing rail facilities do not meet some passenger safety and accessibility requirements; existing rail facilities cannot accommodate forecasted increases in passenger service; and, existing rail facilities and yard do not support long term finanancially and environmentally sustainable operations and maintenance.*

2.2. Goals and Objectives

The Goals and Objectives of the Portland Union Station Building and Tracks Improvement Project, as defined by PDC and the project stakeholders are as follows:

GOAL #1: Revitalize Union Station as a multi-modal transportation hub that can accommodate the future growth and operational needs of passenger and freight rail in the region.

Objective 1-1. Meet the capacity and operating needs of expanded intercity passenger rail.

Objective 1-2. Ensure adequate capacity for freight movement through the station.

Objective 1-3. Improve and enhance the experience of passengers and visitors.

Objective 1-4. Modernize station operations in accordance with Amtrak requirements and design guidelines.

Objective 1-5. Reinforce multi-modal connections and convenience for connecting passengers.

Objective 1-6. Improve station, railside, and streetside ADA accessibility.

Objective 1-7. Upgrade facilities to reflect current seismic and building codes.

Objective 1-8. Upgrade critical life safety and security standards.

GOAL #2: Preserve and protect the historic character of Union Station as an operational passenger station for future generations.

Objective 2-1. Ensure that Union Station is a functional and vibrant a historic landmark for the future.

Objective 2-2. Restore and preserve historic materials, finishes, and building elements.

Objective 2-3. Honor the historic legacy of Union Station as a passenger rail facility.

GOAL #3: Improve the financial viability of Union Station and its contributions to the redevelopment of surrounding neighborhoods.

Objective 3-1. Minimize building operating costs.

Objective 3-2. Improve the quality, marketability, and economic return on leased tenant spaces.

Objective 3-3. Identify opportunities to repurpose underutilized space to benefit both travelers and non-travelers.

Objective 3-4. Support revitalization of the surrounding neighborhoods by positioning Union Station as a key activity center that is integrated into the surrounding urban fabric.

Objective 3-5. Contribute to the economic and social vitality of the surrounding neighborhoods.

GOAL #4: Ensure that Union Station, as a Portland icon, reflects the community's values and best practices for environmental sustainability.

Objective 4-1. Meet or exceed the City's LEED Gold sustainability rating.

Objective 4-2. Incorporate sustainability best practices of project partners.

Objective 4-3. Reduce energy use, water consumption, and trash generation.

Objective 4-4. Reduce greenhouse gas and air pollutant emissions.

Objective 4-5. Remediate hazardous materials in building components.

Objective 4-6. Improve stormwater management and containment of potential groundwater pollutants.

Objective 4-7. Minimize detrimental impacts of station operations (e.g. noise) on passengers, tenants, and surrounding land uses.

Objective 4-8. Promote sustainable transportation options to and from Union Station.

2.3. Evaluation Criteria

The evaluation criteria are divided into four categories:

- Ability to Meet Project Goals
- Cost and Financing
- Implementation and Constructability
- Environmental Impacts and Approvals

Within each category the evaluation criteria are divided into sub-criteria. Contributing factors used to evaluate project alternatives are defined for each sub-criteria and these are described below.

Alternatives were qualitatively assessed based on their ability to best meet the sub-criteria and were rated on a scale of level of potential impact: positive impact, neutral impact, or negative impact. The potential impact and any substantiating notes are included in tables summarizing the comparison of alternatives.

Evaluation Ratings:	●	**Positive Impact**	□	**Neutral Impact**	◆	**Negative Impact**

2.3.1. Ability to Meet Project Goals

This criterion measures the extent to which the project alternatives most effectively address the project's PNGO. This category includes the following sub-criteria:

- Accommodate Future Capacity and Operational Needs of Passenger and Freight Rail
- Preserve and Protect the Historic Character of Union Station
- Improve Economic and Social Vitality
- Improve Environmental Sustainability

Table 2.3-1 Ability to Meet Project Goals Criteria

Evaluation Sub-Criteria	Contributing Factors
Accommodate Future Capacity and Operational Needs of Passenger and Freight Rail	• Meet the future capacity and operating needs of intercity passenger rail • Improve and enhance the experience of passengers and visitors • Accommodate Amtrak business/operational needs and design standards • Accommodate freight movement • Reinforce multi-modal connections and convenience for connecting passengers • Improve ADA accessibility • Accommodate critical seismic and life safety upgrades • Improve site and facility security
Preserve and Protect the Historic Character of Union Station	• Preserve and enhance the historic character of Union Station • Safeguard historic materials and finishes • Incorporate facility improvements in a historically sensitive manner
Improve Economic and Social Vitality	• Contribute to the economic and social vitality of the surrounding neighborhoods • Repurpose underutilized space to productive use • Improve the quality, marketability, and economic return on leased tenant spaces • Improve building management and operating efficiency over the building lifecycle
Improve Environmental Sustainability	• Meet or exceed the City of Portland's LEED Gold sustainability rating • Reduce energy use, water consumption, and trash generation • Reduce greenhouse gas and air pollutant emissions • Remediate existing hazardous materials impacted by facilities improvements • Improve stormwater management and containment of potential groundwater pollutants

2.3.2. Cost and Financing

This criterion addresses likely capital and life cycle cost impacts of the project alternatives. While a full construction cost estimate will not be prepared until the preliminary engineering (PE) phase of the project, this criterion provides a valuable comparison of likely costs as well as cost risk based on the professional judgment of the project team in comparable circumstances.

This category includes the following sub-criteria:

- Estimated Capital Cost
- Lifecycle Cost Impacts
- Cost Risk
- Financial Leverage

Table 2.3-2 Cost and Financing Criteria

Evaluation Sub-Criteria	Contributing Factors
Capital Cost	Order of magnitude capital costs relative to other viable alternatives
Lifecycle Cost Impacts	Impact on long-term operations and maintenance costs for PDC and/or tenants
Cost Risk	Disproportionate cost uncertainties due to unknown factors, complexity, approvals, etc.
Financing Leverage	Ability to capture diverse/alternative funding sources to implement the improvement

2.3.3. Implementation and Constructability

Union Station is a complex transportation facility with sensitive historic features and a constrained urban site. This criterion is a measure of the practicality of each alternative from a technical and construction perspective, taking into account the likely requirement to maintain rail operations at Union Station through the duration of the future construction period.

This category includes the following sub-criteria:

- Technical Complexity and Constructability
- Schedule and Schedule Risk
- Construction Impact on Passenger and Freight Rail Operations
- Construction Impact on Union Station Tenants
- Phasing and Project Segmentation
- Risks, Assumptions, and Unknowns

Table 2.3-3 Implementation and Constructability Criteria

Evaluation Sub-Criteria	Contributing Factors
Technical Complexity and Constructability	• Complexity and viability of the design, materials, and methods proposed • Construction timeframe relative to other alternatives
Schedule and Schedule Risk	• Relative timeframe for design, approvals, permitting, and construction • Risk of delays due to unforeseen conditions, approvals, stakeholder decision making, etc.
Construction Impact on Passenger and Freight Rail Operations	• Degree and duration of disruption to ongoing rail operations during construction • Passenger impacts or inconvenience • Reductions in station or trackside capacity • Freight rail impacts
Construction Impact on Union Station Tenants	• Degree and duration of disruption or displacement to Union Station tenants • Impact of construction on the ability of tenants to conduct business (e.g. noise, closures)
Phasing and Project Segmentation	• Ability to phase work over time to reduce impacts/spread costs • Ability to accomplish work independent of other improvements • Cost or schedule efficiencies of coordinating work with other improvements
Risks, Assumptions, and Unknowns	• Unknown conditions • Reliance on critical assumptions • Risk of damage to historic features or materials • Ability to minimize or mitigate risks

2.3.4. Environmental Impacts and Approvals

This criterion is a measure of the potential impacts of the project alternatives from a historic preservation, NEPA, and project permitting perspective.

This category includes the following sub-criteria:

- Environmental Impacts and Project Classification
- Historic Impacts and Approvals
- Decision Making and Approvals

Table 2.3-4 Environmental Impacts and Approvals Criteria

Evaluation Sub-Criteria	Contributing Factors
Environmental Impacts and Project Classification	• Potential for direct and cumulative environmental impacts/adverse effects • Potential for direct and cumulative beneficial effects of improvements • Likely eligibility of the improvement under FRA's NEPA Categorical Exclusion class of action • Schedule and Implementation Risk due to NEPA process and approvals
Historic Impacts and Approvals	• Issues of potential concern to review agencies • Complexity/risk associated with historic review and approvals • Potential impacts on process and schedule
Decision Making and Approvals	• Key stakeholder or regulatory decisions or approvals associated with the alternative • Impacts to schedule, cost, or feasibility associated with key stakeholder decisions or approvals • Permitting/regulatory requirements

3. Scope of Proposed Building Improvements

3.1. Overview

This section summarizes the scope of Building improvements for Union Station based on conceptual design development. This scope of proposed improvements is a working list, and is expected to evolve based on forthcoming design development and stakeholder/public input.

The improvements represent the range of building improvements envisioned to ensure the preservation, safety, and efficiency of the 120-year-old railway station, and enhance its function as principal multimodal transportation hub in the central city.

The proposed Conceptual Design improvements are organized under the following four categories, each discussed in through the remainder of this report:

- **Architectural and Operational Improvements**
- **Core Building Improvements**
- **Railside Improvements**
- **Union Station Annex Improvements**

The scope of proposed building improvements is illustrated in Figures 3.1-1 through 3.1-4 as well as Tables 3.1-1 through 3.1-4 .

Figure 3.1-1 Proposed Conceptual Design Building Improvements - Exterior

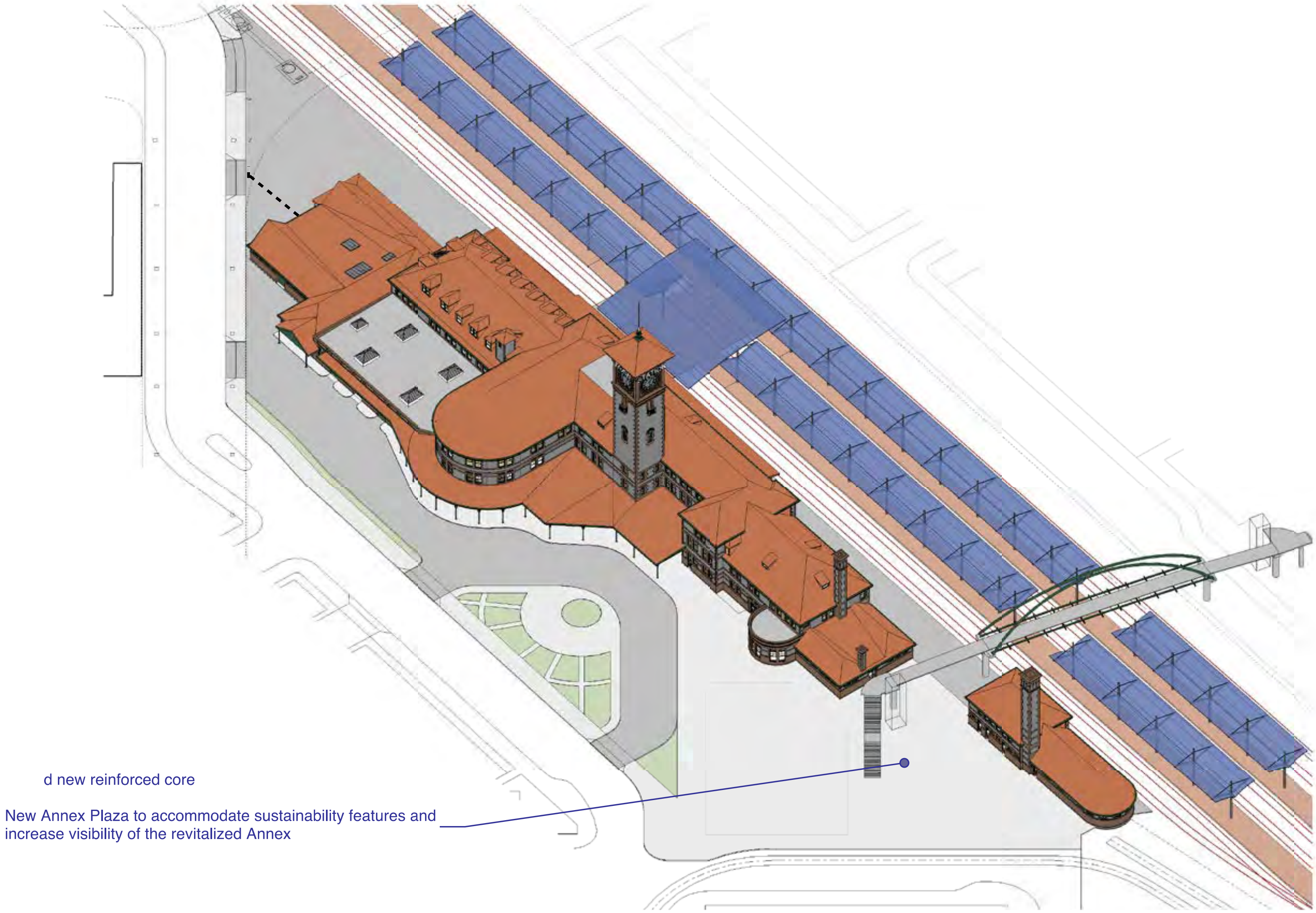


Figure 3.1-2 Proposed Conceptual Design Building Improvements - First Floor

Figure 3.1-3 Proposed Conceptual Design Building Improvements - Second Floor

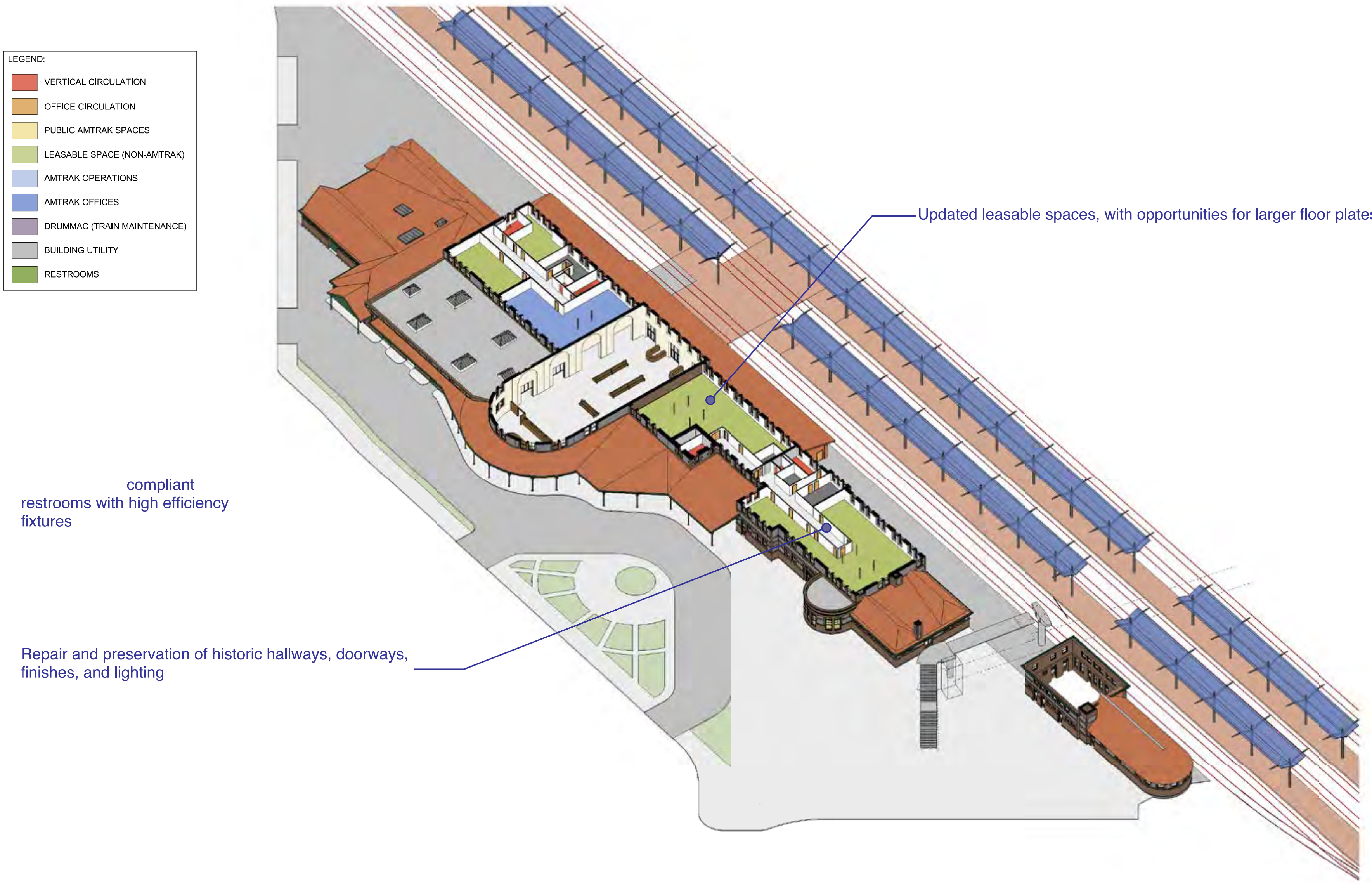


Figure 3.1-4 Proposed Conceptual Design Building Improvements - Third Floor

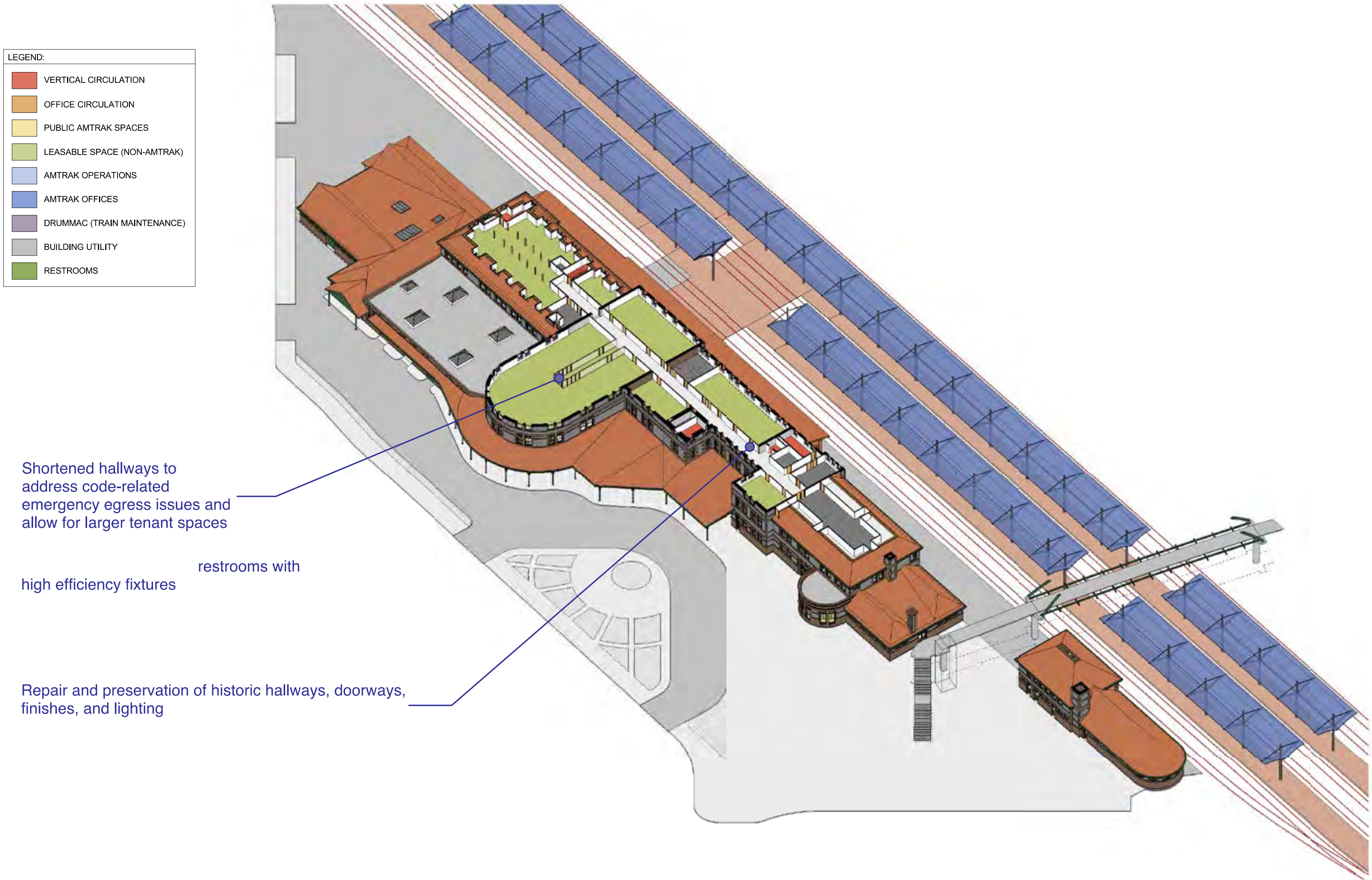


Table 3.1-1 Proposed Improvements: Architectural and Operational

Category	Scope of Proposed Improvements
VERTICAL CIRCULATION	• Implement new, relocated code-compliant stairways • Address code-related egress path issues • Implement two ADA accessible elevators to upper floors
AMTRAK OPERATIONS AND PASSENGER CONCOURSE	• Implement North Foyer hallway and new passenger arrivals door • Repair and restore all boarding doors in the Passenger Loading Vestibule • Reconfigure Ticket/Baggage Counter • Relocate Passenger Restrooms off North Foyer • Reconfigure Red Cap and Security areas • Create dedicated Assisted Boarding area • Create new Baggage Claim area with belt • Renovate Amtrak Baggage Room, office, maintenance, and support spaces • Renovate Amtrak District Office (2nd Floor) • Repurpose Information Desk (option) • Other passenger improvements/amenities (e.g. workspace, walk-on bicycle parking) (option) • Demolish Nursery Room
CONCOURSE LEASABLE SPACES	• Convert Ticketing Office into new café/retail concession • Implement South Concourse Retail Concessions • Improve South Concourse multi-purpose seating • Renovate First Class Lounge; possible repurposing
SOUTH MAIN FLOOR LEASABLE SPACES	• Create new, access controlled Office Lobby for upper-floor tenants • Core and shell improvements for future retain tenant, following floor replacement and structural work • New public entrance to future Annex Plaza • Reconfigure tenant service/refuse/recycling area • External seating/concession area on track side (option)
UPPER FLOOR LEASEABLE SPACES	• Core and shell improvements to 2nd and 3rd floor leasable spaces - larger footprints • Reconfigure and renovate upstairs historic hallways to accommodate vertical circulation and egress requirements
ACCESSIBILITY	• Accessible path from curb to train platform • Accessible path to all public and tenant areas • ADA compliant door hardware, doors, transoms, ramps, etc. • Restroom upgrades • ADA compliant signage • Provide improved illumination where deficient

Category	Scope of Proposed Improvements
HISTORIC PRESERVATION	• Repair historic exterior doors, including train boarding doors • Preserve/restore historic flooring, finishes, and materials • Retrofit historic locks with ADA-compliant hardware • Retrofit and repair historic lighting • Clock repair/restoration (clock faces and mechanism) • Repair/restore "Go by Train" sign • Preserve/repair historic casework • Remove window-mounted AC units and ventilation • Refurbish cast iron/wood Marquee following structural reinforcement • Repair/repoint brick masonry (TBD) • Other exterior repairs (TBD) • Repair/replace window canopies (option) • South Concourse mural restoration (option) • Re-use of platform canopies as artistic/historic feature, e.g. in Annex Plaza or as bus shelter (option) • Historic exhibits and artifact display (option) • 2nd floor safe preservation/restoration (option) • Document architectural history of Union Station (option)
OTHER IMPROVEMENTS	• Refurbish interior architectural finishes as needed • Fur out exterior/masonry walls to insulate and provide flexibility for electrical/data/plumbing service • Provide interior sealed windows and/or other treatments to improve energy efficiency and tenant acoustics • Amtrak ADA compliant wayfinding signage program (interior, exterior, platforms) • Updated Public Address (PA) system • Passenger Information Display System (PIDS) • Art Improvements (TBD) • Bike storage room near Office Lobby (LEED incentive)

Table 3.1-2 Proposed Improvements: Core Building

Category	Scope of Proposed Improvements
STRUCTURAL/ SEISMIC	• Reinforce concrete shear walls and other seismic strengthening for URM walls • Remove Main Concourse marble panels to accommodate work and re-install with seismic anchors • Horizontal plywood diaphragm at ceiling/floor levels • Out-of-plane shear walls • Repair sloping/failing upper floors • Concrete pan joist floor on south end of building • Enlarged Clock Tower pile cap and new micropiles • Concrete/steel braced frame Clock Tower reinforcement; reconstruct access stairs • Reinforce Main Building Chimneys and their foundations; tie to diaphragm • Seismically anchor non-structural elements (e.g. plaster work, clock, balconies, "Go By Train" sign, lighting) • Horizontal truss around curve portion of Main Concourse wall • Reinforce and repair Front Marquee • Foundation repair?
MECHANICAL/ ELECTRICAL/ PLUMBING	• Relocate mechanical/electrical systems to new Mechanical Room on north end of building • New Variable Refrigerant Flow (VRF) HVAC system • Fans/ventilation upgrades for natural ventilation • Ground Source Borefield (sustainability option) • New satellite electrical/mechanical rooms • New electrical distribution and metering systems (with tenant sub-metering) • High efficiency lighting systems • Retrofit existing historic lighting fixtures • Emergency generator • Energy management features (e.g. occupancy detectors, dimmers) • Photovoltaic system on Platform Canopies (sustainability option) • Replace water supply system • New restroom service and fixtures • Rainwater cistern (sustainability option) • Improved stormwater management/drainage • Main Feed Improvements? • New telecom rooms and network

Category	Scope of Proposed Improvements
FIRE/ LIFE SAFETY	• Full sprinkler system • Standpipe system • Dry standpipe system (exterior) • Fire protection dedicated water feed • Clock Tower standpipe and pump room • Upgraded alarms with visual strobe • Elevator recall/air handling • Emergency lighting • Additional fire/heat/gas detection (option) • Mass notification paging (option) • Removal of exterior fire escapes (option) • Fueling system/HAZMAT safety systems (TBD)
SECURITY (Enhancements Identified to Date)	• Perimeter fencing and access-controlled gates • CCTV Surveillance • Rail/tenant access control • Intrusion detection • Fire/Security/TSA Command Center

Table 3.1-3 Proposed Improvements: Railside

Category	Scope of Proposed Improvements
PLATFORM CANOPIES AND HIGH SHED	• New ADA-compliant concrete level boarding platforms with tactile warning edge • New Platform Canopies and High Shed • New ADA-compliant passenger/service vehicle crossings • New underground utilities and distribution • New platform lighting • New platform wayfinding signage • Stormwater improvements • Upgraded/replacement rail operations support infrastructure (potable/non-potable water, 480v, yard air, fuel, storage, safety, etc.) • Implement diesel locomotive anti-idling ground power (option) • Provide increased diesel exhaust ventilation (option) • Explore acoustical treatments to reduce train noise (option
TRAIN/ BUILDING MAINTENANCE AREAS	• New Maintenance Shed (replace Butler-Type Shed) • Exterior covered/secure storage • HAZMAT storage • New/improved paved surface • Reduced and reconfigured parking • Consolidated waste and recycling facilities • New fueling area and distribution systems • New mechanical yard • Updated building support area • Improved screening/security perimeter • Lighting improvements

Table 3.1-4 Proposed Improvements: Union Station Annex

Category	Scope of Proposed Improvements
ARCHITECTURAL	• ADA accessible entrance • Potential entranceway architectural enhancements/canopy • Interior window trim refurbishment • New/leveled concrete slab floors • New access to basement/tunnel
STRUCTURAL	• Shotcrete moment frame on inside of exterior URM walls • Braced frames and other horizontal/vertical truss elements • Plywood diaphragm
MECHNICAL/ ELECTRICAL/ PLUMBING	• New mechanical system (shell) • New plumbing system (shell) • New electrical system (shell) • New high efficiency lighting (shell) • New roof and wall insulation
FIRE/LIFE SAFETY	• Fire/Life Safety Improvements as per Main Building
ACCESSIBILITY	• ADA accessible path to Annex entrance from street and Main Building • Other accessibility improvements per Main Building
ANNEX CHIMNEY	• Deconstruct existing chimney and salvage face brick • Enlarged pile cap and install new micropiles • New reinforced chimney core • Reconstruct chimney with salvaged face brick and stucco over reinforced core
ANNEX PLAZA	• Construct new Annex Plaza (with optional sustainability features)

3.2. Architectural and Operational Improvements

The Architectural/Program Improvements include re-design, adaptations, and re-purposing of portions of Union Station to address the Project Goals and issued identified through the Conditions Assessment Process.

The Architectural and Operational Improvements include public spaces, rail operations spaces (e.g. passenger concourses, Amtrak operations areas, and platforms/canopies), spaces that are currently or potentially leasable to non-Amtrak tenants, and building support spaces.

Re-design and re-programming alternatives for non-rail spaces in Union Station were developed with an eye towards continued urban intensification and redevelopment of the North Broadway corridor surrounding Union Station over the next 10-20 years. This redevelopment could have profound implications of Union Station as a focal point of an emerging Central City neighborhood.

The proposed improvements include re-purposing and reconfiguration of spaces to public, rail operations, and leasable spaces across the facility to increase operational efficiency, address the changing needs of current and future rail passengers, and maximize the vitality of Union Station as a multi-modal passenger hub.

Many of the existing spaces at Union Station, including passenger concourses, ticketing, the baggage counter, rail operations spaces, offices, restrooms, and other features, exist substantially unchanged from the last major renovation of Union Station in 1920-1930 (or even before). The extensive outreach to Amtrak and building management personnel during the Conditions Assessment provided insight into existing operational deficiencies as well as future needs that could be addressed through careful re-configuration of portions of the facility.

A significant portion of Union Station consists of leasable space is available for non-rail uses, and the proposed improvements will increase the quality and economic vitality of leasable spaces in the Main Building and the Annex, improving the long-term financial stability of the station. Revitalizing Union Station through new retail and office development will create a more vibrant hub that will benefit both passengers and the surrounding community.

The scope of proposed Architectural and Operational Improvements includes:

Vertical Circulation: The proposed improvements provide code-compliant vertical circulation via new stairways and upgraded elevator access. Implementation of a second elevator and upgrade of the existing elevator will provide ADA-compliant access to all floors and areas of the Main Building. This includes the southern portion of the Second Floor, which currently can only be reached by stair. Reconfigured vertical circulation will also address other code-related emergency egress deficiencies.

Amtrak Operations and Passenger Concourse: The passenger and rail operations spaces in and around the Main Concourse are the heart of Union Station, The Main Concourse is also the most historically significant in the building. Proposed upgrades in this area are driven by operational requirements of future rail operations as well as preservation of historic resources.

One of the most significant changes from the rail operations perspective is the proposed consolidation of baggage and ticketing functions to a location along the North Foyer. This reflects the evolution of Amtrak business practices and the desire to have a single counter serving all ticketing and baggage functions.

This combined Ticketing/Baggage Counter is located along a new North Foyer Hallway, which consolidates passenger services in line with a new arrivals gate. The North Foyer Hallway helps to eliminate congestion and passenger conflicts between arriving and departing passengers at the existing boarding gates. A new Baggage Claim belt is located along the North Foyer Hallway adjacent to the Baggage/Ticketing Counter.

The North Foyer Hallway also includes fully upgraded passenger restrooms, which are being relocated from the South Concourse to address a longstanding security concern due to the distance of the restrooms from staffed Amtrak and security positions. The restroom relocation is also more convenient for both arriving and departing passengers.

A result of the combination of ticketing and baggage functions is the need to vacate the existing Ticket Counter in the Main Concourse. This space is envisioned to contain a new passenger retain amenity, such as a café. Concepts for this location include preservation and repurposing of the existing walnut casework of the Ticket Counter, the built-in safe, and other historic artifacts as part of the new leasable space.

No significant changes are envisioned for the Main Concourse itself, which is Union Station's premier historic space. Rather, the emphasis in this area is preservation of historic materials and sensitive upgrades to ventilation, lighting, systems, and structural/seismic systems.

The South Concourse is envisioned to retain its primary function as an extension of the passenger waiting area, with enhanced passenger and retail amenities. Multi-purpose seating areas can provide more flexible seating options than the historic Main Concourse bench seating (such as eating tables and work counters), and serve both rail and retail concession passengers during their respective peak periods. Both the existing café/newsstand location and the South Concourse area are envisioned for potential retail amenities, displays, and flexible seating areas.

The adjacent First Class Lounge is envisioned to remain in its current use, based on a preference of Amtrak to retain this amenity for its Sleeper Car and Business Class premium customers. The potential to repurpose as a retail or foodservice amenity has been recognized should this opportunity arise.

New passenger information display systems (PIDS) are anticipated for Union Station, consistent with Amtrak design guidelines for major stations. This includes an upgraded Public Address (PA) system with ADA visual paging system.

Improved static wayfinding signage will be implemented throughout the facility based on Amtrak guidelines and in consideration of the historic nature of many of Union Station's public spaces.

Beyond these public areas, the Amtrak back office operations spaces will undergo a comprehensive reconfiguration to improve efficiency and address longstanding operational shortcomings. The Baggage Room will retain its predominantly open configuration, with improve Amtrak crew spaces, offices, security, commissary, and storage. Office and shops for Amtrak's train maintenance and cleaning contractor will be relocated north into the current City of Portland shop area, adjacent to the exterior Rail Maintenance Area.

New vertical circulation will provide more direct and secure access to Amtrak District Office and training facilities, located on the north end of the Second Floor.

All existing Amtrak and law enforcement spaces recently relocated from the Annex will be consolidated in the Main Building (First or Second Floors, north end), thereby improving operational efficiency and allowing the Annex itself to be repurposed. Adjacencies, space programming/sizing, and operational requirements are a topic of ongoing design discussions with Amtrak.

South Main Floor Leasable Spaces: The Conditions Assessment revealed the need for significant structural, seismic, and systems improvements in the south end of the Main Building. On the Main floor, this includes replacement of the existing wood floor, the only portion of the building where the original wood floor system was not replaced in the 1930s by the concrete pan joist system.

This floor replacement, coupled with other structural and systems improvements, will result in the removal of most of the existing finishes and walls on the first floor of the south end of the Main Building. This creates an opportunity to envision a repurposing and reactivation of this area in a manner that improves the passenger experience and is mutually supportive of the ongoing revitalization of the surrounding neighborhood.

During the renovation period of Union Station, the South Main Floor Leasable Spaces have been identified as a potential temporary location for Amtrak operations and/or passenger facilities while other portions of the building are undergoing rehabilitation.

In the near term, the South Main Floor Leasable Spaces are likely to be upgraded to shell and core pending determination of the requirements of the future tenant(s). Future tenanting/reuse decisions will be finalized closer to the completion of final design or construction, when there is greater certainty about the market potential of this space, the status of the surrounding neighborhood, and the involvement of potential development/equity partners for the fit-out of the upgraded space.

Upper Floor Leasable Spaces: To improve the financial sustainability of Union Station and maximize its potential as a mixed-use activity center, there is a recognized need to improve the quality and marketability of the second and third floor leasable spaces while respecting the historic character of the building.

Improvements to the upper floor leasable spaces begin with a new Office Foyer proposed on the Main Floor between the South Concourse and the Market Hall. This Office Foyer would provide improved, controlled access to the upper floors at all hours via a new stairway core and ADA accessible elevator.

A secure bicycle storage room is being considered adjacent to the Office Foyer, as an amenity for office tenant and visitors that leverages the buildings position along key Central City bicycle routes and the future Green Loop.

The proposed Upper Floor improvements include preservation of the historic upper floor hallways, including the hardwood flooring, door articulation, wainscot, windows and lighting. Improvements to the historic character by removal of surface-mounted conduits and extraneous fixtures (some of which are also ADA access barriers) would enhance these historic corridors. Some portions of the hallways would be foreshortened to address code-driven emergency egress issues.

Within the leasable spaces themselves, spaces that are not historically sensitive will be considered for consolidation and modernization to create leasable spaces with larger footplates, addressing a key marketability concern of the small existing office spaces. Historic materials and resources (such as built-in casework) will be preserved or relocated in an appropriate fashion.

Window and exterior wall treatments are proposed to improve energy performance of the building. Improved acoustic insulation is a particular concern for tenant spaces impacted by train noise and vibration. Acoustic treatment coupled with strategies such as diesel locomotive anti-idling will help to increase tenant satisfaction.

As part of the Core Building Improvements, improved HVAC, electrical, and data services will be provided to upper floor tenant spaces. New wall partitions and exterior wall furring will eliminate the existing surface-mounted conduit, wiring, and piping in evidence throughout Union Station that detracts from the character of the station.

ADA Accessibility: Large portions of Union Station do not meet current code standards for accessibility. The proposed improvements will also increase accessibility throughout the station for passengers, visitors, and employees with disabilities or mobility limitations. This includes barrier-free paths of travel for rail passengers from the front, through all services and amenities inside the terminal, and onto the trains via new level boarding platforms compliant with the FRA Level Boarding Final Rule. Portions of the building that are not currently accessible to ADA regulations, including upper floor leasable spaces, will be rendered fully accessible.

Accessibility improvements encompass a wide range of elements including but not limited to: signage; accessible doors and door hardware; slopes and stairs; elevators and vertical circulation; customer service counters; life safety systems, wayfinding, and more.

Review and definition of ADA Accessibility improvements is a pervasive theme across all building elements, and will be a subject of continuing design development as the project progresses.

Historic Preservation: All of the Conceptual Design alternatives were conceived and evaluated keeping with the objective of preserving and enhancing the historic character of Union Station as a national register property and a prominent civic icon in the region. An analysis of the spaces, materials, and characteristics that defined Union Station's historic character was undertaken as part of the Conditions Assessment process in 2015, which provided guidance to the design team in identifying opportunities to preserve and strengthen this character while also meeting passenger, operational, safety, and accessibility needs of the station's next 120 years.

In general, activities will focus on preservation and repair of historic materials, with particular emphasis on areas in the station identified to be of high historic significance and visibility.

Work such as structural/seismic retrofit may require temporary removal or disturbance of historic materials and finishes. These materials will be replaced as closely as possible to the original configuration following the completion of the work.

It is anticipated that specific impacts and strategies for addressing specific historic materials and spaces will be completed through future phases of design.

Further historic preservation measures will be identified through the course of preliminary design as the scope of improvements is refined and the impacts on historic spaces and materials are evaluated in greater detail.

Other Opportunities: The potential for historic and cultural amenities at Union Station has been recognized during the Conceptual Design process. This may include historic exhibits, display of artifacts of Union Station or Northwest railroading history, children's exhibits, sustainability education features, and/or public art. Opportunities exist in public areas inside the station as well as the exterior – most notably in the proposed Annex Plaza. The existing Platform Canopy structures, once removed, merit special consideration for re-use in interpretive or artistic installations.

At this phase of design development, these opportunities have been identified through stakeholder discussions, but specific deign concepts have not been developed at this time.

3.3. Core Building Improvements

The scope of the proposed Core Building Improvements include upgrades to core building systems (e.g. structural/seismic, mechanical, electrical, plumbing, fire/life safety) to meet current code requirements and to replace inefficient systems that have reached the end of their useful lives.

The most significant and far-reaching of the Core Building Improvements relates to Structural/Seismic upgrades. Union Station is predominantly an unreinforced masonry (URM) structure constructed long before the seismic hazards of the Cascadian Subduction Zone were recognized and incorporated into building codes and engineering design.

In recent decades, the City of Portland has adopted far more stringent seismic codes as a result. As with other code improvements, a major refurbishment of Union Station and its Annex is assumed to trigger mandatory seismic upgrades for the facility. In addition to these requirements, other structural deficiencies have been identified that will need to be addressed – most notably, floor sloping that is evident on the Second Floor at the south end of the Main Building.

Most of the existing mechanical, electrical, plumbing, lighting, and telecommunications systems in Union Station fall far short of performance, efficiency, and reliability expectations of comparable modern systems. Many systems are at or beyond the end of their useful lives, and require a comprehensive rehabilitation or replacement.

The current performance of core building systems has detrimental impact on building operating/maintenance costs as well as the comfort and experience of passengers, tenants, and visitors. While upgrade of core building systems represent a major capital investment need for Union Station, it also creates enormous opportunity to increase the environmental sustainability of Union Station, meeting or exceeding the City's LEED Gold policy new building construction.

Additionally, changes in building codes, life safety standards, and accessibility requirements will likely trigger mandatory upgrades as part of any significant Union Station refurbishment project.

The scope of proposed Core Building Improvements includes:

Structural/Seismic: Necessary improvements include but are not limited to: strengthening of unreinforced masonry walls, chimneys, and the Clock Tower; strengthening of the building diaphragm; foundation repairs; and seismic retrofit of non-structural elements such as the tower clock faces, the "Go by Train" sign, plaster work, light fixtures, and other historic details.

Extreme care is to be taken in the implementation of structural/seismic improvements to minimize permanent impacts on historic materials and spaces. The section of the preferred structural/seismic alternatives reflects this consideration. For example, seismic reinforcement of the Main Building unreinforced masonry walls around the Main Concourse involves careful removal of the historic marble panels, completion of seismic work, and reinstallation of the marble to resemble the original 1930 appearance.

Mechanical/Electrical/Plumbing (MEP): Complete replacement of most mechanical, electrical, and plumbing systems is warranted based on the foregoing assessment of their current conditions as compared with the performance as sustainability features of modern systems.

Increasing the environmental sustainability of Union Station is a key consideration of MEP systems selection and design. The project has a target to exceed the minimum LEED Gold standard for City of Portland buildings, possibly obtaining LEED Platinum or even Net Zero energy consumption.

Consideration of the historic character of many parts of Union Station was an important factor in selecting preferred alternatives and design approaches – e.g., retrofit of historic lighting fixtures. Design alternatives also take into account the sustainability opportunities that arise in upgrading these systems to current standards.

Detailed analysis of existing and future building energy consumption as well as lifecycle costing of proposed MEP system upgrades will occur as part of the upcoming Preliminary Engineering phase.

Fire/Life Safety: Many of the existing fire/life safety systems at Union Station are not compliant with existing code requirements. It is envisioned that alarm systems, fire protection systems, security, and access control will be replaced as part of the building improvements.

Most of Union Station lacks sprinkler systems or sufficient standpipe protections. This includes the Clock Tower that, in addition to requirement a new sprinkler/standpipe system, requires a supplemental pump to ensure sufficient water pressure at the upper levels of the tower.

Much like mechanical, electrical, plumbing, and lighting systems, wholesale upgrades of fire/life safety systems are recommended. New fire walls/doors are also being considered based on anticipated future building occupancies and current code.

Emergency egress routes and fire escapes from the upper floors are also non-compliant, due to deficiencies of the internal stairways and existing external fire escapes. These issues will be addressed thorough reconfiguration of the egress paths and vertical circulation elements.

Certain aspects of the code may be negotiable based on the historic status of Union Station and potential mitigation strategies; these opportunities will be further explored during the Preliminary Engineering phase.

Safety and Security: Another pervasive theme in design development was improvement in building safety and security for passengers, visitors, rail personnel, and tenants. A comprehensive approach was taken to security improvements including physical, technological, and behavioral solutions.

Proposed perimeter fencing will enclose the rail/building maintenance area that is currently open to the public via NW Station Way. Another fence will provide railside perimeter security between the Main Building and the Annex, addressing another uncontrolled access location. Future design development will address access control and emergency egress aspects of these improvements, as well as design for compatibility with the historic structures.

Inside the building, one of the key security improvements is the proposed relocation of the passenger restrooms closer to the new Ticketing/Baggage counter in order to discourage unauthorized or illegal behavior through increased surveillance by station and security personnel.

A new tenant lobby is envisioned in the ground floor to better control access (including after-hours access) to the upper floors.

New closed-circuit television (CCTV) surveillance is envisioned both inside and outside the facility, building upon preliminary analysis completed by Amtrak. Other intrusion detection/alarm capabilities will be considered on a case-by-case basis during future phases of design.

New electronic access control systems are envisioned to improve security inside and outside the facility, including rail operations, building maintenance, tenant spaces, and other non-public areas.

3.4. Railside Improvements

Proposed track and signal improvements for Portland Union Station are a key factor driving the design requirements of the Railside improvements discussed here.

The Union Station PE/NEPA project Rail Team (Team B) developed Conceptual Design Alternatives includes track, platform, signal, and rail operations support equipment to meet the demands of increasing passenger rail service and continued freight rail services through the station. These proposed improvements are discussed within a separate companion document, the *Portland Union Station Rail Conceptual Design Report*. The Buildings and Rail design teams have worked closely through the Conceptual Design Alternatives process, and will continue to collaborate on the preliminary engineering design of the preferred alternatives to ensure a seamless and highly functional design.

The architectural elements of the Union Station railside, including the Platforms, Platform Canopies, High Shed, Maintenance Area, and related rail operations equipment, have been identified to have substantial operational and structural/seismic deficiencies. This area is critical to future rail operations, but has seen only modest and incremental capital improvements in recent decades.

Platforms: The proposed improvements will substantially reconstruct and replace the existing Platform systems to current standards, in combination with other rail infrastructure improvements.

The passenger boarding platforms (i.e., Track 2/3 Platform and Track 4/5 Platform) would be replaced with new concrete platforms that are compliant with the USDOT Final Rule on level boarding. For most tracks, this assumes a 15" platform height, though Track 5 (a shared passenger/freight track) would be limited to a maximum 8" height. The reconstructed passenger platforms would also include tactile warning edges for visually impaired passengers as required by ADA.

The Track 1 Platform would be repurposed as a dedicated maintenance and storage track, retaining the existing low (0" above top of rail) platform height to accommodate rail inspection and maintenance activities that cannot be accommodated on tracks with a 15" platform height. In the future, Track 1 would not be used for active passenger boarding.

The new platforms will be designed to current Amtrak standards for offset, slope, drainage, and other requirements. Designs would accommodate both passenger and service vehicle needs in terms of width, slope, and access.

Platform Canopies and High Shed: Because of the seismic deficiencies, clearance conflicts, and advanced deterioration of the existing Platform Canopies and High Shed, a new replacement Platform Canopy and High Shed system is proposed for Union Station.

The replacement system is anticipated to reflect the existing Umbrella Canopy form, including the perpendicular High Shed element providing overage over the crossing from the building to the platforms.

Based on the preferred alternative, it is anticipated that this canopy system will use an architectural expression that is evocative of the historic umbrella/High Shed form while using more contemporary styling, materials, and construction to distinguish it from the historic parts of the building.

The new Platform Canopies would be raised to meet minimum clearance requirements per Amtrak and freight railroad design guidelines. Additionally, the edges of the platform canopies would be extended to approximately the centerline of the adjacent track to improve weather protection for boarding and de-boarding passengers and train crews.

A glass canopy surface is proposed for the Platform Canopies and High Shed as opposed to the existing opaque sheet metal roof structure. A glass surface would improve natural lighting penetration to the platform area and would improve visibility of the historic building and Cock Tower for arriving passengers.

Platform illumination levels, currently substandard, will be upgraded with new high efficiency fixtures to meet minimum illumination requirements stipulated in Amtrak design guidelines.

A key sustainability opportunity offered by the implementation of new Platform Canopies is the potential to include a photovoltaic (PV) system (solar panels) to generate electric power on site to meet some or all of the electricity generation needs of Union Station. Preliminary analysis suggests this goal is attainable by implementing a PV array as part of a glass canopy and/or opaque canopy system. Pursuit of this sustainability option will continue into the preliminary engineering phase.

It is anticipated that new wayfinding systems will be implemented into the new Platform Canopies, consistent with Amtrak design guidelines and best practices at other major rail terminals.

The existing, outmoded platform public address (PA) system should be upgraded and incorporated with the replacement system in the Main Building.

Passenger and Service Crossings: The existing at-grade passenger and service crossing underneath the High Shed will be rehabilitated to address pavement and surface irregularities and meet ADA requirements. The overall crossing width will be reduced and shifted to the north in order to accommodate train length requirements on both the North and South Tracks, consistent with the engineering design for rail improvements.

Careful attention will be paid to address the flow and maneuverability requirements for both passengers and service vehicles on this crossing, taking into consideration the reorganized Maintenance Area and the reconfigured North Foyer passenger arrivals Hallway and reinstatement of the north side door of the Passenger Loading Vestibule.

Additional, secondary service crossings north and south of the main crossing will be explored in preliminary engineering based on refined track and platform design to ensure service vehicle access to the passenger coaches, baggage cars, and locomotives on all tracks. The objective is to ensure safe and adequate access, turn-around radius, and maneuvering space for baggage carts and other service vehicles, and to minimize conflicts with passenger boarding and de-boarding activity.

Other Railside Improvements: As part of the Platform replacement, it is anticipated that existing rail servicing systems and equipment will be replaced. This includes: 480V ground power systems; diesel anti-idling systems; 120-volt AC power; potable water; non-potable water; yard air; HAZMAT emergency spill kits; and secure on-platform storage for maintenance and servicing equipment. Quantities and placement of these systems will be determined through discussion with Amtrak during preliminary engineering.

Provisions for fueling and fuel distribution are currently under discussion with Amtrak, and will be incorporated in to the platform design.

New stormwater drainage systems will be implemented to improve track, canopy, and platform drainage. As appropriate, stormwater systems may include oil traps and/or feed into on-site cisterns to support onsite re-use.

Fire/Life Safety system upgrades will also be extended to the Platform and Maintenance areas. This is anticipated to include new alarm systems with visual strobes, and may include other fire protection such as standpipe systems. Any special requirements due to the presence of fueling operations and/or hazardous materials use and storage will be evaluated during Preliminary Engineering based on proposed designs.

New CCTV camera systems have been installed as part of major renovation projects at other Amtrak stations, and it is anticipated that security cameras will be considered for the Union Station Platforms as part of a new interior/exterior CCTV surveillance system for the facility.

Utility ducts underneath the platform canopies will service electrical needs as well as potable/non potable water, yard air, and data/telecom (e.g. CCTV camera, PA system, alarms) and other systems needs on the platforms. Rail signals and switch communications and power may also be routed through the platform area.

Rail/Building Maintenance and Operations Areas: The Conditions Assessment identified the opportunity to reorganize and rationalize the Rail and Building Maintenance Areas on the north side of Union Station. Facilities here are little changed from the days of private passenger railroad operations, and are a key opportunity to improve the future efficiency of Amtrak operations.

Based on the proposed track design, the adjacent Track 1 North is envisioned as a dedicated train maintenance and inspections area. When possible, maintenance support facilities (e.g. storage) will be placed in close proximity to this area, with unnecessary functions or obstacles removed to facilitate maintenance access.

A replacement for the seismically deficient and non-historic Butler-Type Shed is proposed for the rail maintenance area. When this structure was implemented, a portion of the original Union Station gable roof was removed. The Buildings team proposes to reinstate this historic gable roof, potentially complemented with a new, reduced sized maintenance shed that complements the form and materials of the new Platform Canopies. Discussions with Amtrak about the operational needs and organization of this space and the shed coverage will continue through preliminary engineering.

Rail Maintenance space rationalization includes: elimination of parking for non-official Amtrak and building management vehicles (i.e., no employee parking); new outdoor secure storage; HAZMAT storage; and consolidated refuse and recycling facilities, including a trash compactor.

Access and circulation will be improved to adjacent interior functions in the building, including the Baggage Room, the rail maintenance contractor's shops and offices; Amtrak crew areas, and the building maintenance support areas.

A new off-street fueling system access and hook-up location is anticipated to be located in the maintenance area on the north side of the maintenance area nearest the Broadway Bridge and adjacent to Track 1. The fueling distribution system is currently under design.

Currently, the unrestricted access to the rail maintenance area from the public street is an important safety and security concern for Amtrak. The proposed improvements include a perimeter security fence or wall with access-controlled gates to improve security as well as visual screening from the street. A continuation of this security perimeter is envisioned on the south side of the station to secure the area between the Main

Building and the Annex. CCTV surveillance may also be considered in these areas for improved security monitoring.

Rail and Building Operations Areas are a topic of ongoing design development involving PDC and Amtrak. Further refinement of space requirements, operational needs (e.g. fueling), security, storage, service vehicle circulation, and other factors will occur as the project proceeds into preliminary design. These requirements also will influence the sizing and type of canopy coverage requires as a replacement for the existing, seismically deficient Butler-Type Shed.

3.5. Union Station Annex Improvements

Currently the Annex building houses boiler equipment for the Union Station campus, Amtrak crew and operations support spaces, and other leasable tenant spaces.

The Conceptual Design alternatives envision re-purposing of the Annex to accommodate a third-party tenant leasable space. This newly activated use for the Annex would improve the quality and viability of the space for non-rail leased tenants. All existing Amtrak support and building operations functions of today's Annex would be relocated to alterative locations within the Main Building.

A core-and-shell approach to the Annex is anticipated in the near term, stabilizing and preserving the building and making necessary architectural, seismic, and building systems improvements to prepare the building for tenant fit-out when a future occupant and use is identified.

The scope of proposed Union Station Annex Improvements includes:

Annex Plaza: Redevelopment of the adjacent Landscaped Area into a proposed Annex Plaza would increase the visibility and prominence of the Annex as a leasable space. The Annex is set back from the public street, and is currently obscured from view by the existing Landscaped Area. Access is from an existing parking lot that serves Amtrak and building operations functions. Creating a new plaza will create a more active gathering space that helps tie together the Annex, South Main Building, and adjacent parcels in the revitalizing North Broadway Corridor. Additionally, creation of the plaza will help to accommodate new proposed building sustainability features, including the Ground Source Borefield for HVAC, and an on-site retention cistern for storage and re-use of rainwater.

Annex Architectural: The current configuration of the Annex, with a two-story office space and a one-story Boiler Room with vaulted ceiling will be modified to accommodate a single-floor use with an optional future Annex. The proposed elimination of the existing Annex second floor stems from its poor existing architectural and seismic condition, plus the lack of code- and ADA-compliant vertical circulation. The cost of incorporating the necessary improvements is not justified by the relatively small increase in leasable space that the partial second story would provide.

During the renovation period of Union Station, the Annex has been identified as a potential temporary location for Amtrak operations and/or passenger facilities while other portions of the building are undergoing rehabilitation.

Annex Structural: Like the Main Building, the Annex consists of unreinforced masonry construction that is seismically deficient. The initial core and shell improvements to the Annex will address this condition through a package of structural/seismic improvements to the structures walls, foundation, and roof system.

Annex Chimney: The 80-foot Annex Chimney is a character-defining feature of the Annex indicative of its historic use as a boiler room. However, this unreinforced masonry structure is seismically insufficient, and its foundation is severely degraded. The proposed improvements would re-construct the Annex Chimney by reusing the historic face brick and affixing it to a new, seismically upgraded internal core and foundation.

Annex Mechanical/Electrical/Plumbing: The Annex will require new mechanical, electrical, and plumbing systems to support its future use as a leasable tenant space. The existing boiler infrastructure currently serving the Union Station campus will be removed and relocated from the Annex building.

The core and shell approach to the Annex implies that Annex MEP systems will be stubbed out in the initial phase, with full fit-out occurring when the Annex tenant requirements are known in the future.

A determination will be made in preliminary Engineering whether the Annex should utilize the same systems as the Main Building, or have stand-alone MEP systems. This determination will be made based on lifecycle cost factors, anticipated phasing of the tenant fit-out of the Annex, and technical feasibility.

Annex Fire/Life Safety: It is anticipated that the Annex will be outfitted with new Fire/Life Safety Systems along with the Main Building, including upgraded alarms, sprinklers, standpipes, and other features.

Annex Accessibility: Like the Main Building, the Annex will require a suite of accessibility upgrades to ensure compliance with current codes and the Americans with Disabilities Act.

Annex Entrance Canopy: Based on future re-use decisions, it may be advantageous to highlight the main entrance to the Annex building by repositioning one of the west side doors as the main entrance to the repurposed space. This will improve visibility form the public street and reduce potential conflicts with rail operations and security enhancements (e.g., fencing). Concepts for such an entrance canopy have been explored in Conceptual Design, but formal alternatives have not been developed at this time.

4. Buildings Alternatives Considered

4.1. Summary of Alternatives Considered

For major components of the proposed building improvements, a number of alternatives were developed that reflect stakeholder requirements and design responses to building deficiencies identified during the Conditions Assessment. The building conceptual design alternatives are summarized in Tables 4.1-1 through 4.1-4.

Many of the alternatives presented are not mutually exclusive; that is, elements could be combined or modified in many ways to achieve the final preferred design alternatives. However, they represent a range of feasible alternatives and varies approaches to achieve similar project objectives.

Often, there are variations in how well the alternatives meet the project goals and objectives, and/or tradeoffs of one goal or objective against others. The purpose of the evaluation criteria is to evaluate these similarities, as well as differences, among alternatives in order to support informed decision making.

Table 4.1-1 Architectural and Operational Alternatives

Main Building Vertical Circulation		No Build	
		A	Two Elevators; Enclosed Stair to 2nd and 3rd Floors
		B	Two Elevators; Open Internal Stair to 2nd Floor
		C	Mezzanine Connector Bridge
Amtrak Operations and Passenger Concourse		No Build	
		A	Existing Boarding Gates
		B	North Foyer Hallway - Configuration 1
		C	North Foyer Hallway - Configuration 2
Concourse Leasable Spaces	**Ticket Counter Re-Use**	No Build	
		A	Café - Preserve Existing Counter
		B	Kiosk - Remove Counter
		C	Seating - Preserve Existing Counter
	South Concourse	No Build	
		A	Retail Concessions: Newsstand/Café
		B	Waiting Area
		C	Exhibit Space
	First Class Passenger Lounge	No Build	
		A	Amtrak First Class Passenger Lounge
		B	Restaurant/Café
Nursery		No Build	
		A	Retain Nursery As-Is
		B	Rehabilitate Nursery
		C	Remove Nursery
South Main Floor Leasable Spaces		No Build	
		A	Restaurant (Existing Program)
		B	Single Tenant, Business Incubator
		C	Market Hall
Upper Floors Leasable Spaces		No Build	
		A	Retain Existing Configuration and Footprint of Leasable Spaces
		B	Create Larger Footprint

Table 4.1-2 Core Building Alternatives

Structural Seismic	**Main Building Seismic Strengthening**	No Build	
		A	Reinforced Concrete Shear Walls
		B	Steel Braced Frames
		C	Steel Plate Shear Walls
	Diaphragm	No Build	
		A	Plywood Sheathing Above/Below Existing Wood Floor Framing
		B	Horizontal Steel Truss
	Out-of-plane Strengthening	No Build	
		A	Reinforced Concrete Shear Walls
		B	Steel Tube Strongback System
		C	Vertical Core Drilling
	Tower URM Strengthening	No Build	
		A	Steel Braced Frames Above Reinforced Concrete Shear Walls
		B	Steel Braced Frames Full Height
		C	Reinforced Concrete Shear Walls Full Height
	Tower Overturning Resistance	No Build	
		A	Pile Foundations Improvement
		B	Horizontal Trusses at Floor Levels
	Chimney Alternatives	No Build	
		A	Internal Steel Pipe Propped to Diaphragms
		B	Exterior Braces
		C	Remove Chimney
Mechanical, Electrical, Plumbing, and Lighting		No Build	
		A	LEED Gold Target (minimum standard per City of Portland policy)
		B	LEED Platinum Target
		C	Net Zero Target

Table 4.1-3 Railside Alternatives

Train/Building Maintenance Areas	No Build	
	A	Reinstate Historic Attached Gable Shed
	B	Reduced Size Replacement Shed
	C	Full Size Replacement Shed
Platforms, Canopies, and High Shed	No Build	
	A	New Umbrella Canopies/High Shed - Replica of Existing
	B	New Umbrella Canopies/High Shed - Contemporary
	C	New Train Shed - Traditional
	D	New Train Shed - Contemporary

Table 4.1-4 Union Station Annex Alternatives

Interior/Structural	No Build	
	A	Two Story (2+1) – No Mezzanine
	B	Two Story + Mezzanine
	C	One Story Open Floor Plan
Chimney	No Build	
	A	Full Height Chimney with Reinforcement
	B	Reduced-Height Chimney Reconstruction with Reinforcement
	C	Remove Chimney
	D	Ghost Chimney
Annex Plaza	No Build	
	A	Existing Landscaped Area/Parking
	B	Annex Plaza

5. Main Building Architectural Improvements

This section describes the Main Building Architectural Improvements evaluated in conceptual design. These alternatives are organized as follows:

- Main Building Vertical Circulation and Access Alternatives
- Amtrak Operations and Passenger Concourse
- Ticket Counter
- South Concourse
- First Class Lounge
- South Main Floor Leasable Spaces
- Upper Floor Leasable Spaces
- Nursery

5.1. Main Building Vertical Circulation and Access

This improvement addresses code, accessibility, emergency egress, and deterioration issues associates with the existing stairs and elevators (Figure 5.1-1) as identified in the Conditions Assessment.

The following alternatives were evaluated:

- The No-Build Alternative would make no changes to the existing stairways or elevator.
- Alternative A: The Two Elevators - Enclosed Stair to 2nd and 3rd Floors alternative replaces and relocates the existing elevator and reconfigures stairways to address access and emergency egress requirements.
- Alternative B: The Two Elevators - Open Internal Stair to 2nd Floor alternative also replaces and relocates the existing elevator and reconfigures stairways to address access and emergency egress requirements, but arranges these elements differently.
- Alternative C: The Second Floor Connector Bridge alternative provides a new pedestrian bridge through the Main Concourse that restores the connection between the two halves of the second floor that existed prior to the 1930 remodel.

The results of the evaluation of the four alternatives are summarized in Table 5.1-1.

5.1.1. Design Requirements and Objectives

The key design requirements for vertical circulation and access identified through the conditions assessment and stakeholder discussions include:

- Upgrading vertical circulation (stairs and elevators) to current code requirements.
- Provide ADA accessibility to all areas on all floors (currently lacking today).
- Providing elevator access to the south portion of the second floor (Figure 5.1-2)
- Address emergency egress path code issues, including fire escapes, areas of refuge, dead-end hallways, etc.
- Supporting access needs of future building uses, including directness of connections and access control.

Figure 5.1-1 Existing Vertical Circulation

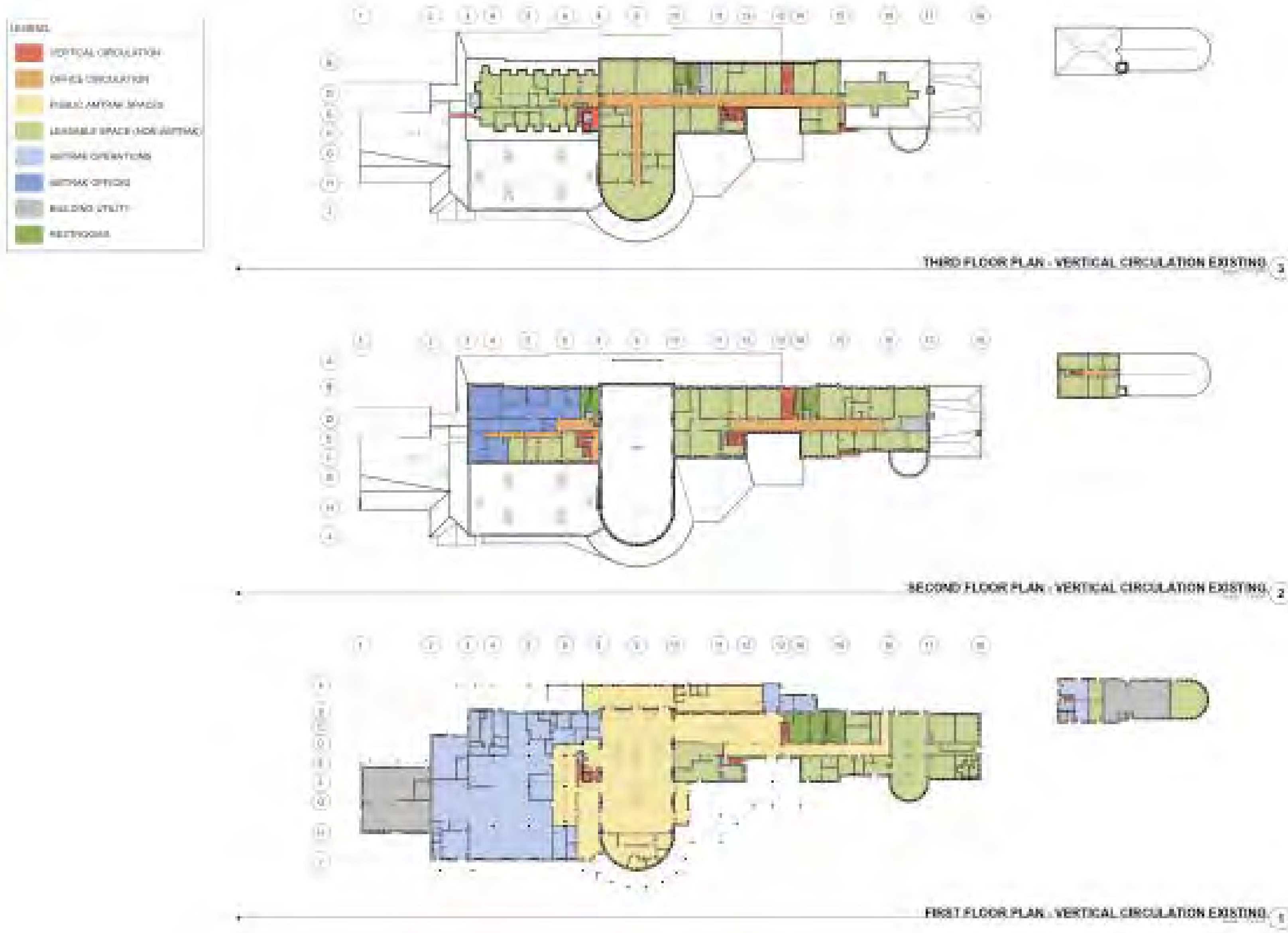
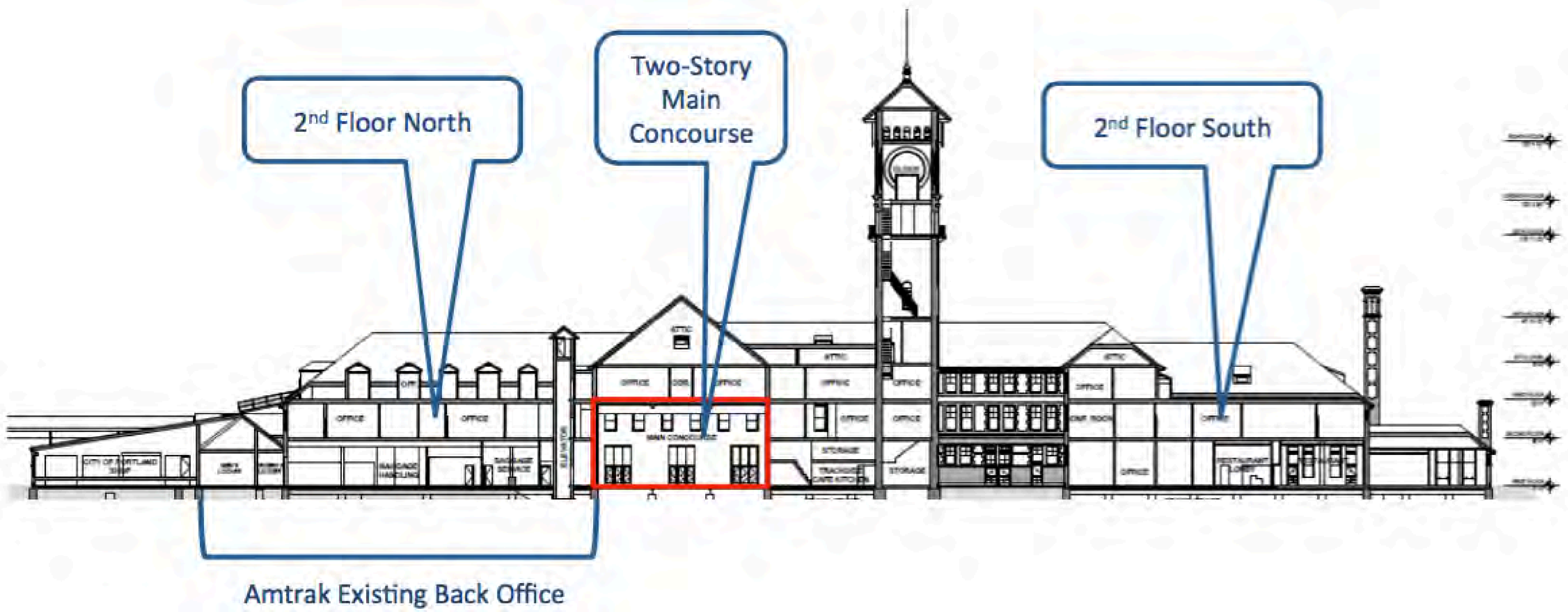


Figure 5.1-2 Elevation Illustrating Discontinuous Second Floor, Resulting in Lack of Elevator Access to Second Floor South



5.1.2. Vertical Circulation and Access Build Alternatives Analysis

There are three build concepts for vertical circulation in the northwest and southeast wings of the Main Building with the main concourse as the dividing organization element. These alternative vertical circulation concepts allow for reorganization of the internal spaces for the overall building concept, improving upon circulation, security, operations, safety, and customer improvements.

5.1.2.1 Vertical Circulation No-Build Alternative

The No-Build Alternative would leave the vertical circulation as it is today. Numerous deficiencies were identified during the assessment of conditions and the No-Build Alternative was determined to be infeasible due to the current condition and configuration of vertical circulation and egress paths in the building. Some of the identified deficiencies include:

- Large portions of the facility, notably the south end of the second floor, lack elevator access.
- No portion of the building has ADA-compliant elevator access.
- The physical condition of the existing elevator is poor and requires replacement.
- The existing geometry and location of the stairwells does not meet current code requirements for design or emergency egress.
- Emergency exits rely on exterior fire escapes and ramps that do not comply with current code requirements.

For these reasons, the No-Build Alternative has been eliminated from further consideration.

5.1.2.2 Alternative A: Two Elevators; Enclosed Stair to 2nd and 3rd Floors

This alternative would replace and relocate the existing elevator serving the north side of the second floor as well as the third floor (Figure 5.1-4). And, a second elevator would be added south of the main concourse. This elevator would provide new elevator service to the south end of the second floor, and also would provide additional, primary tenant access to the third floor from the south hallway. This location would provide an opportunity for a more distinctive and secure tenant lobby that does not conflict with rail operations and passenger movements of the main concourse. The stairwells would also be relocated and reconfigured to meet egress and code requirements.

5.1.2.3 Alternative B: Two Elevators; Open Internal Stair to 2nd Floor

This alternative is very similar to Alternative A, with two elevators in a comparable configuration (Figure 5.1-5). The primary difference is the configuration of the north stairway, which is an open internal stair between the first and second floors only. This configuration would provide the same circulation functions, but it would create more challenging space configurations on the second and third floors. It would require a hallway to the full north end of the third floor in order to access the egress stairs, which would reduce the potential to create larger and more flexible floor plates for future tenants.

5.1.2.4 Alternative C: 2nd Floor Connector Bridge

This alternative would provide a new mezzanine connector bridge connecting the two halves of the second floor through the main concourse (Figure 5.1-6). This bridge would replicate a former connector hallway (with accompanying offices) that originally connected the north and south portions of the second floor; this connection was removed in the 1930 remodel. The new bridge is envisioned as an open bridge structure of metal and glass construction, suspended from structural supports within the main concourse ceiling. Care in the design and orientation of this bridge would be necessary because of the historic integrity and public prominence of the main concourse as a character-defining feature of Union Station. One benefit of the bridge connector is the ability to travel between the north and south portions of the second floor without needing to pass through the main concourse or the continuous third floor hallway over the main concourse. However, this benefit is perceived to be of limited value, because strong interaction between second floor tenant spaces on the north and south sides of the building is not anticipated. Amtrak is anticipated to lease a majority of the north second floor for District Office functions (e.g. training rooms), while tenants on the south side will be unrelated third-party tenants.

Figure 5.1-3 Vertical Circulation and Access Alternative C - 2nd Floor Connector Bridge Concept

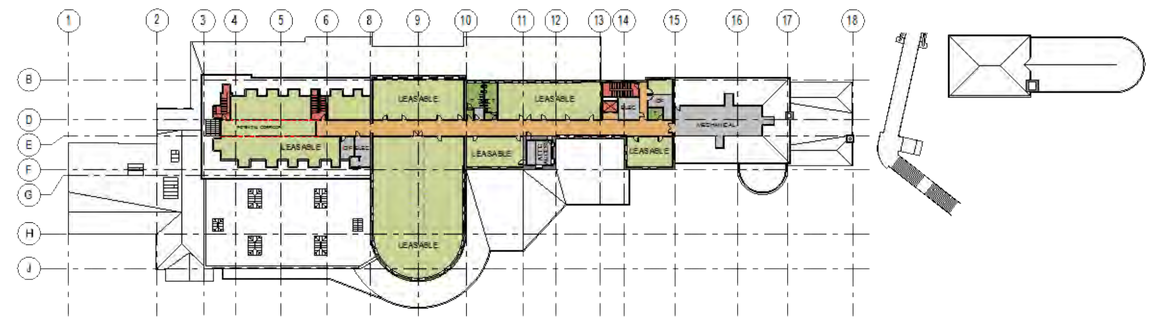
5.1.3. Recommendation: Vertical Circulation and Access

The project team recommends implementing Alternative B with the two-elevator configuration with an enclosed stair to the second and third floors (Figure 5.1-5). The two-elevator approach avoids the potential historic impact of the mezzanine connector bridge on the main concourse. The stairway and elevator configuration would be the most compatible with proposed main floor and upper floor improvements in Amtrak and other leasable spaces.

Figure 5.1-4 Vertical Circulation and Access Alternative A - Two Elevators, Enclosed Stairs

LEGEND:

- VERTICAL CIRCULATION
- OFFICE CIRCULATION
- PUBLIC AMTRAK SPACES
- LEASABLE SPACE (NON-AMTRAK)
- AMTRAK OPERATIONS
- AMTRAK OFFICES
- DRUMMAC (TRAIN MAINTENANCE)
- BUILDING UTILITY
- RESTROOMS

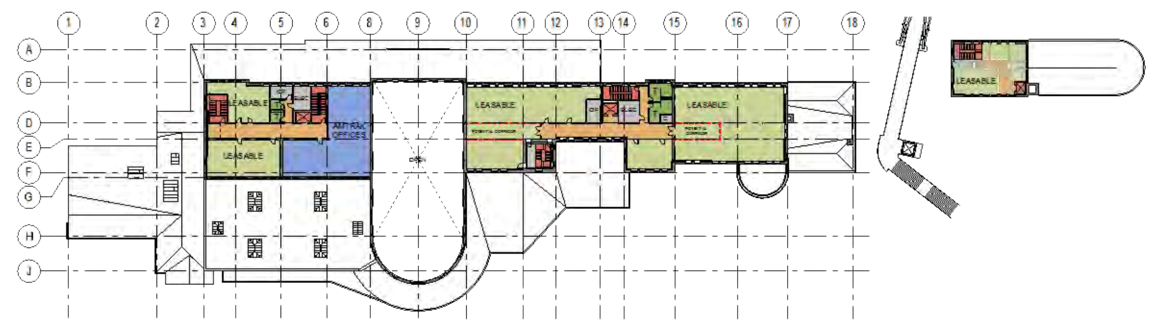


THIRD FLOOR PLAN - VERTICAL CIRCULATION OPTION A 3

VERTICAL CIRCULATION OPTION A:

THE NORTH END HAS (1) ELEVATOR TO THE SECOND FLOOR AND (2) STAIRS TO THE THIRD FLOOR. THIS OPTION HAS THE ABILITY TO HAVE A LARGER LEASABLE AREA AT THE NORTH END OF THE THIRD FLOOR.

THE SOUTH END HAS (1) ELEVATOR TO THE THIRD FLOOR, (1) STAIR TO THE THIRD FLOOR, AND (1) STAIR TO THE SECOND FLOOR.



SECOND FLOOR PLAN - VERTICAL CIRCULATION OPTION A 2

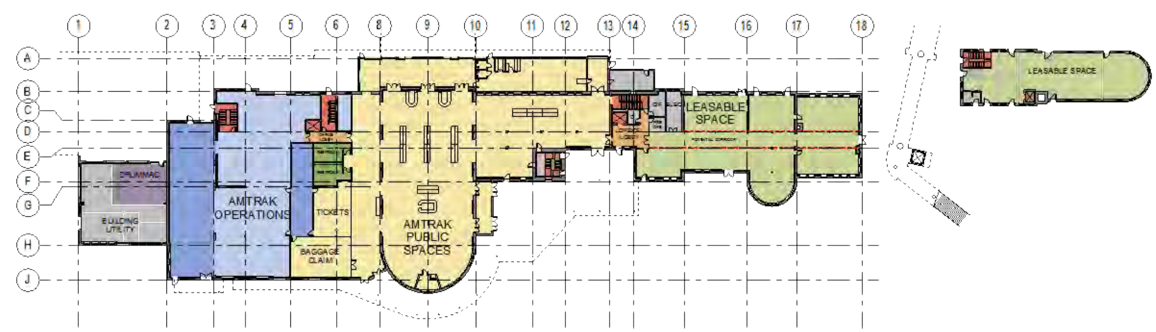
MAXIMUM LEASABLE SQUARE FOOTAGE:

MAIN BUILDING:

THIRD FLOOR:	13,120
SECOND FLOOR:	11,545
FIRST FLOOR:	6,850
TOTAL:	31,515

ANNEX:

SECOND FLOOR:	950
FIRST FLOOR:	2,900
TOTAL:	3,850

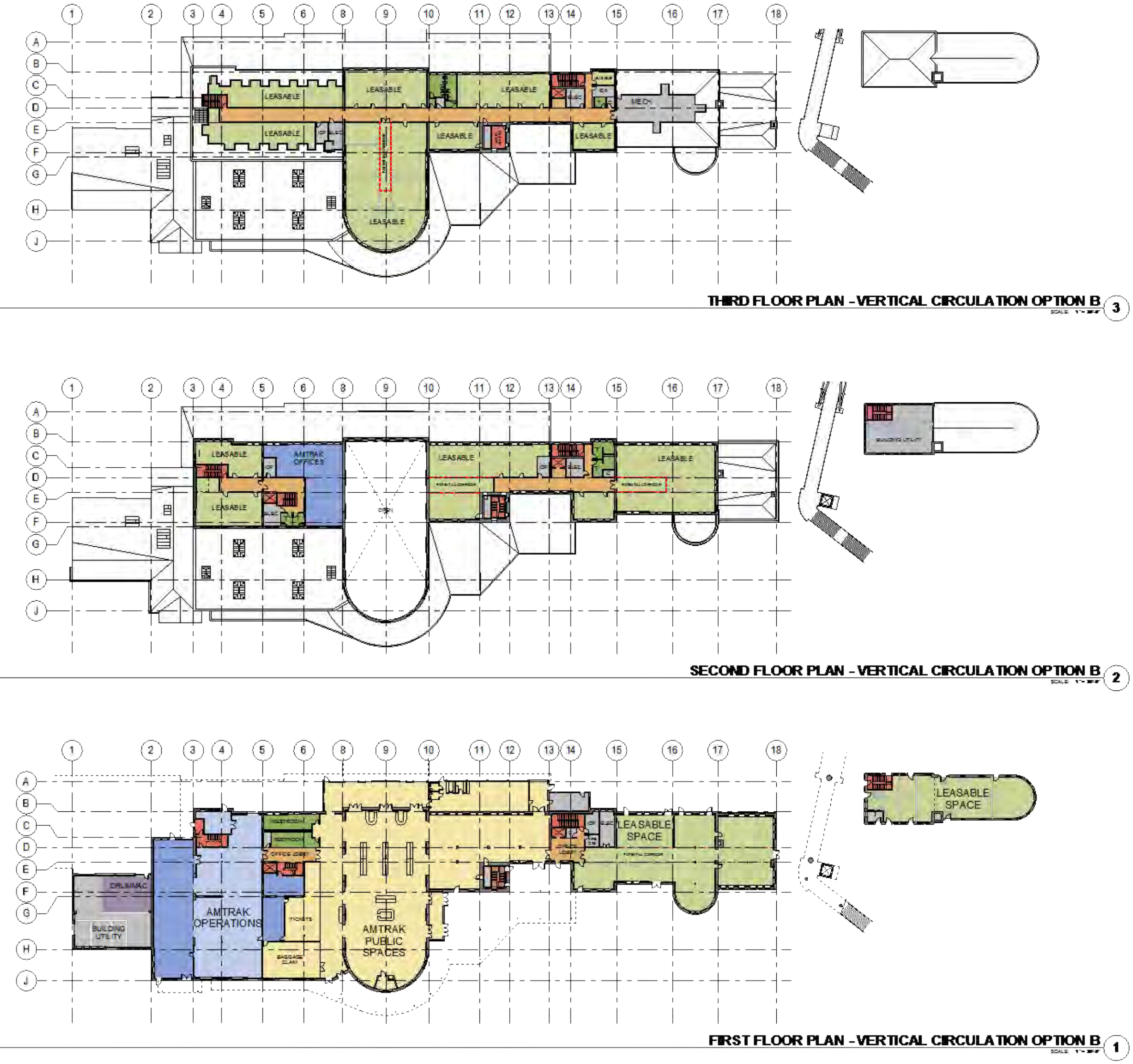


FIRST FLOOR PLAN - VERTICAL CIRCULATION OPTION A 1

Figure 5.1-5 Vertical Circulation and Access Alternative B - Two Elevators, Open Stair

LEGEND:

- VERTICAL CIRCULATION
- OFFICE CIRCULATION
- PUBLIC AMTRAK SPACES
- LEASABLE SPACE (NON-AMTRAK)
- AMTRAK OPERATIONS
- AMTRAK OFFICES
- DRUMMAC (TRAIN MAINTENANCE)
- BUILDING UTILITY
- RESTROOMS



VERTICAL CIRCULATION OPTION B:

THE NORTH END HAS (1) ELEVATOR TO THE SECOND FLOOR, (1) STAIR TO THE THIRD FLOOR, AND (1) STAIR TO THE SECOND FLOOR. THIS OPTION ALLOWS FOR BETTER CONNECTIVITY BETWEEN FIRST AND SECOND FLOOR AMTRAK SPACES

THE SOUTH END HAS (1) ELEVATOR TO THE THIRD FLOOR, (1) STAIR TO THE THIRD FLOOR, AND (1) STAIR TO THE SECOND FLOOR.

MAXIMUM LEASABLE SQUARE FOOTAGE:

MAIN BUILDING:

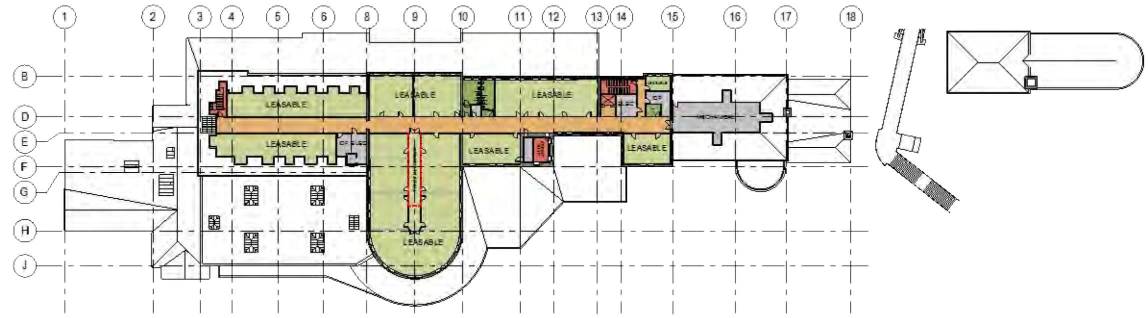
THIRD FLOOR:	12,700
SECOND FLOOR:	11,745
FIRST FLOOR:	6,855
TOTAL:	31,300

ANNEX:

SECOND FLOOR:	0
FIRST FLOOR:	3,300
TOTAL:	3,300

Figure 5.1-6 Vertical Circulation and Access Alternative C - 2nd Floor Connector Bridge

LEGEND:
- VERTICAL CIRCULATION
- OFFICE CIRCULATION
- PUBLIC AMTRAK SPACES
- LEASABLE SPACE (NON-AMTRAK)
- AMTRAK OPERATIONS
- AMTRAK OFFICES
- DRUMMAC (TRAIN MAINTENANCE)
- BUILDING UTILITY
- RESTROOMS

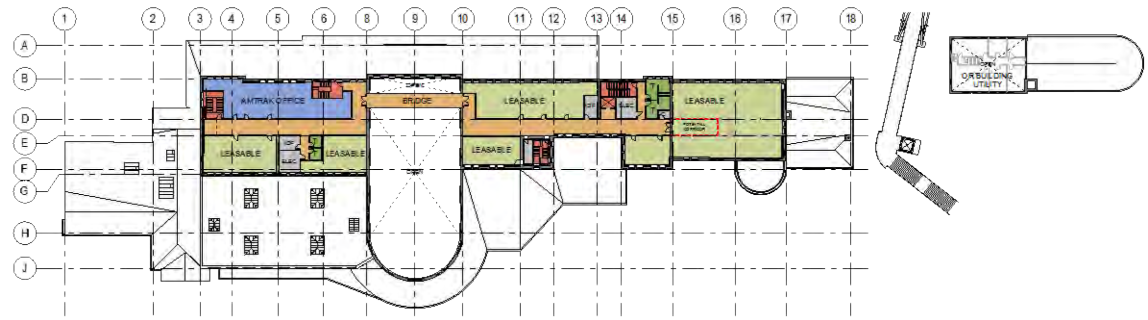


THIRD FLOOR PLAN - VERTICAL CIRCULATION OPTION C 3

VERTICAL CIRCULATION OPTION C:

THE NORTH END HAS (1) STAIR TO THE THIRD FLOOR AND (1) STAIR TO THE SECOND FLOOR. AT THE SECOND FLOOR, A BRIDGE ACROSS THE MAIN CONCOURSE PROVIDES ELEVATOR ACCESS TO THE NORTH END.

THE SOUTH END HAS (1) ELEVATOR TO THE THIRD FLOOR, (1) STAIR TO THE THIRD FLOOR, AND (1) STAIR TO THE SECOND FLOOR.



SECOND FLOOR PLAN - VERTICAL CIRCULATION OPTION C 2

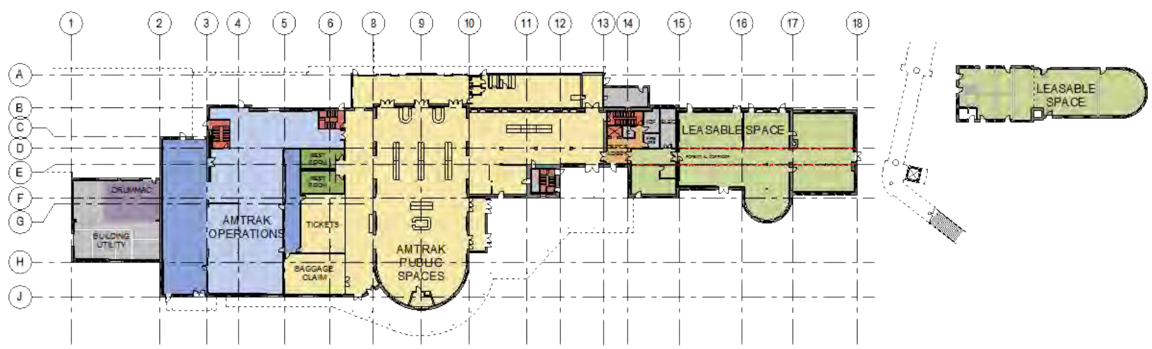
MAXIMUM LEASABLE SQUARE FOOTAGE:

MAIN BUILDING:

THIRD FLOOR:	12,615
SECOND FLOOR:	10,330
FIRST FLOOR:	6,945
TOTAL:	29,890

ANNEX:

SECOND FLOOR:	0
FIRST FLOOR:	3,300
TOTAL:	3,300



FIRST FLOOR PLAN - VERTICAL CIRCULATION OPTION C 1

Table 5.1-1 Evaluation of Vertical Circulation and Access Alternatives

Evaluation Criteria		No-Build	A	Two-Elevators; Enclosed Stair to 2nd and 3rd Floors	B	Two Elevators; Open Internal Stair to 2nd Floor	C	Second Floor Connector Bridge
A: Ability to Meet Project Goals								
A.1. Accommodate Future Capacity and Operational Needs of Passenger and Freight Rail	◆	Amtrak second floor levels will continue to lack ADA accessibility.	●	Improves connections between first and second floor Amtrak spaces	●	Improves connections between first and second floor Amtrak spaces	●	Improves connections between first and second floor Amtrak spaces
A.2. Preserve and Protect the Historic Character of Union Station	◆	Existing stairways and elevators will continue to exist in degraded condition.	●	Vertical circulation improvements do not substantially impact key historic elements of the building.	●	Vertical circulation improvements do not substantially impact key historic elements of the building.	●	Vertical circulation improvements do not substantially impact key historic elements of the building.
A.3. Improve Economic and Social Vitality	◆	The upper floors will continue to lack accessibility, hampering leasing ability and financial return.	●	All leasable areas of the building will have improved access and ADA accessibility	●	All leasable areas of the building will have improved access and ADA accessibility	●	All leasable areas of the building will have improved access and ADA accessibility
A.4. Improve Environmental Sustainability	◆	Older, less energy efficient elevator will continue to operate	●	Upgraded elevator equipment and lighting systems will use up to date energy efficiency technology	●	Upgraded elevator equipment and lighting systems will use up to date energy efficiency technology	●	Upgraded elevator equipment and lighting systems will use up to date energy efficiency technology
B. Cost and Financing								
B.1. Estimated Capital Cost	◆	Capital costs deferred but likely to be higher in the future	□	Costs for option A and B are similar with two elevators	□	Costs for option A and B are similar with two elevators	◆	Higher costs anticipated as compared to two elevator alternatives
B.2. Lifecycle Cost Impacts	◆	Increased operating and maintenance costs from continued used of older elevator equipment.	●	Reduced operating and repair costs for upgraded elevators	●	Reduced operating and repair costs for upgraded elevators	●	Reduced operating and repair costs for upgraded elevator

Evaluation Criteria		No-Build	A	Two-Elevators; Enclosed Stair to 2nd and 3rd Floors	B	Two Elevators; Open Internal Stair to 2nd Floor	C	Second Floor Connector Bridge
B.3. Cost Risk	◆	Risk of unanticipated failures to aging elevator equipment increases O&M cost risk.	☐	No unusual factors anticipated	☐	No unusual factors anticipated	◆	Design and materials requirements to ensure compatibility with historic main concourse increase cost uncertainty
B.4. Financial Leverage	◆	More difficult to finance improvements as a stand-alone project	●	Increased funding potential as part of a multifaceted renovation project.	●	Increased funding potential as part of a multifaceted renovation project.	●	Increased funding potential as part of a multifaceted renovation project.
C. Implementability and Constructability								
C.1. Technical Complexity and Constructability	☐	N/A – No capital improvement project	☐	New floor openings and structural framing will be required to insert the new stairs and elevators, coordinated with structural/seismic retrofit and systems design.	☐	New floor openings and structural framing will be required to insert the new stairs and elevators, coordinated with structural/seismic retrofit and systems design.	◆	Bridge structure design requires careful coordination of architectural and structural design as well as historic preservation and SHPO consultation.
C.2. Schedule and Schedule Risk	☐	N/A – No capital improvement project	☐	No unusual factors anticipated	☐	No unusual factors anticipated	◆	Complexity increases schedule risk for design, approvals, and construction
C.3. Construction Impact on Passenger and Freight Rail Operations	☐	N/A – No capital improvement project	☐	All vertical circulation improvements will temporarily impact upper floor Amtrak operations.	☐	All vertical circulation improvements will temporarily impact upper floor Amtrak operations.	◆	Increased complexity, and potential duration, of impacts on main concourse and passenger operations.
C.4. Construction Impact on Union Station Tenants	☐	N/A – No capital improvement project	☐	All vertical circulation improvements will temporarily impact upper floor tenants.	☐	All vertical circulation improvements will temporarily impact upper floor tenants.	☐	All vertical circulation improvements will temporarily impact upper floor tenants.

Evaluation Criteria		No-Build	A	Two-Elevators; Enclosed Stair to 2nd and 3rd Floors	B	Two Elevators; Open Internal Stair to 2nd Floor	C	Second Floor Connector Bridge
C.5. Phasing and Project Segmentation	□	N/A – No capital improvement project	□	No unusual factors anticipated	□	No unusual factors anticipated	◆	Requires closer coordination of vertical circulation and main concourse work.
C.6. Risks, Assumptions and Unknowns	□	N/A – No capital improvement project	□	No unusual factors anticipated	□	No unusual factors anticipated	◆	Larger impact to historic features of building and the concourse space
D. Environmental Impacts and Approvals								
D.1. Environmental Impacts and Project Classification	◆	Continued degradation of historic elements will continue; may lead to eventual loss of resources	□	Comparable among build alternatives	□	Comparable among build alternatives	□	Comparable among build alternatives
D.2. Historic Impacts and Approvals	◆	Historic spaces and materials will continue to degrade over time.	●	Minimal impact on high profile historic spaces	●	Minimal impact on high profile historic spaces	◆	Increased impact on primary historic spaces will likely require additional consultation and prolongs approvals process.
D.3. Decision Making and Approvals	◆	Project approvals and permitting may be hampered if code-mandated upgrades are not implemented	□	No unusual factors anticipated	□	No unusual factors anticipated	◆	Increased impact on primary historic spaces will likely require additional consultation and prolongs approvals process.

5.2. Amtrak Operations and Passenger Concourses

This improvement would provide improvements to rail passenger and rail operations spaces to accommodate the needs of future intercity rail, accommodate evolving passenger requirements (e.g. assisted boarding), improve accessibility, and preserve historic materials and finishes in Union Station's most prominent interior public spaces. It would also address the security and deteriorated conditions of the passenger restrooms.

The following alternatives were evaluated:

- The No-Build Alternative would preserve existing passenger and rail operations as-is.
- The Existing Boarding Gates alternative preserves the configuration of the existing passenger boarding gates, so that all passenger boarding and alighting activity occurs through the main concourse at existing capacity levels.
- The north foyer hallway -Configuration 1 alternative creates a new hallway connection and arriving passenger gate along with reconfigured restrooms and customer services.
- The north foyer hallway -Configuration 2 alternative is similar to the above alternative, with variations in the configuration of restrooms, customer services, and Amtrak operations spaces.

The results of the evaluation of the four alternatives are summarized in Table 5.2-1.

5.2.1. Design Requirements and Objectives

The key design requirements for Amtrak Operations and the Passenger Concourses (main concourse and south concourse) identified through the conditions assessment and stakeholder discussions include:

- Accommodating current and future Amtrak operational and business needs for safe, secure, and efficient railroad operations.
- Improving comfort, security, accessibility, and amenities for rail passengers and Union Station visitors.
- Consolidating the ticketing/baggage areas into a single location to better support Amtrak operations best practices, and to provide ADA accessibility to the customer service counters.
- Accommodating projected growth in passenger demand through the 2035 long-range planning horizon for the Cascades Corridor.
- Combine/consolidating Amtrak spaces into the Main Building, and optimizing sizing and relationships of passenger amenities, rail support, and office spaces.
- Improving overall security in the public and operations areas, particularly the Amtrak customer restrooms on the main floor.

5.2.2. Amtrak Operations and Passenger Concourses Alternatives Analysis

5.2.2.1 No-Build Alternative

The current configuration of Amtrak ticketing, baggage, maintenance, crew space, office, and security facilities has not been substantially modified since the 1930s or before. There are substantial differences between rail and passenger operations needs of that era with the current and future needs of Amtrak. The current location of the main floor restrooms is particularly problematic given the lack of security surveillance and the history of illegal and unauthorized activities in these areas.

Many of these deficiencies negatively impact the rail passenger and visitor experience, including those with disabilities. This erodes the quality of the passenger rail experience and undermines Union Station's effectiveness as a multi-modal transportation hub, and the project goals to support future rail passenger needs and revitalization of the facility.

5.2.2.2 Alternative A: Existing Boarding Gates
This alternative would preserve the configuration of the existing passenger boarding gates, so that all passenger boarding and alighting activity occurs through the main concourse. Ticketing and baggage operations would be consolidated into a new ticketing / baggage customer service counter located off of the existing north foyer. Restrooms would also be relocated to this area from the south concourse, closer to staffed Amtrak positions and the main concourse waiting area, to improve passenger convenience and improve security surveillance. A new baggage claim belt would be implemented and would replace the existing counter.

5.2.2.3 Alternative B: North Foyer Hallway (Configuration 1)
This alternative would extend the north foyer to create a north foyer hallway in the area currently occupied by the existing elevator and north stairway. This north foyer hallway would include a new exterior entrance for arriving passengers that would provide direct access to future restrooms, redcap services, customer service counters, and a new baggage claim belt. The north foyer would provide direct access to connecting thruway bus services as well as other amenities and transportation via the entrances to the adjacent main concourse.

5.2.2.4 Alternative C: North Foyer Hallway (Configuration 2)
This alternative is very similar to Alternative B, except that the layout of Amtrak operations spaces would be adjusted to reflect the location of Vertical Circulation and Access Alternative B. The configuration of customer service amenities along the north foyer hallway is identical to Alternative A. As discussed previously, Alternative B with two elevators and the open internal stairs is not the preferred vertical circulation and access alternative.

Figure 5.2-1 View of North Foyer Hallway (Alternatives B and C) for Arriving Passengers, Showing Relocated Restrooms, Ticketing, and Baggage

Figure 5.2-2 North Foyer Hallway, Baggage Pick-Up (Alternatives B and C)

Figure 5.2-3 View of Ticketing/Baggage Area (Alternatives B and C), with ADA Accessible Counter

5.2.3. Recommendation: Amtrak Operations and Passenger Concourse

The project team recommends implementing Alternative B, the North Foyer Hallway – Configuration 1. Creation of a new north foyer hallway would increase train boarding gate capacity for growth in future passenger rail service, and would minimize circulation and quieting conflicts between arriving and departing passenger flows and queues within the main concourse. The configuration of ticketing, baggage, and restrooms in this alternative would meet Amtrak operational and business objectives, and the orientation of passenger services would be the most conducive for arriving and departing passengers. Consolidation of ticketing / baggage functions would increase Amtrak operational efficiency and passenger convenience and would create opportunities to implement accessibility improvements to the customer service counter.

Figure 5.2-4 Amtrak Operations and Passenger Concourse Alternative A - Existing Boarding Gates

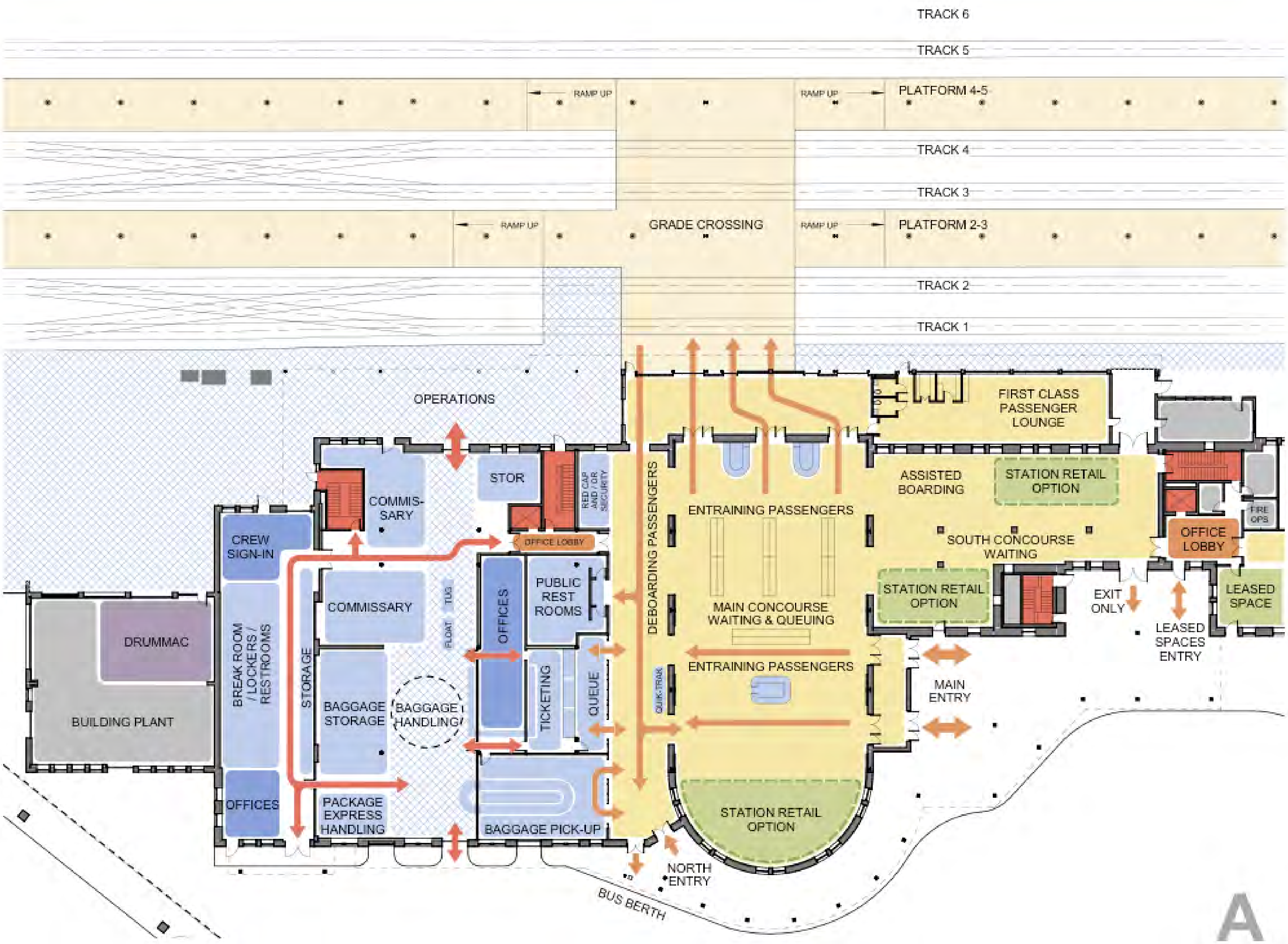


Figure 5.2-5 Amtrak Operations and Passenger Concourse Alternative B - North Foyer Hallway (Configuration 1)

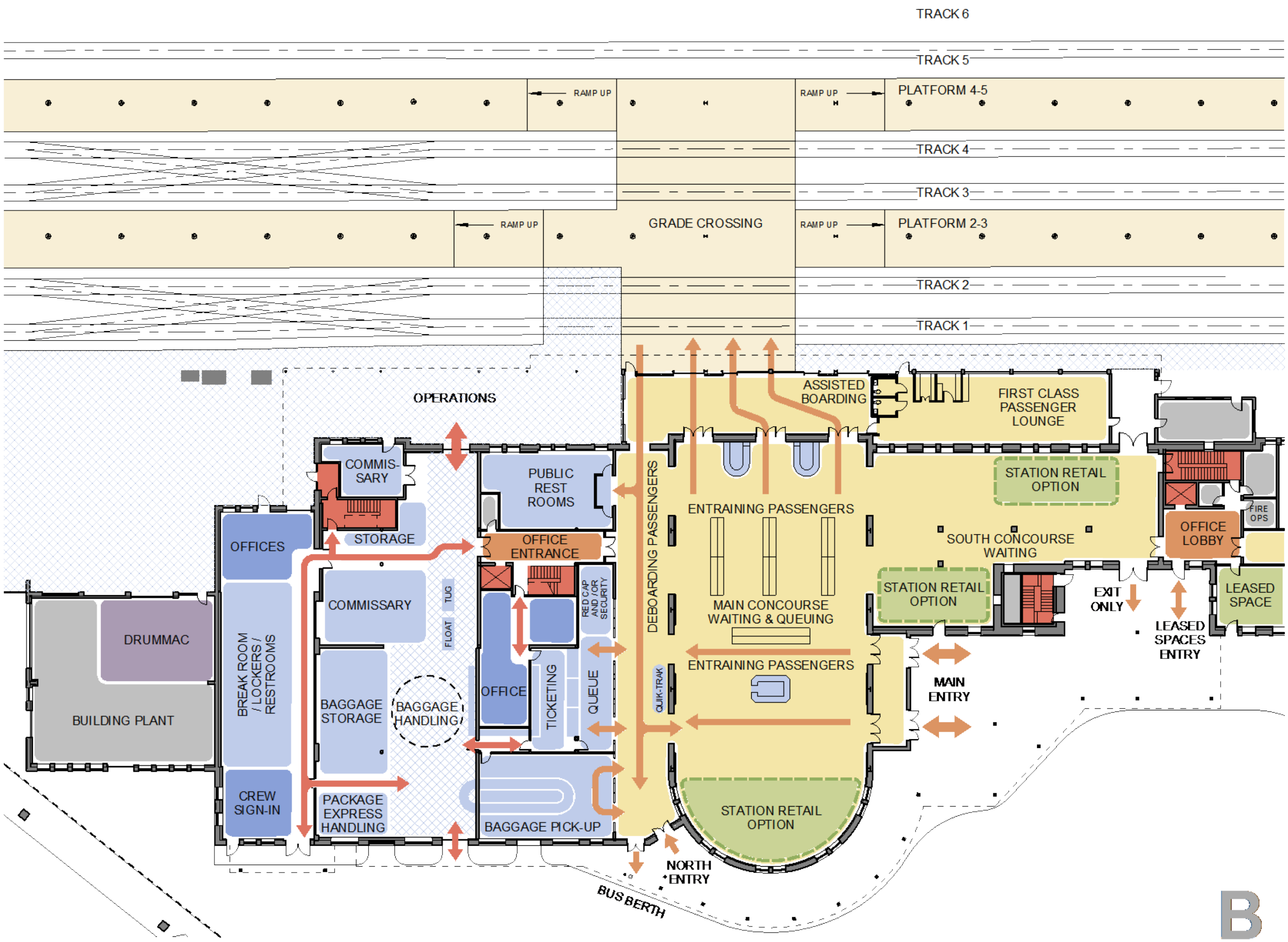


Figure 5.2-6 Amtrak Operations and Passenger Concourse Alternative C - North Foyer Hallway (Configuration 2)

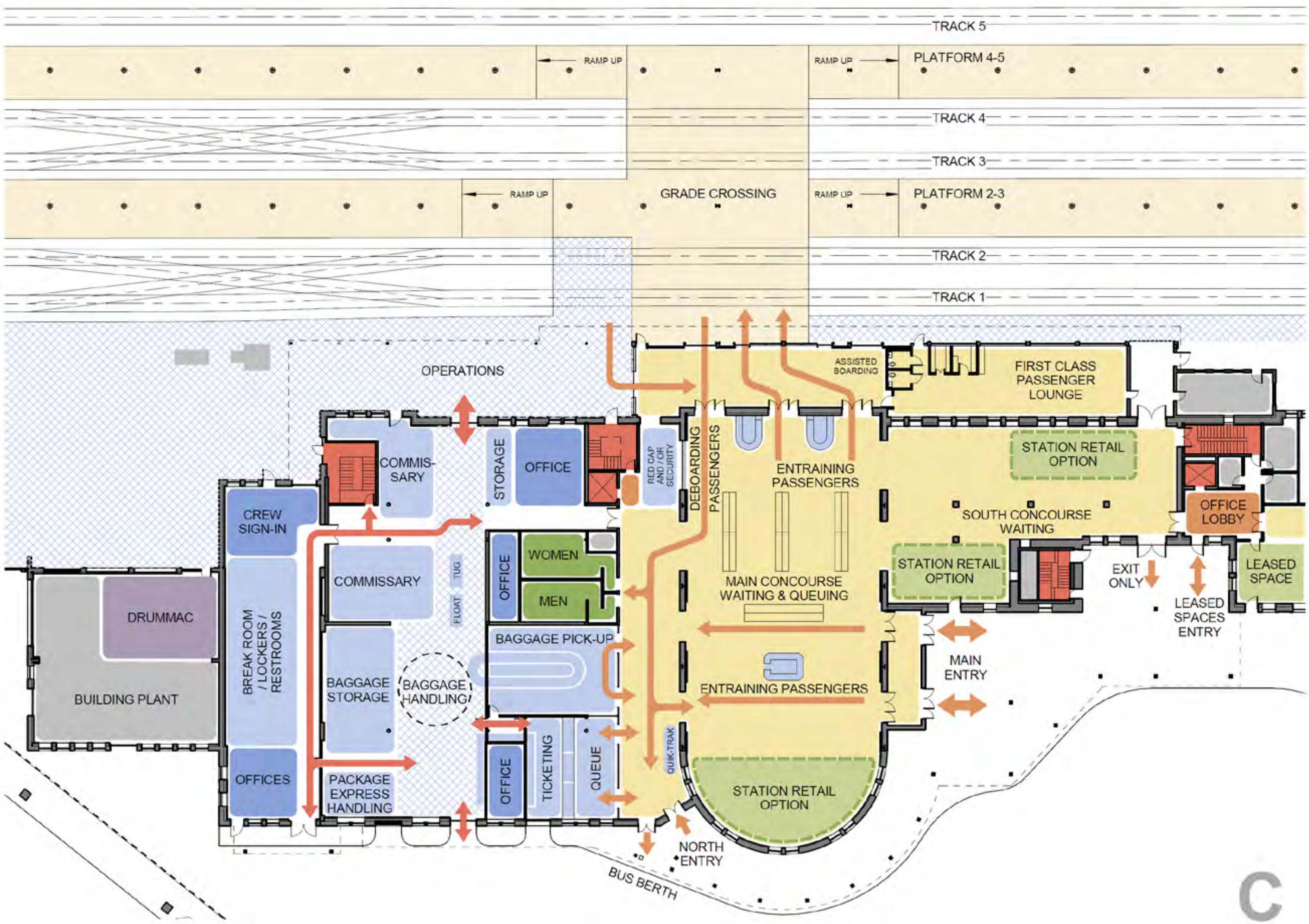


Table 5.2-1 Evaluation of Amtrak Operations and Passenger Concourse Alternatives

Evaluation Criteria		No-Build	A	Existing Boarding Gates	B	North Foyer Hallway – Configuration 1	C	North Foyer Hallway – Configuration 2
A: Ability to Meet Project Goals								
A.1. Accommodate Future Capacity and Operational Needs of Passenger and Freight Rail	◆	Existing deficiencies will continue to affect the passenger experience and rail operations	◆	Does not increase boarding gate capacity to accommodate increases in future demand and existing boarding gate congestion/conflicts.	●	Increases boarding gate capacity and reduces conflicts between arrive and departing passenger flows. Provides additional space to accommodate assisted boarding needs.	●	Increases boarding gate capacity and reduces conflicts between arrive and departing passenger flows. Provides additional space to accommodate assisted boarding needs.
A.2. Preserve and Protect the Historic Character of Union Station	◆	Historic characteristics of the building will continue to degrade over time.	●	Preserves historic features and materials while increasing station vitality.	●	Preserves historic features and materials while increasing station vitality.	●	Preserves historic features and materials while increasing station vitality.
A.3. Improve Economic and Social Vitality	◆	Missed opportunities to increase activation and vitality of the historic station	●	Allows for increased activation of the concourse through improved passenger amenities and concessions.	●	Allows for increased activation of the concourse through improved passenger amenities and concessions.	●	Allows for increased activation of the concourse through improved passenger amenities and concessions.
A.4. Improve Environmental Sustainability	◆	Old and inefficient building systems will remain in place.	●	Building systems and sustainability features will be upgraded to meet or exceed City standards	●	Building systems and sustainability features will be upgraded to meet or exceed City standards	●	Building systems and sustainability features will be upgraded to meet or exceed City standards
B. Cost and Financing								
B.1. Estimated Capital Cost	◆	Capital costs deferred but likely to be higher in the future	☐	Similar capital costs for all build alternatives	☐	Similar capital costs for all build alternatives	☐	Similar capital costs for all build alternatives

Evaluation Criteria		No-Build	A	Existing Boarding Gates	B	North Foyer Hallway – Configuration 1	C	North Foyer Hallway – Configuration 2
B.2. Lifecycle Cost Impacts	◆	Old and inefficient building systems will remain in place.	☐	Similar life cycle cost improvements (building and rail operations) for all build alternatives	☐	Similar life cycle cost improvements (building and rail operations) for all build alternatives	☐	Similar life cycle cost improvements (building and rail operations) for all build alternatives
B.3. Cost Risk	◆	Facilities O&M costs likely to remain higher and less predictable with older facilities and systems in place.	☐	Similar risk levels for all build alternatives	☐	Similar risk levels for all build alternatives	☐	Similar risk levels for all build alternatives
B.4. Financial Leverage	◆	Funding improvements is likely to be more difficult as a future stand-alone project	●	Increased funding potential as part of a multifaceted renovation project.	●	Increased funding potential as part of a multifaceted renovation project.	●	Increased funding potential as part of a multifaceted renovation project.
C. Implementability and Constructability								
C.1. Technical Complexity and Constructability	☐	N/A – No capital improvement project	☐	Similar scale of impacts for all build alternatives	☐	Similar scale of impacts for all build alternatives	☐	Similar scale of impacts for all build alternatives
C.2. Schedule and Schedule Risk	☐	N/A – No capital improvement project	☐	Similar scale of impacts for all build alternatives	☐	Similar scale of impacts for all build alternatives	☐	Similar scale of impacts for all build alternatives
C.3. Construction Impact on Passenger and Freight Rail Operations	☐	N/A – No capital improvement project	◆	Substantial disruption to passenger and rail operations will require temporary relocation of facilities and potential reduction in capacity during construction.	◆	Substantial disruption to passenger and rail operations will require temporary relocation of facilities and potential reduction in capacity during construction.	◆	Substantial disruption to passenger and rail operations will require temporary relocation of facilities and potential reduction in capacity during construction.

Evaluation Criteria		No-Build	A	Existing Boarding Gates	B	North Foyer Hallway – Configuration 1	C	North Foyer Hallway – Configuration 2
C.4. Construction Impact on Union Station Tenants	☐	N/A – No capital improvement project	◆	Potential impact to non-rail tenants during construction, including possible temporary use of non-rail tenant spaces for rail operations functions.	◆	Potential impact to non-rail tenants during construction, including possible temporary use of non-rail tenant spaces for rail operations functions.	◆	Potential impact to non-rail tenants during construction, including possible temporary use of non-rail tenant spaces for rail operations functions.
C.5. Phasing and Project Segmentation	☐	N/A – No capital improvement project	☐	Similar scale of impacts for all build alternatives	☐	Similar scale of impacts for all build alternatives	☐	Similar scale of impacts for all build alternatives
C.6. Risks, Assumptions and Unknowns	☐	N/A – No capital improvement project	☐	Similar risks and unknowns for all build alternatives	☐	Similar risks and unknowns for all build alternatives	☐	Similar risks and unknowns for all build alternatives
D. Environmental Impacts and Approvals								
D.1. Environmental Impacts and Project Classification	◆	Continued degradation of historic elements will continue; may lead to eventual loss of resources	☐	No unusual factors anticipated	☐	No unusual factors anticipated	☐	No unusual factors anticipated
D.2. Historic Impacts and Approvals	◆	Historic spaces and materials will continue to degrade over time.	◆	Impacts on historically sensitive areas, including the main concourse, will require design consultation and approvals.	◆	Impacts on historically sensitive areas, including the main concourse, will require design consultation and approvals.	◆	Impacts on historically sensitive areas, including the main concourse, will require design consultation and approvals. Changes to north foyer hallway with new external egress will potentially involve more historic discussion items.

Evaluation Criteria		No-Build	A	Existing Boarding Gates	B	North Foyer Hallway – Configuration 1	C	North Foyer Hallway – Configuration 2
D.3. Decision Making and Approvals	◆	Project approvals and permitting may be hampered if code-mandated upgrades are not implemented	☐	No unusual factors anticipated	☐	No unusual factors anticipated	☐	No unusual factors anticipated

5.3. Ticket Counter

This improvement repurposes the existing ticket counter area as a new rail passenger amenity. The ticket counter is anticipated to be vacated due to the proposed consolidation of the Amtrak ticketing function is combined with the baggage counter in the north foyer, in accordance with Amtrak's stated business requirements.

Figure 5.3-1 Existing Ticket Counter

Figure 5.3-2 1920s View of Newsstand Prior to Installation of the Existing 1930 Ticket Counter

5.3.1. Design Requirements and Objectives

The key design requirements for the ticket counter identified through the conditions assessment and stakeholder discussions include:

- Repurpose the ticket counter when vacated by Amtrak due to consolidation of ticketing and baggage functions.
- Improve passenger amenities and waiting areas to improve the attractiveness, convenience, and comfort of the rail passenger experience.
- Provide amenities that benefit other Amtrak tenants and visitors.
- Accommodate mutually beneficial uses that enhance rail travel and also complement the overall revitalization of the Broadway Corridor.
- Maximize potential return on leasable spaces to improve the financial sustainability of Union Station in the future.

5.3.2. Ticket Counter Alternatives Analysis

The following alternatives were evaluated:

- The No-Build Alternative would maintain Amtrak ticketing function in the existing location.
- The Café/Retain Existing Ticket Counter alternative repurposes the ticket counter as a retail concession. (This alternative assumes consolidation of the Amtrak ticketing function is combined with the baggage counter in the north foyer.)
- The Passenger Seating/Retain Existing Ticket Counter alternative repurposes the ticket counter as an additional passenger waiting area. (This alternative assumes consolidation of the Amtrak ticketing function is combined with the baggage counter in the North Foyer.)
- The Remove Existing Ticket Counter alternative removes the ticket counter and replaces it with an open, contiguous passenger waiting area, potentially with a freestanding retail or display kiosk. (This alternative assumes consolidation of the Amtrak ticketing function is combined with the baggage counter in the north foyer.)

The results of the evaluation of the four alternatives are summarized in Table 5.3-1.

5.3.2.1 Ticket Counter No-Build Alternative

The No-Build Alternative would retain the existing Amtrak passenger ticketing function at its existing location in the 1903s era ticket counter. The desired consolidation of Amtrak ticketing and baggage functions into a single location to support customer convenience and business practices would not be accommodated. The ticket counter would continue to lack ADA accessibility features such as a reduced height counter. Amtrak back office accounting functions located behind the counter would remain as-is, without improvements to facilities or security.

5.3.2.2 Alternative A: Café/Retain Existing Ticket Counter

This option would preserve the existing, historic walnut ticketing counter to incorporate it as a feature into a new retail concession such as a café (Figure 5.3-3). The counter itself, following preservation work, could be incorporated into the concession as a service counter or seating area. This re-use would preserve the feel of the existing Ticket Counter in the main concourse, and would lend a distinctive character and rail there to any concession. Areas behind the main counter would likely be modified to accommodate the needs of the future concession, with care taken to preserve historic materials and features (such as marble paneling or a vault).

Figure 5.3-3 Ticket Counter Alternative A - Café/Retain Existing Ticket Counter

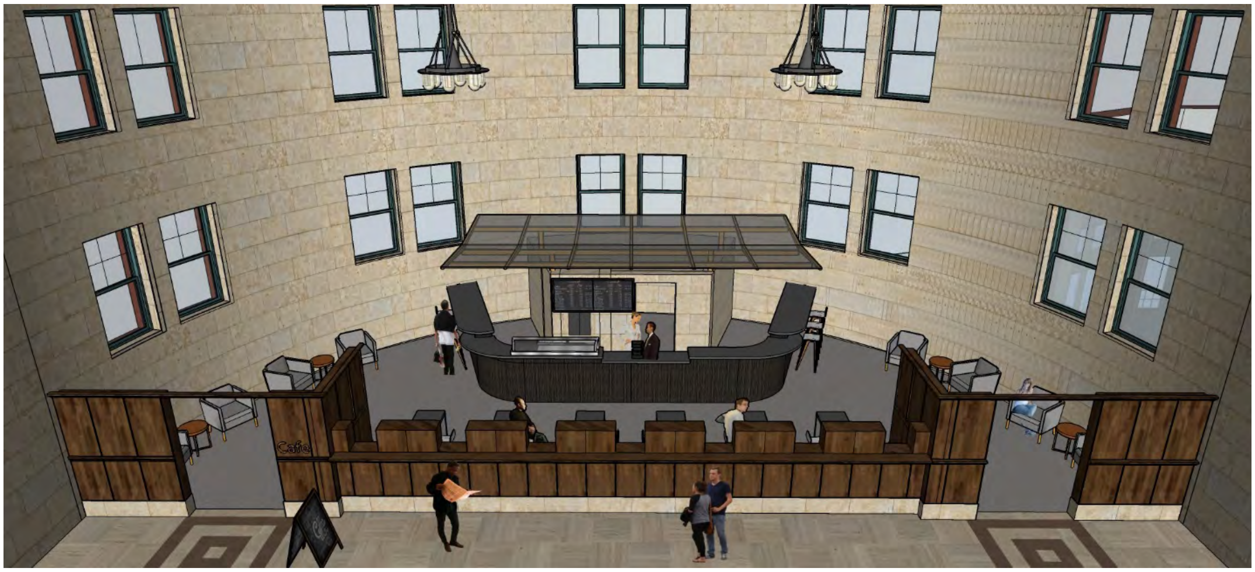


Figure 5.3-4 Repurposed Ticket Counter from the Entrance of the Main Concourse, Showing Preservation of the Historic Counter

Figure 5.3-5 Former Ticket Window at Denver Union Station, Repurposed as a Bar/Lounge

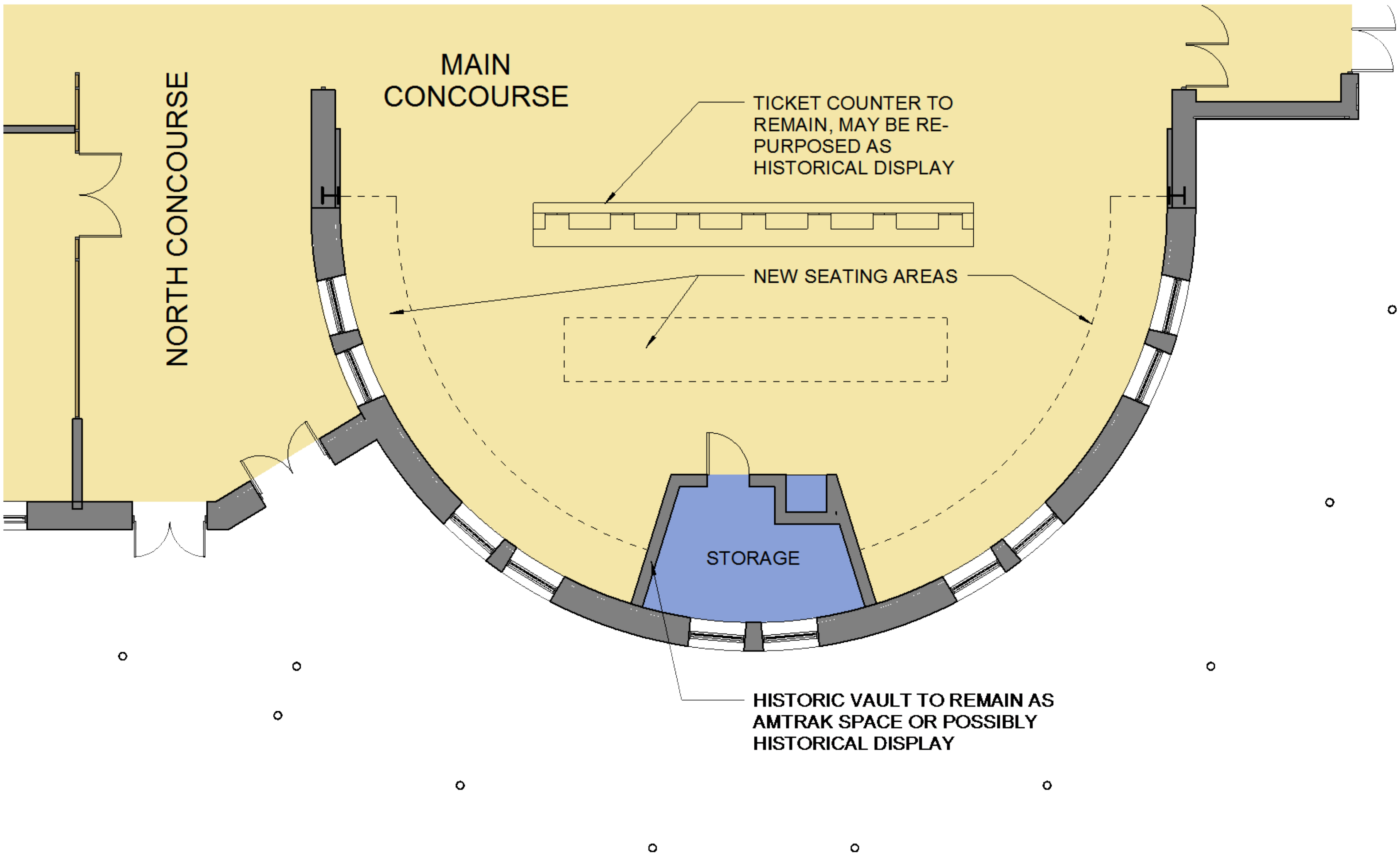
Figure 5.3-6 Repurposed Ticket Counter (Alternative A) from Main Concourse

Figure 5.3-7 Café Concept from Behind Ticket Counter

5.3.2.3 Alternative B: Passenger Seating/Retain Existing Ticket Counter

This option is similar to Alterative A in that it would preserve the existing historic walnut ticketing counter. However rather than housing a leasable space, the area behind the ticket counter would be repurposed for additional passenger seating and waiting area (Figure 5.3-8). The ticket counter itself could be preserved as a unique seating area for patrons, providing table and work space with a view of the historic main concourse and train activities. There is a wide variety of potential variation in the design of this space, including incorporation of historic artifacts, exhibits, or art.

Figure 5.3-8 Ticket Counter Alternative B – Passenger Seating/Retain Existing Ticket Counter



5.3.2.4 Alternative C: Remove Existing Ticket Counter

This alternative would remove the existing ticket counter entirely, creating a larger, contiguous waiting area within the main concourse (Figure 5.3-9). The vacated area could contain a retail kiosk, additional searing area, or both. Care would need to be taken to preserve existing historic materials while introducing new design materials if necessary, for example, to patch flooring within the footprint of the removed ticket counter.

Figure 5.3-9 Ticket Counter Alternative C – Remove Existing Ticket Counter

5.3.3. Recommendation: Ticket Counter

The project team recommends preserving the existing, historic walnut ticketing counter to incorporate it as a feature into a new retail concession such as a café. A café alternative would provide a new passenger amenity and creates a high-quality amenity in a prominent main concourse location. Preservation of the existing walnut ticket counter and other features would honor the historic use of this area and would add interest and character to the space.

Table 5.3-1 Evaluation of Ticket Counter Alternatives

Evaluation Criteria		No-Build	A	Café/Retain Existing Ticket Counter	B	Passenger Seating / Retain Existing Ticket Counter	C	Remove Existing Ticket Counter
A: Ability to Meet Project Goals								
A.1. Accommodate Future Capacity and Operational Needs of Passenger and Freight Rail	◆	Amtrak customer service options continue to be divided into separate portions of the station. Facilities are not ADA accessible.	●	Assumes relocation and consolidation of new, ADA accessible customer service functions to the north foyer. Adds an additional passenger amenity/seating capacity to the main concourse.	●	Assumes relocation and consolidation of new, ADA accessible customer service functions to the north foyer. Adds an additional passenger amenity/seating capacity to the main concourse.	●	Assumes relocation and consolidation of new, ADA accessible customer service functions to the north foyer. Adds an additional passenger amenity/seating capacity to the main concourse.
A.2. Preserve and Protect the Historic Character of Union Station	◆	Historic characteristics of the building will continue to degrade over time. Risk of abandonment of Ticket Counter as a functioning element as it becomes increasing obsolete.	●	Repurposes the ticket counter as a functional passenger amenity	●	Repurposes the ticket counter as a functional passenger amenity	◆	Results in removal of the historic ticket counter
A.3. Improve Economic and Social Vitality	◆	Missed opportunity to create new amenities and vitality in Union Station	●	Creates additional passenger amenity and vitality in Union Station's public areas. Increased revenue potential from new leasable space.	□	Increases seating capacity.	□	Increases seating capacity
A.4. Improve Environmental Sustainability	◆	Old and inefficient building systems will remain in place.	●	Building systems and sustainability features will be upgraded to meet or exceed City standards	●	Building systems and sustainability features will be upgraded to meet or exceed City standards	●	Building systems and sustainability features will be upgraded to meet or exceed City standards

Evaluation Criteria		No-Build	A	Café/Retain Existing Ticket Counter	B	Passenger Seating / Retain Existing Ticket Counter	C	Remove Existing Ticket Counter
B. Cost and Financing								
B.1. Estimated Capital Cost	◆	Capital costs deferred but likely to be higher in the future	□	Similar capital costs for all build alternatives	□	Similar capital costs for all build alternatives	□	Similar capital costs for all build alternatives
B.2. Lifecycle Cost Impacts	◆	Higher rail operating costs for Amtrak. Old and inefficient building systems will remain in place.	●	Reduced rail and building operating costs due to facilities consolidation and improvement.	●	Reduced rail and building operating costs due to facilities consolidation and improvement.	●	Reduced rail and building operating costs due to facilities consolidation and improvement.
B.3. Cost Risk	◆	Facilities O&M costs likely to remain higher and less predictable with older facilities and systems in place.	□	Similar risk levels for all build alternatives	□	Similar risk levels for all build alternatives	□	Similar risk levels for all build alternatives
B.4. Financial Leverage	◆	Funding improvements is likely to be more difficult as a future stand-alone project	●	Potential for new lease revenue generation/concessionaire financing to factor into project financing.	●	Increased funding potential as part of a multifaceted renovation project.	●	Increased funding potential as part of a multifaceted renovation project.
C. Implementability and Constructability								
C.1. Technical Complexity and Constructability	□	N/A – No capital improvement project	□	Similar scale of impacts for all build alternatives	□	Similar scale of impacts for all build alternatives	□	Similar scale of impacts for all build alternatives
C.2. Schedule and Schedule Risk	□	N/A – No capital improvement project	□	Similar scale of impacts for all build alternatives	□	Similar scale of impacts for all build alternatives	□	Similar scale of impacts for all build alternatives
C.3. Construction Impact on Passenger and Freight Rail Operations	□	N/A – No capital improvement project	□	Minimal impacts - work could be accomplished during major main concourse Renovations and is limited to ticketing area.	□	Minimal impacts - work could be accomplished during major main concourse Renovations and is limited to ticketing area.	□	Minimal impacts - work could be accomplished during major main concourse Renovations and is limited to ticketing area.

Evaluation Criteria		No-Build	A	Café/Retain Existing Ticket Counter	B	Passenger Seating / Retain Existing Ticket Counter	C	Remove Existing Ticket Counter
C.4. Construction Impact on Union Station Tenants	☐	N/A – No capital improvement project	☐	Minimal impact on existing tenants	☐	Minimal impact on existing tenants	☐	Minimal impact on existing tenants
C.5. Phasing and Project Segmentation	☐	N/A – No capital improvement project	☐	Tenant improvements can be phased after major improvements are completed	☐	Similar scale of impacts for all build alternatives	☐	Similar scale of impacts for all build alternatives
C.6. Risks, Assumptions and Unknowns	☐	N/A – No capital improvement project	☐	Similar risks and unknowns for all build alternatives	☐	Similar risks and unknowns for all build alternatives	☐	Similar risks and unknowns for all build alternatives
D. Environmental Impacts and Approvals								
D.1. Environmental Impacts and Project Classification	◆	Continued degradation of historic elements will continue; may lead to eventual loss of resources	●	Historic resource remains active and vital part of train station	●	Historic resource remains active and vital part of train station	◆	Loss of historic resource
D.2. Historic Impacts and Approvals	◆	Historic spaces and materials will continue to degrade over time.	◆	Ticket Counter preservation and adaptation will require historic consultations and approvals.	◆	Highest impact in historic resources	◆	Highest impact in historic resources
D.3. Decision Making and Approvals	◆	Project approvals and permitting may be hampered if code-mandated upgrades are not implemented	◆	Ticket Counter preservation and adaptation will require historic consultations and approvals.	◆	Highest impact in historic resources	◆	Highest impact in historic resources

5.4. South Concourse

This improvement would improve passenger waiting areas and amenities of south concourse through reconfiguration of seating, retail amenities, and potential changes to the seating area. These improvements would support re-activation of the main floor was well as improving the quality of rail passenger facilities.

The following alternatives were evaluated:

- The No-Build Alternative preserves the south concourse leasable spaces in the current configuration.
- The Expanded Retail Concessions With Shared Use Seating alternative activates the south concourse by introducing additional retail concessions in the south concourse, and created a shared-use seating area for both retail and rail passengers.
- The Passenger Waiting Area with Existing Concession alternative retains the existing concession area along with improve passenger and concession seating in the south concourse.
- The Dedicated Rail Passenger Seating alternative removes the existing concession area and refurbishes the south concourse as an expanded seating area dedicated to rail passengers.

The results of the evaluation of the four alternatives are summarized in Table 5.4-1.

5.4.1. Design Requirements and Objectives

The key design requirements for the south concourse identified through the conditions assessment and stakeholder discussions include:

- Improve passenger amenities and waiting areas to improve the attractiveness, convenience, and comfort of the rail passenger experience.
- Provide amenities that benefit other Amtrak tenants and visitors.
- Accommodate mutually beneficial uses that enhance rail travel and also complement the overall revitalization of the Broadway Corridor.
- Maximize potential return on leasable spaces to improve the financial sustainability of Union Station in the future.

5.4.2. South Concourse Alternatives Analysis

5.4.2.1 South Concourse No-Build Alternative

The No-Build Alternative would retain the existing configuration of the south concourse as a passenger seating area with one retail concession equipped with storage and kitchen space. Existing, bench-type seating in the south concourse would be retained.

5.4.2.2 Alternative A: Expanded Retail Concessions with Shared Use Seating

This alternative would activate the south concourse by increasing the amount of leasable retail/concession activity in the south concourse (Figure 5.4-1). Concessions could use the existing Trackside Café space and other kiosk/counter locations in or around the south concourse. These concessions, which would be anticipated to include food service uses, would use a shared seating area with new chairs, benches, or tables for both concession patrons as well as Amtrak passengers. This would increase the variety of seating and amenity options for passengers waiting for trains, and would also serve the needs of building tenants and patrons from the surrounding neighborhoods. During peak periods, the shared seating area could help to absorb the seating demand for rail passengers; at other times, it may be dominated by restaurant or café patrons. This alternative applies a concept that can be observed in rail and air transportation terminals around the world, where blending of concession and transportation waiting areas provides a richer experience for travelers and reduces the need for dedicated seating for both uses. In this case, the existing south concourse café could be repurposed for seating, business/work area, a children's amenity, exhibit space, etc.

Figure 5.4-1 South Concourse Alternative A – Expanded Retail Concessions with Shared Use Seating

5.4.2.3 Alternative B: Passenger Waiting Area with Existing Concession

This alternative would retain the existing balance of retail and seating space in the south concourse area (Figure 5.4-3). The current café/retail space would continue to be occupied by a similar concession, and the south concourse itself would be dedicated primarily to waiting rail passengers. Seating could be re-configured to provide additional seating and seating variety. Exhibit spaces or art could also be incorporated into the final concept.

5.4.2.4 Alternative C: Dedicated Rail Passenger Seating

This alternative would dedicate the entire south concourse to rail passenger seating (Figure 5.4-4). While a retail concession for rail passengers is a desirable feature, this alternative could occur if the existing retail concession in the south concourse was relocated to the area of the former ticket counter (Ticket Counter Re-Use Alternative A). As with other alternatives, the seating could be re-configured to provide additional seating and seating variety. Exhibit spaces or art could also be incorporated into the final concept. This configuration may also accommodate specialized passenger waiting facility needs – for example, roll-aboard bike storage for Amtrak Cascades passengers or an assisted boarding area.

5.4.3. Recommendation: South Concourse Alternative:

The project team recommends implementing Alternative A, which would expand retail concessions and have shared use seating. This alternative would improve and enhance the south concourse as an amenity for rail passengers, building tenants, and visitors alike. This alternative envisions flexible seating that can be used both by concession patrons and waiting rail passengers, providing flexible capacity during peak periods. Introduction of new retail concessions activates this area is compatible with providing exhibit space as part of the final space configuration.

Figure 5.4-2 South Concourse Alternative A: Expanded Retail Concessions with Shared Use Seating

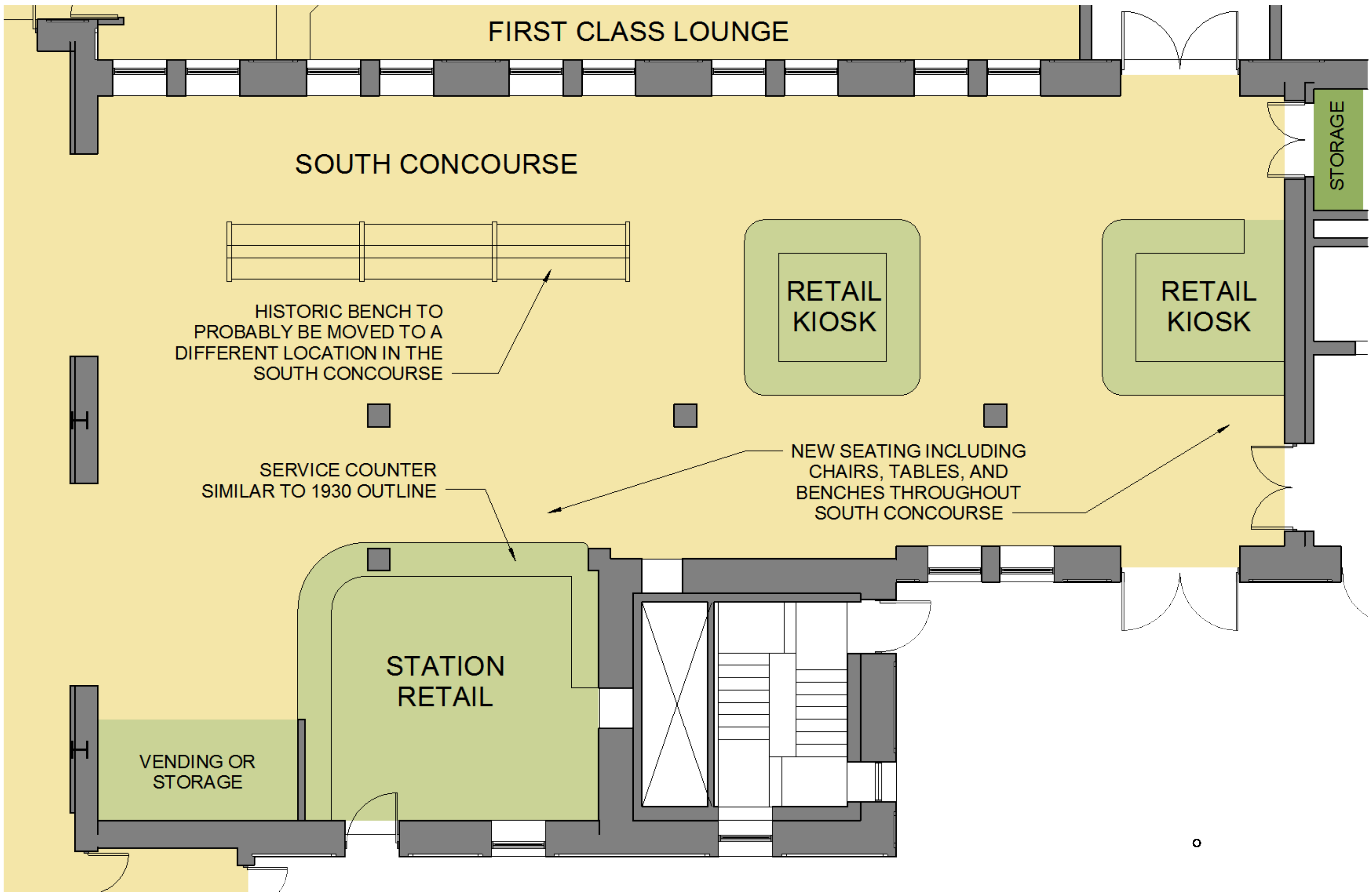


Figure 5.4-3 South Concourse Alternative B – Passenger Waiting Area with Existing Concession

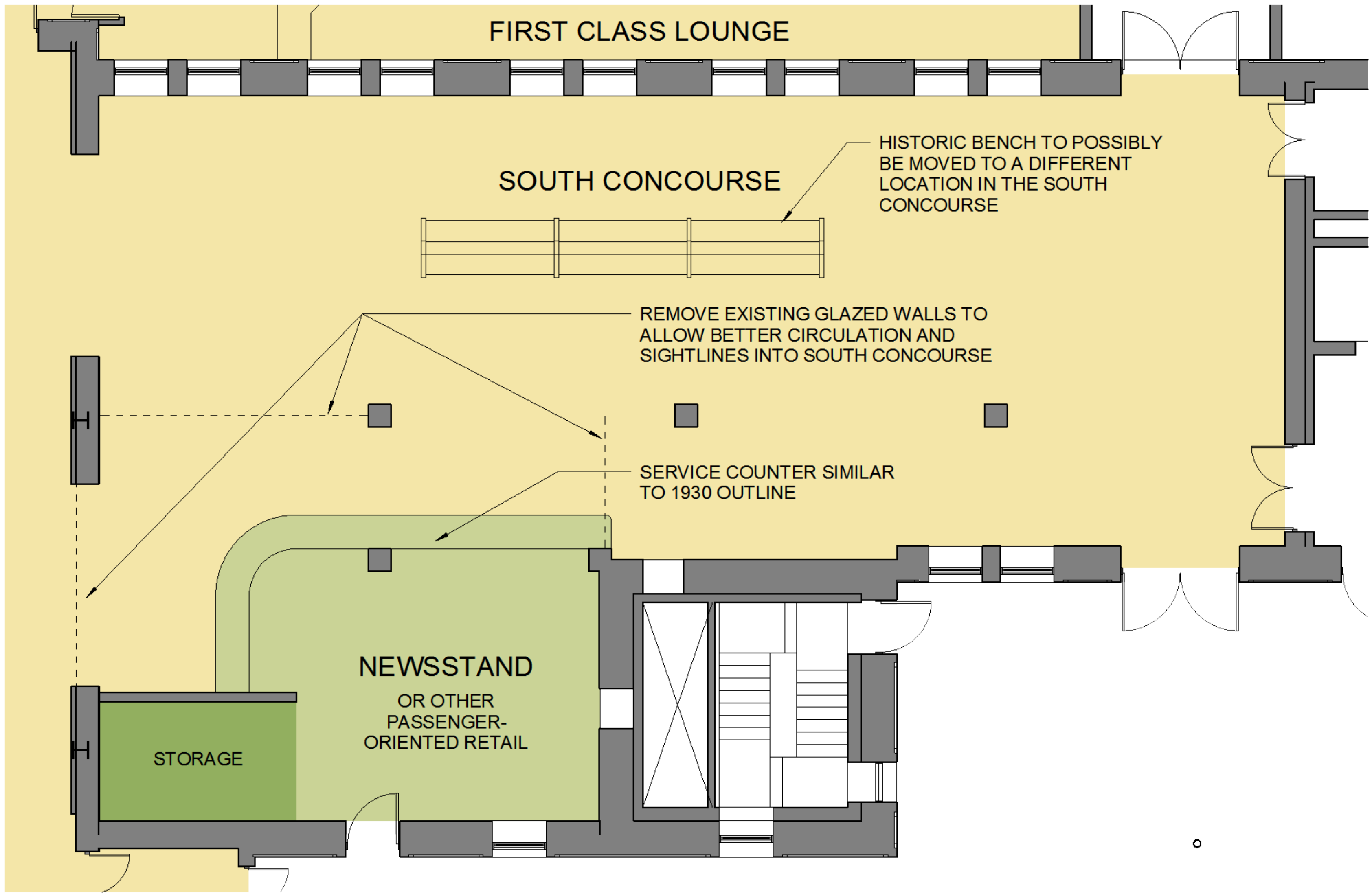


Figure 5.4-4 South Concourse Alternative C – Dedicated Rail Passenger Seating

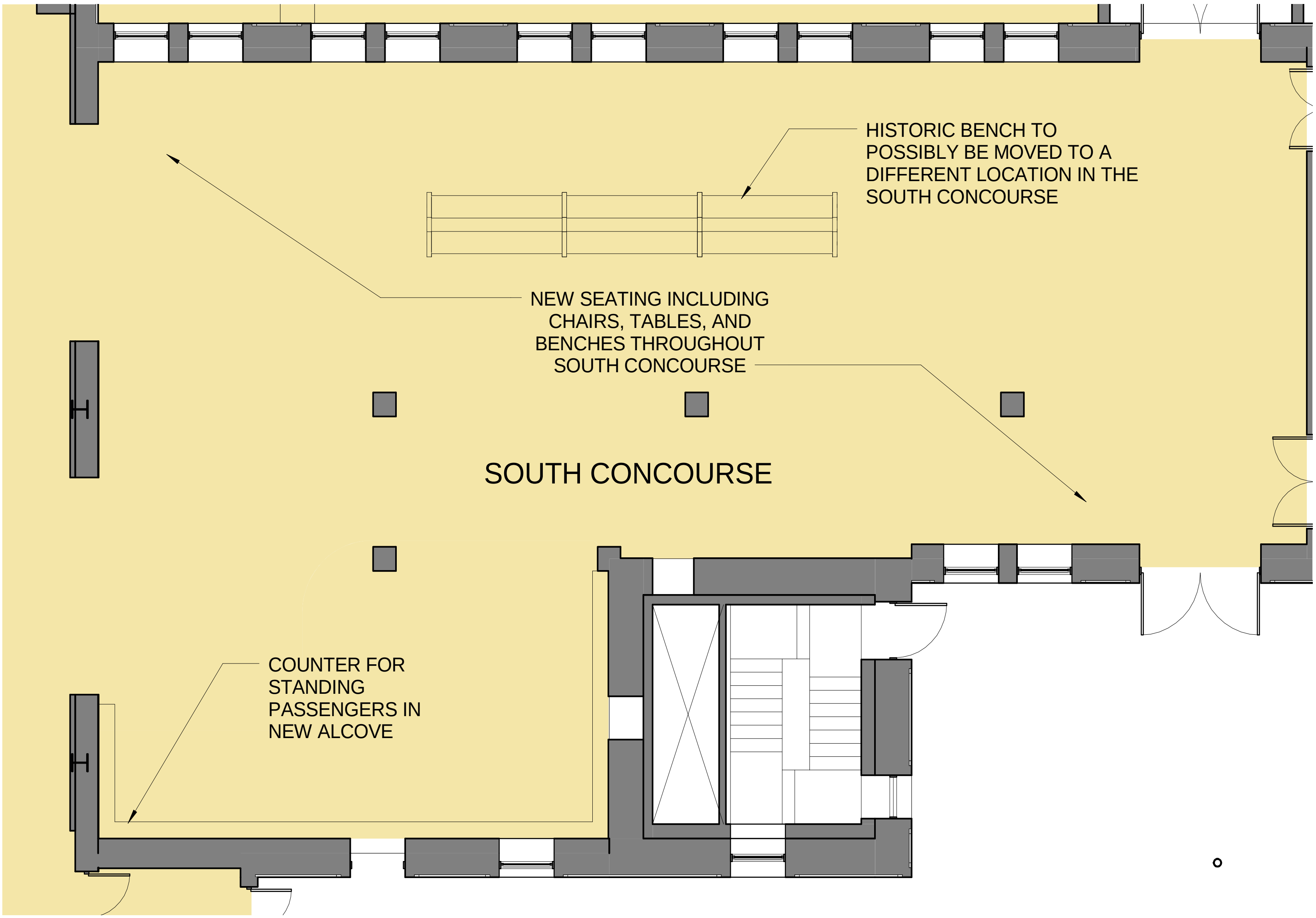


Table 5.4-1 Evaluation of South Concourse Alternatives

Evaluation Criteria		No-Build	A	Expanded Retail Concessions with Shared Use Seating	B	Passenger Waiting Area with Existing Concessions	C	Dedicated Rail Passenger Seating
A: Ability to Meet Project Goals								
A.1. Accommodate Future Capacity and Operational Needs of Passenger and Freight Rail	◆	Does not increase vitality for rail passengers	●	Creates additional passenger amenity and shared passenger/retail seating.	●	Includes improved and expanded rail passenger seating area.	●	Includes improved and expanded rail passenger seating area.
A.2. Preserve and Protect the Historic Character of Union Station	◆	Historic characteristics of the building will continue to degrade over time.	□	Comparable among build alternatives	□	Comparable among build alternatives	□	Comparable among build alternatives
A.3. Improve Economic and Social Vitality	◆	Missed opportunity to create new amenities and vitality in Union Station	●	Creates additional passenger amenity and vitality in Union Station's public areas. Increased revenue potential from new leasable space.	●	Retains passenger amenity and revenue potential from existing leasable space.	◆	Reduces passenger amenities, vitality, and lease revenue potential.
A.4. Improve Environmental Sustainability	◆	Old and inefficient building systems will remain in place.	●	Building systems and sustainability features will be upgraded to meet or exceed City standards	●	Building systems and sustainability features will be upgraded to meet or exceed City standards	●	Building systems and sustainability features will be upgraded to meet or exceed City standards
B. Cost and Financing								
B.1. Estimated Capital Cost	◆	Capital costs deferred but likely to be higher in the future	□	Similar capital costs for all build alternatives (excluding tenant improvements)	□	Similar capital costs for all build alternatives	□	Similar capital costs for all build alternatives

Evaluation Criteria		No-Build	A	Expanded Retail Concessions with Shared Use Seating	B	Passenger Waiting Area with Existing Concessions	C	Dedicated Rail Passenger Seating
B.2. Lifecycle Cost Impacts	◆	Existing, potentially diminishing, long term lease revenues from existing concession	●	Potential new lease revenue to offset building operating costs. Improvement in building operational efficiency.	●	Improvement in building operational efficiency	●	Improvement in building operational efficiency
B.3. Cost Risk	◆	Costs likely to be higher in the future with deferred investment	☐	Comparable among build alternatives	☐	Comparable among build alternatives	☐	Comparable among build alternatives
B.4. Financial Leverage	◆	Funding improvements is likely to be more difficult as a future stand-alone project	●	Potential for new lease revenue generation/concessionaire financing to factor into project financing.	●	Potential for new lease revenue generation/concessionaire financing to factor into project financing.	●	Potential for new lease revenue generation/concessionaire financing to factor into project financing.
C. Implementability and Constructability								
C.1. Technical Complexity and Constructability	☐	N/A – No capital improvement project	☐	Similar scale of impacts for all build alternatives	☐	Similar scale of impacts for all build alternatives	☐	Similar scale of impacts for all build alternatives
C.2. Schedule and Schedule Risk	☐	N/A – No capital improvement project	☐	Similar scale of impacts for all build alternatives	☐	Similar scale of impacts for all build alternatives	☐	Similar scale of impacts for all build alternatives
C.3. Construction Impact on Passenger and Freight Rail Operations	☐	N/A – No capital improvement project	☐	Minimal impacts - work could be coordinated with major main concourse or south Main Building renovations and is limited in scope.	☐	Minimal impacts - work could be coordinated with major main concourse or south Main Building renovations and is limited in scope.	☐	Minimal impacts - work could be coordinated with major main concourse or south Main Building renovations and is limited in scope.
C.4. Construction Impact on Union Station Tenants	☐	N/A – No capital improvement project	☐	Minimal impact on existing tenants except existing south concourse concessionaire.	☐	Minimal impact on existing tenants except existing south concourse concessionaire.	☐	Minimal impact on existing tenants except existing south concourse concessionaire.
C.5. Phasing and Project Segmentation	☐	N/A – No capital improvement project	☐	Tenant improvements can be phased after major improvements are completed	☐	Similar scale of impacts for all build alternatives	☐	Similar scale of impacts for all build alternatives

Evaluation Criteria		No-Build	A	Expanded Retail Concessions with Shared Use Seating	B	Passenger Waiting Area with Existing Concessions	C	Dedicated Rail Passenger Seating
C.6. Risks, Assumptions and Unknowns	☐	N/A – No capital improvement project	☐	Similar risks and unknowns for all build alternatives	☐	Similar risks and unknowns for all build alternatives	☐	Similar risks and unknowns for all build alternatives
D. Environmental Impacts and Approvals								
D.1. Environmental Impacts and Project Classification	◆	Continued degradation of historic elements will continue; may lead to eventual loss of resources	●	Historic portion of station remains vital part of passenger experience	●	Historic portion of station remains vital part of passenger experience	●	Historic portion of station remains vital part of passenger experience
D.2. Historic Impacts and Approvals	◆	Historic spaces and materials will continue to degrade over time.	◆	Changes and preservation of south concourse will require historic consultations and approvals.	◆	Changes and preservation of south concourse will require historic consultations and approvals.	◆	Changes and preservation of south concourse will require historic consultations and approvals.
D.3. Decision Making and Approvals	◆	Project approvals and permitting may be hampered if code-mandated upgrades are not implemented	◆	Changes and preservation of south concourse will require historic consultations and approvals.	◆	Changes and preservation of south concourse will require historic consultations and approvals.	◆	Changes and preservation of south concourse will require historic consultations and approvals.

5.5. First Class Lounge

This improvement considers upgrades and potential re-use of the existing Amtrak First Class Lounge located off of the south concourse.

The following alternatives were evaluated:

- The No-Build Alternative preserves the existing first class lounge as-is.
- The Retain Amtrak First Class Lounge alternative retains the lounge function but completes upgrades and reconfigurations per Amtrak requirements.
- The Repurpose First Class Lounge alternative would reprogram the space as a retail concession or restaurant space, creating an additional amenity for rail passengers and increased vitality along the south concourse, should Amtrak's business decision to retain the First Class Lounge change in the future.

The results of the evaluation of the three alternatives are summarized in Table 5.5-1.

5.5.1. First Class Lounge Alternatives Analysis

5.5.1.1 First Class Lounge No-Build Alternative

The No-Build Alternative would retain the existing Amtrak First Class Passenger Lounge as is, without changes or improvements to the space. No modifications to existing bathrooms, doors, seating areas, or fixtures would be implemented. Existing ADA accessibility barriers would remain.

5.5.1.2 Alternative A: Retain Amtrak First Class Lounge

This option would retain the Amtrak First Class Lounge in its current location and configurations (Figure 5.5-1). Modifications necessary to complete the building renovation and upgrades would be implemented, potentially along with other remodeling improvements by Amtrak as the leasing tenant. The area closest to the passenger boarding vestibule could be modified to accommodate a new assisted boarding location with direct access to the platforms.

Figure 5.5-1 First Class Lounge Alternative A - Retain Amtrak First Class Lounge

5.5.1.3 Alternative B: Repurpose First Class Lounge

This alternative would repurpose the Amtrak First Class Lounge space. If the Amtrak First Class Lounge space was vacated, this area could be used for a retail concession or restaurant space, creating an additional amenity for rail passengers and increased vitality along the south concourse (Figure 5.5-2). In this scenario, the Amtrak First Class Lounge could potentially be relocated, though there are few alternative locations on the Main floor that provide similar direct access to the trackside (for First Class and Sleeping Car passengers) without potentially interfering with baggage and train servicing operations. The existing masonry wall with windows separating the First Class Passenger Lounge could be made more "porous" by creating opening (e.g. a serving window) to an extended foodservice or counter space on the south concourse side of this wall. Similarly, a tenant in the First Class Lounge space could use possibly use shared seating in the south concourse for patrons, providing additional activation of the south concourse.

Figure 5.5-2 First Class Lounge Alternative B - Repurpose First Class Lounge

Figure 5.5-3 First Class Lounge Concept Extending into South Concourse

5.5.2. Recommendation: First Class Lounge

Amtrak has requested that the First Class Passenger Lounge be retained because of its value to its premium customer base such as sleeper car passengers and business class passengers; therefore, the project team recommends implementing Alterative A. Should Amtrak direction change, the space could be repurposed to accommodate a tenant or amenity as described in Alternative B.

Table 5.5-1 Evaluation of First Class Lounge Alternatives

Evaluation Criteria		No-Build	A	Retain Amtrak First Class Passenger Lounge	B	Repurpose First Class Passenger Lounge
A: Ability to Meet Project Goals						
A.1. Accommodate Future Capacity and Operational Needs of Passenger and Freight Rail	□	Retains amenity, though with existing deficiencies and ingoing degradation	●	Provides a key amenity for Amtrak Cascades Business Class and long-distance sleeper car passengers. Provides direct loading door for these passengers to platforms.	●	Provides a new amenity accessible for all rail passengers and building visitors.
A.2. Preserve and Protect the Historic Character of Union Station	◆	Historic characteristics of the building will continue to degrade over time.	●	Preserves historic features and materials while increasing station vitality.	●	Preserves historic features and materials while increasing station vitality.
A.3. Improve Economic and Social Vitality	◆	Leasability and occupancy of the station are anticipated to decline with increased deterioration of leasable spaces.	●	Improves existing passenger amenity	●	Provides a new passenger/visitor amenity to activate the south Concourse.
A.4. Improve Environmental Sustainability	◆	Old and inefficient building systems will remain in place.	●	Building systems and sustainability features will be upgraded to meet or exceed City standards	●	Building systems and sustainability features will be upgraded to meet or exceed City standards
B. Cost and Financing						
B.1. Estimated Capital Cost	□	Capital costs deferred but likely to be higher in the future	□	Similar capital costs for all build alternatives	□	Similar capital costs for all build alternatives (excluding tenant improvements)
B.2. Lifecycle Cost Impacts	◆	Higher building O&M costs due to continued operation with older and less efficient systems	●	Improvement in building operational efficiency	●	Improvement in building operational efficiency
B.3. Cost Risk	□	Higher risk of unanticipated repair costs due to continued operation with older and less efficient systems	□	No unusual factors anticipated	□	No unusual factors anticipated

Evaluation Criteria		No-Build	A	Retain Amtrak First Class Passenger Lounge	B	Repurpose First Class Passenger Lounge
B.4. Financial Leverage	☐	Funding improvements is likely to be more difficult as a future stand-alone project	●	Potential for new lease revenue generation/concessionaire financing to factor into project financing.	●	Potential for Amtrak lease revenue generation/rail funding to factor into project financing.
C. Implementability and Constructability						
C.1. Technical Complexity and Constructability	☐	N/A – No capital improvement project	☐	Comparable among build alternatives	☐	Comparable among build alternatives
C.2. Schedule and Schedule Risk	☐	N/A – No capital improvement project	☐	Comparable among build alternatives	☐	Comparable among build alternatives
C.3. Construction Impact on Passenger and Freight Rail Operations	☐	N/A – No capital improvement project	☐	Temporary impact to first class passengers when facility is closed.	☐	Temporary impact to first class passengers when facility is closed.
C.4. Construction Impact on Union Station Tenants	☐	N/A – No capital improvement project	☐	Limited to Amtrak leased space.	☐	Limited to Amtrak leased space.
C.5. Phasing and Project Segmentation	☐	N/A – No capital improvement project	☐	Potential to stage with Main/south concourse work for minimal impact	☐	Potential to stage with Main/south concourse work for minimal impact
C.6. Risks, Assumptions and Unknowns	☐	N/A – No capital improvement project	☐	Comparable among build alternatives	☐	Comparable among build alternatives
D. Environmental Impacts and Approvals						
D.1. Environmental Impacts and Project Classification	☐	Continued degradation of historic elements will continue; may lead to eventual loss of resources	☐	Historic portion of station remains vital part of passenger experience	☐	Historic portion of station remains vital part of passenger experience
D.2. Historic Impacts and Approvals	☐	Historic spaces and materials will continue to degrade over time.	☐	Minimal changes to historic spaces anticipated.	◆	Changes and preservation of south concourse will require historic consultations and approvals.
D.3. Decision Making and Approvals	☐	Project approvals and permitting may be hampered if code-mandated upgrades are not implemented	☐	No unusual factors anticipated	◆	Changes and preservation of south concourse will require historic consultations and approvals.

5.6. South Main Floor Leasable Spaces

This improvement would provide additional amenities that would enhance the experience for passengers and visitors, support the revitalization of the surrounding neighborhood, and improve the financial sustainability of the building. The following alternatives were considered:

- The No-Build Alternative preserves the existing restaurant use and south hallways as is, without structural, systems, or accessibility upgrades.
- The Core and Shell Only alternative upgrades the south main floor Leasable Spaces to core and shell conditions following major structural, seismic, and systems work, with programing and tenanting decision deferred until a future phase of design.
- The Restaurant alternative retains the existing use of the space as a full-service restaurant, with necessary changes to accommodate seismic, systems, accessibility, and life safety upgrades.
- The Single Tenant Space would create a contiguous floorplate to house an office-type, shared work, studio, or similar tenant, much like the current and proposed tenants on the upper floors.
- The Market Hall alternative creates and active space consisting of multiple retail and food service tenant stalls, and would serve as a supplemental waiting areas for rail passengers while also providing a gathering spot and amenity for the surrounding, revitalizing Broadway Corridor.

The results of the evaluation of the five alternatives are summarized in Table 5.6-1.

5.6.1. Design Requirements and Objectives

The key design requirements for the South Floor Leasable Spaces identified through the conditions assessment and stakeholder discussions include:

- Accommodate mutually beneficial uses that enhance rail travel and also complement the overall revitalization of the Broadway Corridor.
- Accommodate retail tenants with a draw beyond the convenience needs of train passengers.
- Reactivate the south hallway, currently used for storage and restroom access, with more active, public-facing uses.
- Maximize return on south Main floor leasable spaces to improve the long-term financial sustainability of Union Station.
- Improve access and security of this area as a lobby space for accessing upper floor leasable spaces.
- Provide a space that can be potentially used as an interim passenger waiting area, Amtrak operations support space, and/or temporary upper floor tenant accommodation during renovations of other portions Union Station.

5.6.2. South Main Floor Leasable Spaces Alternatives

5.6.2.1 South Main Floor Leasable Spaces No-Build Alternative

Under the No-Build Alternative, the south main floor would remain in its current condition with regular maintenance but no capital investment. The south end of Union Station requires extensive structural/seismic retrofit and systems replacement. The south end of the main floor includes original wood flooring from the 1890s, as it was not replaced in the 1930s remodel like the majority of the north end main floor. A number of structural efficiencies and failures were identified in this area during the conditions assessment, from the foundations to the floors to the unreinforced concrete masonry building. Under the No-Build Alternative, there is no opportunity to restore the historic vitality of the south end hallway, which is currently closed off to the public. Repairing these deficiencies would require removal and replacement of the existing floors, finishes, and systems.

5.6.2.2 Alternative A: Core and Shell Only

This alternative would upgrade the south main floor Leasable Spaces to core and shell conditions following major structural, seismic, and systems work (Figure 5.6-4). Future tenant fit-out and configuration would be determined in the future, closer to the date of tenant occupancy. This retains the most flexibility for future use and changing market conditions, as well as providing a space for temporary use during construction.

5.6.2.3 Alternative B: Restaurant

This alternative would re-create a restaurant space similar to the current use (Figure 5.6-5). The layout of the restaurant could be similar, but not identical, to the current layout, given the need to accommodate building upgrades, egress, accessibility, etc. It may be possible to re-create the entrance to the restaurant from the south hallway, recreating the manner in which the historic dining room was connected to the station prior to 1930. Existing historic finish materials in the current restaurant could potentially be preserved, repurposed, or relocated following the implementation of major building upgrades.

5.6.2.4 Alternative C: Single Tenant Office Space

This alternative would create a single floorplate to accommodate a single office tenant space on the main floor (Figure 5.6-6). Depending on the future tenant, this use may or may not provide benefit to rail passengers as a service or amenity. It would create a far larger contiguous leasable office space than currently exists on the upper floors of Union Station.

5.6.2.5 Alternative D: Market Hall

This alternative would create a "Market Hall" consisting of multiple retail and food service tenant stalls to create the feel of an active market (Figure 5.6-7). The Market Hall would include dining seating areas that could serve as supplemental waiting areas for rail passengers, while also providing a gathering spot and amenity for the surrounding, revitalizing Broadway Corridor. The Market Hall would be aligned along the footprint of the existing south hallway, which would continue as an open corridor through to the south end of the building. There is an opportunity to provide a new exterior egress to a future Annex Plaza at the south end. Access control to the Market Hall could be provided to limit access to the public outside of business hours by using doors or partitions near the proposed upper floor tenant lobby space. However, the overall design objective would be to provide an inviting, continuous corridor from the south concourse to encourage interaction between the Market Hall and the passenger concourses. This could include an extension of Market Hall style amenities into the south concourse area. The economic vitality of a Market Hall use would likely require substantial foot traffic from the adjacent neighborhood in addition to rail passengers, tenants, and visitors.

Figure 5.6-1 Market Hall Concept (Alternative C)

Figure 5.6-2 Market Hall Concept (Alternative C)

Figure 5.6-3 Market Hall Precedents (Clockwise from Upper Left: Chelsea Market, New York City; Pine Street Market, Portland, OR; Ferry Building, San Francisco; Faneuil Hall, Boston)

5.6.3. Recommendation: South Main Floor Leasable Spaces

The project team recommends implementing the core and shell only option (Alternative A).The decision about the highest and best use of this space will depend on future market conditions closer to the completion of construction, which is anticipated to be up to five or more years into the future. During this time, market conditions are expected to evolve significantly in the Broadway Corridor, particularly with the potential redevelopment of the nearby U.S. Post Office site and other parcels in the immediate vicinity.

The core and shell improvement (Alternative A) would accommodate any of the three re-use scenarios presented in Alternatives B through D. Restaurant and/or retail is the preferred re-use option, consistent with the historic uses of the south end of the building as a restaurant and dining hall, and the historical presence of other public services along the south hallway (e.g. barber shop). The refurbishments of this area of the building would require replacement of the floor structure, potential modifications to the ceiling structure, and seismic retrofits of the interior and exterior walls. Code and accessibility requirements would likely result in modification to the existing configuration of interior spaces. The re-designed south floor leasable spaces would incorporate elements of the historic corridor to the extent practical.

Figure 5.6-4 South Main Building Leasable Spaces Alternative A: Core and Shell Only

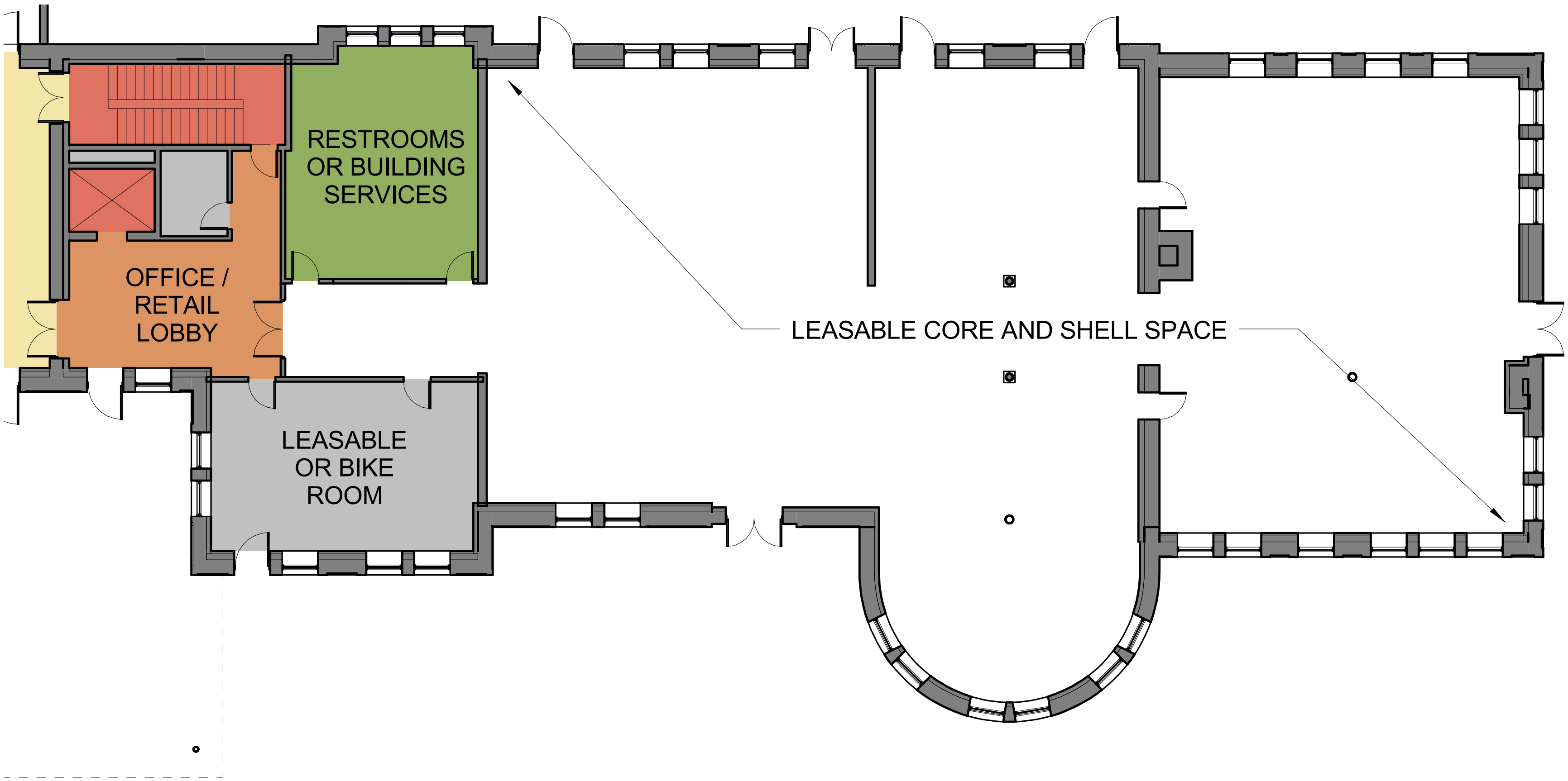


Figure 5.6-5 South Main Floor Leasable Spaces Alternative B - Restaurant

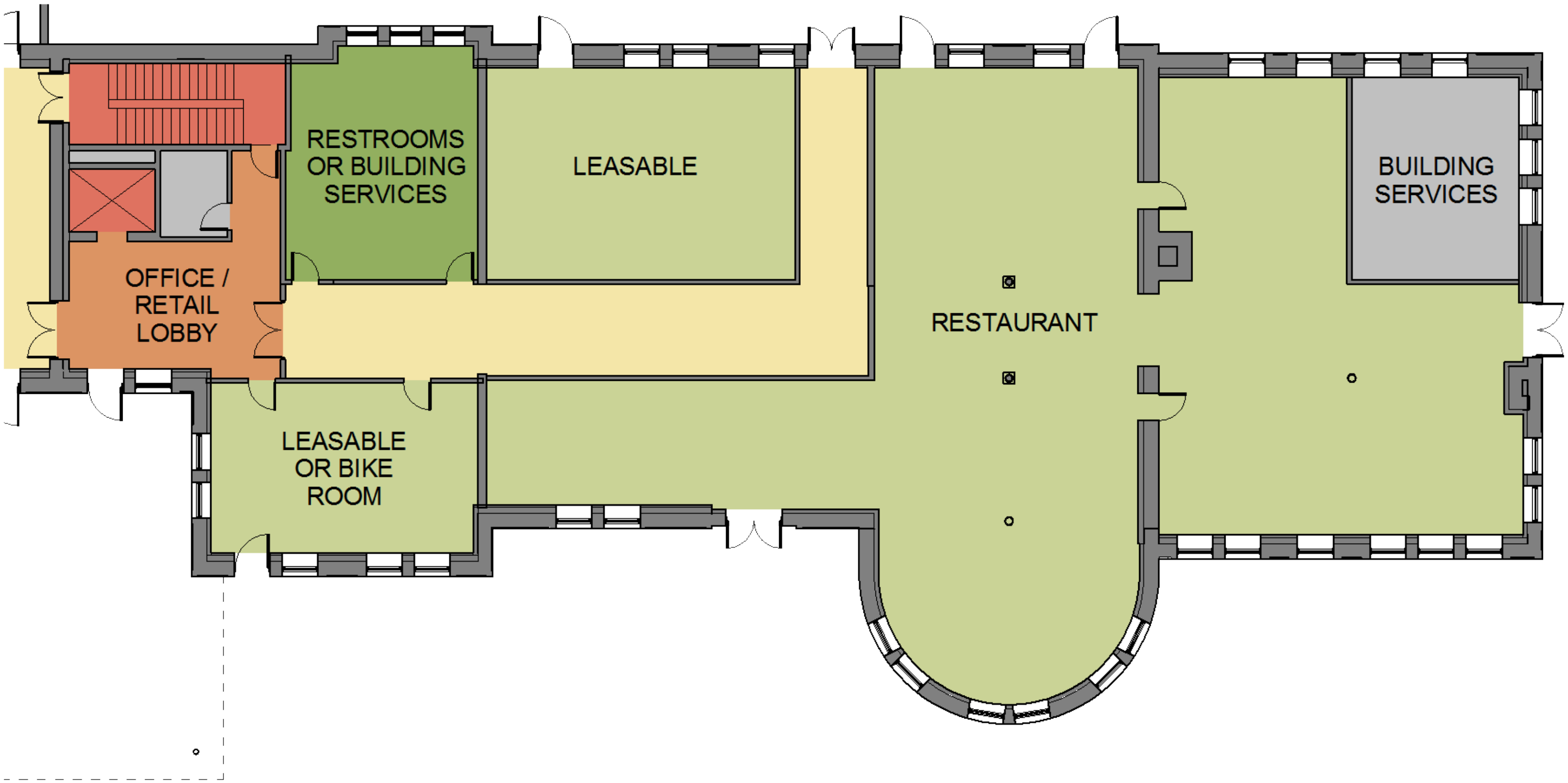


Figure 5.6-6 South Main Floor Leasable Spaces Alternative C - Single Tenant Office Space

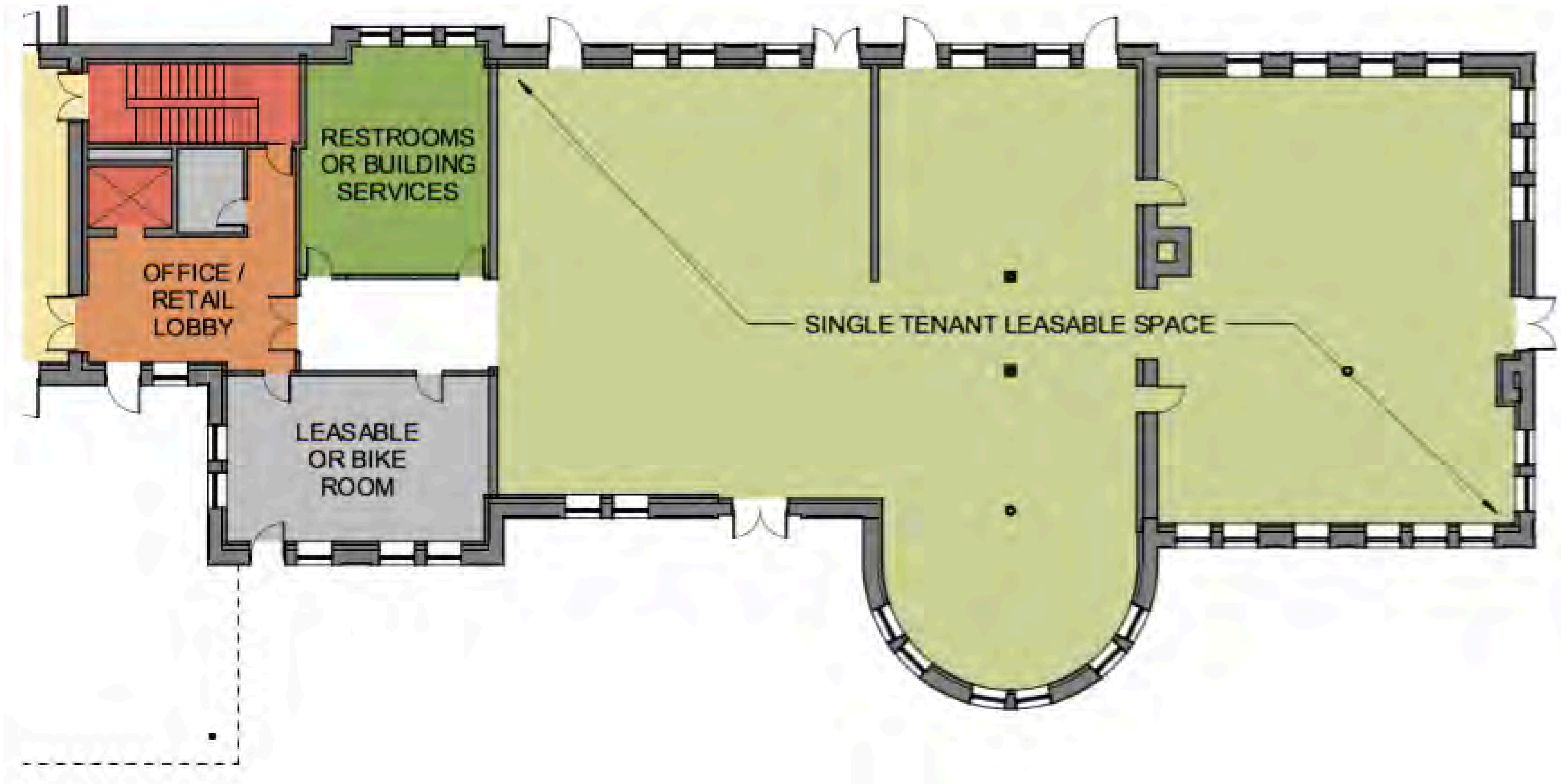


Figure 5.6-7 South Main Floor Leasable Spaces Alternative D - Market Hall

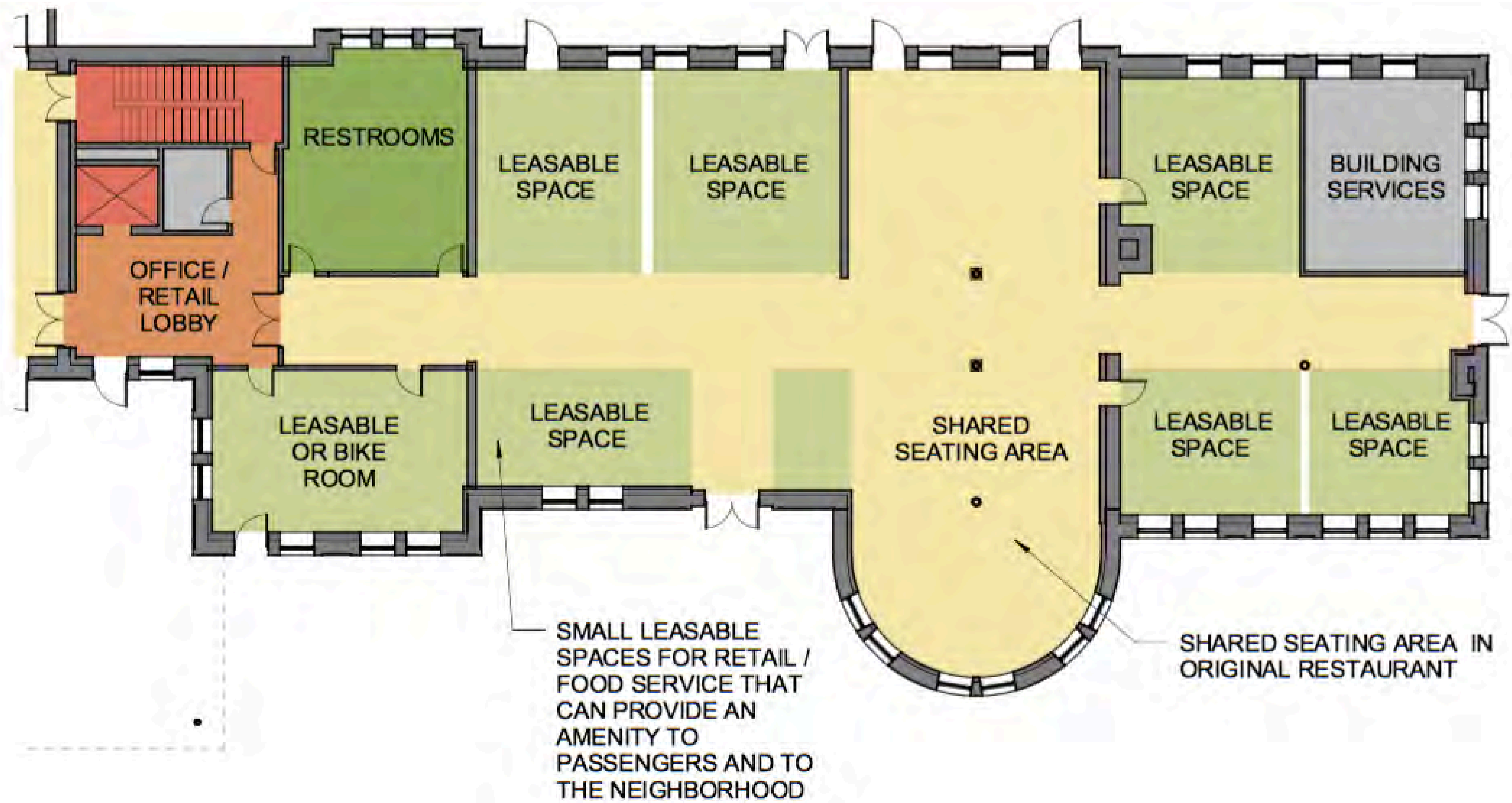


Table 5.6-1 Evaluation of South Main Floor Leasable Spaces Alternatives

Evaluation Criteria		No-Build	A	Core and Shell Only	B	Restaurant	C	Single Tenant: Business Incubator	D	Market Hall
A: Ability to Meet Project Goals										
A.1. Accommodate Future Capacity and Operational Needs of Passenger and Freight Rail	◆	Lost opportunity to provide improved amenities to enhance rail passenger experience.	●	Preserves opportunity to incorporate future passenger amenities.	●	Preserves restaurant function as an existing amenity	◆	Note likely to be a tenant that provides benefit to rail passengers	●	Provides expanded retail and food service options and seating as rail passenger amenities
A.2. Preserve and Protect the Historic Character of Union Station	◆	Historic characteristics of the building will continue to degrade over time. Severe structural issues in south end of the building remain unaddressed.	□	Future fit out of space will be determined in the future.	●	Consistent with historic restaurant/dining hall function	◆	Does not reflect historic passenger-facing uses of this part of the building	◆	Changes the historic use and footprint of the south end of the building.
A.3. Improve Economic and Social Vitality	◆	Leasability and occupancy of the station are anticipated to decline with increased deterioration of leasable spaces.	□	Future fit out of space will be determined in the future.	□	Vitality benefit from a single tenant would depend largely on the tenant. Likely little change from current activity levels.	◆	Not as supportive to neighborhood revitalization and Annex activation	●	Increased tenant variety with potentially greater integration with the surrounding neighborhood.
A.4. Improve Environmental Sustainability	◆	Old and inefficient building systems will remain in place.	●	Building systems and sustainability features will be upgraded to meet or exceed City standards	●	Building systems and sustainability features will be upgraded to meet or exceed City standards	●	Building systems and sustainability features will be upgraded to meet or exceed City standards	●	Building systems and sustainability features will be upgraded to meet or exceed City standards

Evaluation Criteria		No-Build	A	Core and Shell Only	B	Restaurant	C	Single Tenant: Business Incubator	D	Market Hall
B. Cost and Financing										
B.1. Estimated Capital Cost	◆	Capital costs deferred but likely to be higher in the future	□	Similar capital costs for all build alternatives (excluding tenant improvements)	□	Similar capital costs for all build alternatives (excluding tenant improvements)	□	Similar capital costs for all build alternatives (excluding tenant improvements)	□	Similar capital costs for all build alternatives (excluding tenant improvements)
B.2. Lifecycle Cost Impacts	◆	Higher building O&M costs due to continued operation with older and less efficient systems	●	Potential new lease revenue to offset building operating costs. Improvement in building operational efficiency.	●	Potential new lease revenue to offset building operating costs. Improvement in building operational efficiency.	●	Potential new lease revenue to offset building operating costs. Improvement in building operational efficiency.	●	Potential new lease revenue to offset building operating costs. Improvement in building operational efficiency.
B.3. Cost Risk	◆	Higher risk of unanticipated repair costs due to continued operation with older and less efficient systems	□	Risks shared by future tenant	□	Risks shared by future tenant	□	Risks shared by future tenant	□	Risks shared by future tenant
B.4. Financial Leverage	◆	Funding improvements is likely to be more difficult as a future stand-alone project	●	Potential for new lease revenue generation/concessionaire financing to factor into project financing.	●	Potential for new lease revenue generation/concessionaire financing to factor into project financing.	●	Potential for new lease revenue generation/concessionaire financing to factor into project financing.	●	Potential for new lease revenue generation/concessionaire financing to factor into project financing.
C. Implementability and Constructability										
C.1. Technical Complexity and Constructability	□	N/A – No capital improvement project	●	Owner provides shell and core.	●	Owner provides shell and core.	●	Owner provides shell and core.	●	Owner provides shell and core.

Evaluation Criteria		No-Build	A	Core and Shell Only	B	Restaurant	C	Single Tenant: Business Incubator	D	Market Hall
C.2. Schedule and Schedule Risk	□	N/A – No capital improvement project	□	No unusual factors anticipated	□	No unusual factors anticipated	□	No unusual factors anticipated	□	No unusual factors anticipated
C.3. Construction Impact on Passenger and Freight Rail Operations	□	N/A – No capital improvement project	●	Potential use of south end of the building as a temporary passenger facility or rail operations area during construction.	●	Potential use of south end of the building as a temporary passenger facility or rail operations area during construction.	●	Potential use of south end of the building as a temporary passenger facility or rail operations area during construction.	●	Potential use of south end of the building as a temporary passenger facility or rail operations area during construction.
C.4. Construction Impact on Union Station Tenants	□	N/A – No capital improvement project	◆	Negative impact on existing tenants during substantial structural/seismic retrofit	◆	Negative impact on existing tenants during substantial structural/seismic retrofit	◆	Negative impact on existing tenants during substantial structural/seismic retrofit	◆	Negative impact on existing tenants during substantial structural/seismic retrofit
C.5. Phasing and Project Segmentation	□	N/A – No capital improvement project	●	Fit-out of space can be delayed until after major renovations, based on market conditions	◆	Involves earlier commitment to tenant type, based on unknown future market conditions.	◆	Involves earlier commitment to tenant type, based on unknown future market conditions.	◆	Involves earlier commitment to tenant type, based on unknown future market conditions.
C.6. Risks, Assumptions and Unknowns	□	N/A – No capital improvement project	◆	Existing structural condition of the building in this area poses risks to cost, scope, and schedule.	◆	Existing structural condition of the building in this area poses risks to cost, scope, and schedule.	◆	Existing structural condition of the building in this area poses risks to cost, scope, and schedule.	◆	Existing structural condition of the building in this area poses risks to cost, scope, and schedule.

Evaluation Criteria		No-Build	A	Core and Shell Only	B	Restaurant	C	Single Tenant: Business Incubator	D	Market Hall
D. Environmental Impacts and Approvals										
D.1. Environmental Impacts and Project Classification	◆	Continued degradation of historic elements will continue; may lead to eventual loss of resources	●	Historic portion of station remains vital part of passenger experience	●	Historic portion of station remains vital part of passenger experience consistent with historic use for food service	□	Area repurposed/ reactivated but not part of rail passenger experience	●	Historic portion of station remains vital part of passenger experience consistent with historic use for food service
D.2. Historic Impacts and Approvals	◆	Historic spaces and materials will continue to degrade over time.	◆	Changes and preservation of south concourse will require historic consultations and approvals.	◆	Changes and preservation of south concourse will require historic consultations and approvals.	◆	Potentially most significant historic impacts that will need to be evaluated.	◆	Potentially most significant historic impacts that will need to be evaluated.
D.3. Decision Making and Approvals	◆	Project approvals and permitting may be hampered if code-mandated upgrades are not implemented	◆	Changes and preservation of south concourse will require historic consultations and approvals.	◆	Changes and preservation of south concourse will require historic consultations and approvals.	◆	Potentially most significant historic impacts that will need to be evaluated.	◆	Potentially most significant historic impacts that will need to be evaluated.

5.7. Upper Floor Leasable Spaces

This improvement would address the need to upgrade upper floor leasable spaces and supporting infrastructure due to deterioration and deficiencies that compromise the quality and leasability of upper floors. These improvements are intended to enhance the tenant/visitor experience, increase the quality and marketability of the second and third floor leasable spaces while respecting the historic character of the building.

The following alternatives were evaluated:

- The No-Build Alternative would leave upper floor leasable spaces as-is, without improvements.
- The Retain Existing Configuration and Floor Plates of Leasable Spaces alternative would upgrade and refurbish upper floor leasable spaces, while keeping the floor plates of the existing rooms and hallways essentially intact.
- The Reconfigure Leasable Spaces to Create Larger Leasable Floor Plates creates larger floorp lates for future tenants (core and shell) to accommodate a more diverse range of future office, creative, or other suitable tenants.

The results of the evaluation of the three alternatives are summarized in Table 5.7-1.

5.7.1. Design Requirements and Objectives

The key design requirements for the south floor leasable spaces identified through the conditions assessment and stakeholder discussions include:

- Addressing existing circulation, egress, and accessibility issues as stipulated by code requirements.
- Accommodating Amtrak regional office space needs, consolidated on the 2nd floor north and connected by vertical circulation to other Amtrak leasable spaces on the main floor directly below.
- Preserving and enhancing the integrity and character of the historic hallways.
- Addressing existing deficiencies in leasable tenant spaces (lighting, noise, vibration, HVAC, physical condition, etc.) that detract from the tenant experience and leasability of these spaces.
- Providing accessibility to all areas of the upper floors as required by current code.
- Creating larger footplates to attract larger and more diverse tenants.
- Maximizing return on upper floor leasable space to improve the long-term financial vitality of Union Station.
- Accommodate building support, mechanical, electrical, and telecommunications support spaces to improve building operational efficiency and to service future tenant needs.

5.7.2. Upper Floor Leasable Spaces Alternatives Analysis

5.7.2.1 Upper Floor Leasable Spaces No-Build Alternative

Under the No-Build Alternative, the upper floor leasable spaces would remain in its current condition with regular maintenance but no capital investment. Like the main floor, the upper floors will require substantial intervention to address structural, seismic, code, accessibility, life safety, and mechanical/electrical/plumbing deficiencies identified in the conditions assessment. Some of these changes, including vertical circulation and egress, will require reconfiguration of building elements. Additionally, feedback from building tenants and operations personnel identified numerous existing deficiencies to leasable tenant spaces, including: noise/vibration from trains; inadequate power, lighting, and telecom; a lack of ventilation and climate control; obsolete restroom fixtures; a lack of accessibility; a lack of access control; and general degraded condition of materials and finishes. These challenges, as well as the small floorplate of existing offices, are causing increasing challenges for leasing spaces at market rates. The historic hallways have also been compromised by incremental changes over the years that degrade their character and appearance.

5.7.2.2 Alternative A: Retain Existing Configuration and Floor Plates of Leasable Spaces

This alternative would maintain the existing footplate and tenant leasable spaces as is, following the implementation of core building (Figure 5.7-1). This new configuration would implemented by upgrading leasable areas to the core and shell stage following major structural, seismic, and mechanical improvements, with new partitions and tenant fit-out performed based on the needs of the future tenant. Historic finishes or casework within the tenant spaces themselves could potentially be preserved, reused, or relocated. In this alternative, the dead-end 'T' hallway on the second floor will likely need to be shortened to meet current code requirements.

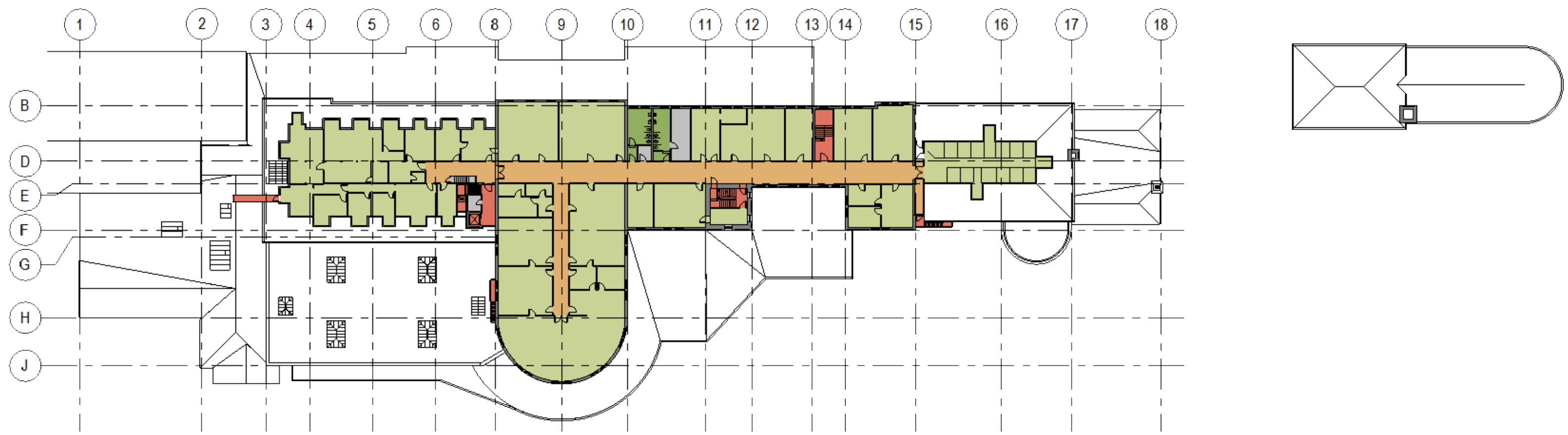
5.7.2.3 Alternative B: Reconfigure Leasable Spaces to Create Larger Leasable Floor Plates

This alternative would create larger floor plates for future tenants (core and shell) to accommodate a more diverse range of future office, creative, or other suitable tenants (Figure 5.7-2). The objective is to improve overall vitality and marketability of these spaces. This new configuration would implemented by upgrading leasable areas to the core and shell stage following major structural, seismic, and mechanical improvements, with new partitions and tenant fit-out performed based on the needs of the future tenant. Care would be taken to preserve the finishes and door openings of the existing historic hallway, even if some doors become inoperable in the future. Also, historic finishes or casework within the tenant spaces themselves could potentially be preserved, reused, or relocated. As with Alternative A, the dead-end 'T' hallway on the second floor would likely need to be shortened to meet current code requirements, though it could also be eliminated entirely to create an even larger contiguous leasable footplate.

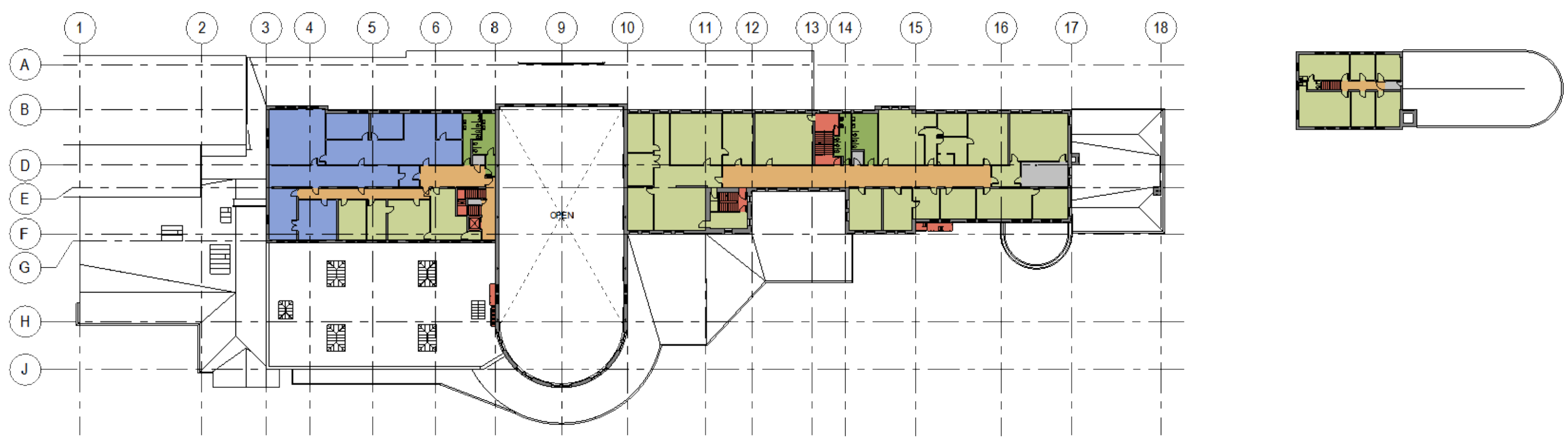
5.7.3. Recommendation: Upper Floor Leasable Spaces

The preferred alternative is to reconfigure leasable spaces to create larger floor plates (Alternative B). With this alternative, PDC will preserve the existing character, footprint, and materials of the existing historic corridors, while creating larger footprint leasable spaces that are more financially viable. In the near term, it is expected that leasable spaces will be rehabilitated to a core and shell level following major structural, systems, and vertical circulation improvements. This will maintain flexibility for tenant fit-out in the future. On a case-by-case basis, historic materials and features of leasable areas (e.g. casework, finishes) will be preserved and/or relocated.

Figure 5.7-1 Upper Floor Leasable Spaces Alternative A - Retain Existing Configuration and Floorplates of Leasable Spaces

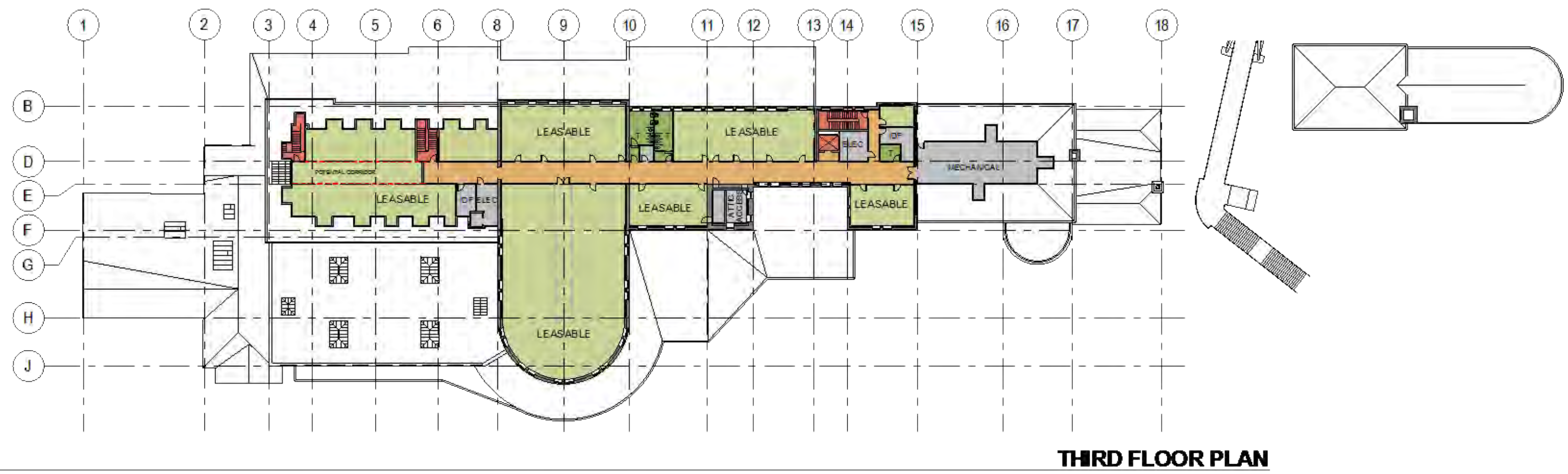


THIRD FLOOR PLAN



SECOND FLOOR PLAN

Figure 5.7-2 Upper Floor Leasable Spaces Alternative B - Reconfigure Leasable Spaces to Create Larger Leasable Floorplates



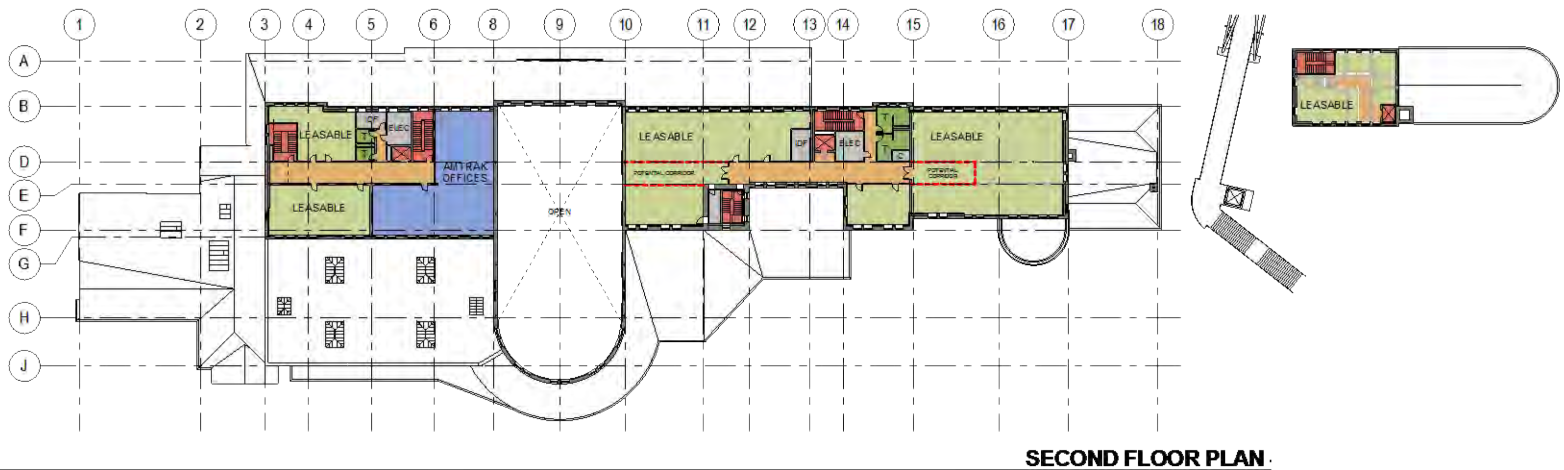


Table 5.7-1 Evaluation of Upper Floor Leasable Spaces Alternatives

Evaluation Criteria		No-Build	A	Retain Existing Configuration and Floorplates of Leasable Spaces	B	Reconfigure Leasable Spaces to Create Larger Leasable Floorplates
A: Ability to Meet Project Goals						
A.1. Accommodate Future Capacity and Operational Needs of Passenger and Freight Rail	◆	No improvements to Amtrak second floor office spaces	●	Improves Amtrak second floor office spaces to better meet current and future needs	●	Improves Amtrak second floor office spaces to better meet current and future needs
A.2. Preserve and Protect the Historic Character of Union Station	◆	Historic characteristics of the building will continue to degrade over time.	●	Preserves historic features and materials while increasing station vitality.	●	Preserves historic features and materials while increasing station vitality.
A.3. Improve Economic and Social Vitality	◆	Leasability and occupancy of the station are anticipated to decline with increased deterioration of leasable spaces.	●	Improves reactivation opportunities and long term financial sustainability of the station	●	Maximizes reactivation opportunities and long term financial sustainability of the station
A.4. Improve Environmental Sustainability	◆	Old and inefficient building systems will remain in place.	●	Building systems and sustainability features will be upgraded to meet or exceed City standards	●	Building systems and sustainability features will be upgraded to meet or exceed City standards
B. Cost and Financing						
B.1. Estimated Capital Cost	◆	Capital costs deferred but likely to be higher in the future	□	Comparable costs anticipated for major building upgrades irrespective of final footprint configuration.	□	Comparable costs anticipated for major building upgrades irrespective of final footprint configuration.
B.2. Lifecycle Cost Impacts	◆	Operating and maintenance costs of failing and obsolete building systems will remain.	●	Building systems will be upgraded, reducing lifecycle costs and unanticipated repairs.	●	Building systems will be upgraded, reducing lifecycle costs and unanticipated repairs.
B.3. Cost Risk	◆	Unanticipated system failures are a cost risk that is difficult to estimate and manage.	●	Building systems will be upgraded, reducing lifecycle costs and unanticipated repairs.	●	Building systems will be upgraded, reducing lifecycle costs and unanticipated repairs.
B.4. Financial Leverage	◆	Funding improvements is likely to be more difficult as a future stand-alone project	●	Increased funding potential as part of a multifaceted renovation project.	●	Increased funding potential as part of a multifaceted renovation project.

Evaluation Criteria		No-Build	A	Retain Existing Configuration and Floorplates of Leasable Spaces	B	Reconfigure Leasable Spaces to Create Larger Leasable Floorplates
C. Implementability and Constructability						
C.1. Technical Complexity and Constructability	☐	N/A – No capital improvement project	☐	No unusual factors anticipated	●	Greater flexibility in incorporating core building improvements and programmatic changes if the leasable space footplates can be modified.
C.2. Schedule and Schedule Risk	☐	N/A – No capital improvement project	☐	No unusual factors anticipated	☐	No unusual factors anticipated
C.3. Construction Impact on Passenger and Freight Rail Operations	☐	N/A – No capital improvement project	☐	Temporary relocation of Amtrak upper floor offices required.	☐	Temporary relocation of Amtrak upper floor offices required.
C.4. Construction Impact on Union Station Tenants	☐	N/A – No capital improvement project	◆	All build options will have a detrimental near-term impact on tenants during the construction phase, requiring temporary relocation.	◆	All build options will have a detrimental near-term impact on tenants during the construction phase, requiring temporary relocation.
C.5. Phasing and Project Segmentation	☐	N/A – No capital improvement project	☐	Upgrades will occur after core building systems work (structural/seismic and building systems)	☐	Upgrades will occur after core building systems work (structural/seismic and building systems)
C.6. Risks, Assumptions and Unknowns	☐	N/A – No capital improvement project	☐	The ability to preserve and replace historic finishes following construction is anticipated, but represents a risk.	☐	The ability to preserve and replace historic finishes following construction is anticipated, but represents a risk.
D. Environmental Impacts and Approvals						
D.1. Environmental Impacts and Project Classification	◆	Continued degradation of historic elements will continue; may lead to eventual loss of resources	●	Historic materials and building features will be preserved and enhanced as part of the renovation.	●	Historic materials and building features will be preserved and enhanced as part of the renovation.

Evaluation Criteria		No-Build	A	Retain Existing Configuration and Floorplates of Leasable Spaces	B	Reconfigure Leasable Spaces to Create Larger Leasable Floorplates
D.2. Historic Impacts and Approvals	◆	Historic spaces and materials will continue to degrade over time.	●	Historic materials and building features will be preserved and enhanced as part of the renovation.	●	Historic materials and building features will be preserved and enhanced as part of the renovation.
D.3. Decision Making and Approvals	◆	Project approvals and permitting may be hampered if code-mandated upgrades are not implemented	□	Will require consultations to ensure that proposed changes are compatible with historic character of critical elements of the upper floors (e.g. hallways).	●	Allows future decisions on programming of leasable spaces to be deferred to reflect market conditions closer to the completion of construction. Will likely require additional consultations to ensure that proposed changes are compatible with historic character of critical elements of the upper floors (e.g. hallways).

5.8. Nursery

This improvement would address structural and deterioration issues in the 1940s nursery addition that, because of deterioration and deficiencies, is currently not occupied.

5.8.1. Design Requirements and Objectives

The key design requirements for the Nursery identified through the conditions assessment and stakeholder discussions include:

- Preserve, repurpose, or remove the nursery given its current non-habitable condition and degradation.
- Prevent damage to the Main Building through incursion of water or mold leaking through the nursery.

5.8.2. Nursery Alternatives

The following alternatives were evaluated:

- The No-Build Alternative would leave the nursery as-is, and it would continue to be left unoccupied in its current degraded condition.
- The Rehabilitate Nursery alternative would preserve the existing nursery building and complete necessary upgrades and refurbishments to restore it to a condition where it could be occupied.
- The Remove Nursery alternative would demolish the Nursery building.
- The Replace Nursery Building would demolish and reconstruct the Nursery building as a new structure.

The results of the evaluation of the four alternatives are summarized in Table 5.8-1.

5.8.2.1 Nursery No-Build Alternative

Under the No-Build Alternative, the nursery would remain in its current condition and without regular maintenance or capital investment because of the health and safety risks associated with its current condition (Figure 5.8-1). The nursery is currently not occupied given its current condition and would continue to be unoccupied because of the health and safety risks. The nursery would continue to have seismic, structural, life safety, accessibility, and mechanical deficiencies, similar to the remainder of the building. Failure to remedy these conditions would result in continued deterioration and non-occupancy.

5.8.2.2 Alternative A: Rehabilitate Nursery

Under Alternative A, the nursery building would be repaired and seismically strengthened in line with current codes and requirements. The location of the structure on the trackside of the building suggests that a building/tenant support space or storage would be the most likely re-use of the space.

5.8.2.3 Alternative B: Remove Nursery

Under Alternative B, the nursery building would be removed and necessary repairs to the adjacent Main Building exterior wall would be made.

5.8.2.4 Alternative C: Replace Nursery Building

This alternative would replace the existing nursery building with a new structure of similar size and construction, consistent with modern code requirements and using new materials. As with the rehabilitation option, the location of the structure on the trackside of the building suggests that a building/tenant support space or storage would be the most likely re-use of the space.

Figure 5.8-1 Existing Nursery

5.8.3. Recommendation: Nursery

The project team recommends removing the nursery building (Alternative B). The nursery building is in poor physical and seismic condition, is currently unused, and cannot be occupied in its current state. Damage due to water and mold has compromised the structure, which risks damaging the main structure. The trackside location behind the Amtrak security control line limits the re-use options and potential future public access to any rehabilitated or reconstructed space. In order to preserve the legacy of the WWII era nursery, an interpretive display of the history of Union Station during WWII in a more public area of Union Station could be considered.

Table 5.8-1 Evaluation of Nursery Alternatives

Evaluation Criteria		No-Build	A	Rehabilitate Nursery	B	Replace Nursery Building	C	Remove Nursery Building
A: Ability to Meet Project Goals								
A.1. Accommodate Future Capacity and Operational Needs of Passenger and Freight Rail	□	Nursery not use for rail operations	□	Nursery not use for rail operations	□	Nursery not use for rail operations	□	Nursery not use for rail operations
A.2. Preserve and Protect the Historic Character of Union Station	◆	Historic characteristics of the building will continue to degrade over time	●	Preserves historic nursery and restores it to a state that can be occupied	●	Incorporates a facsimile of the historic nursery that can be occupied	◆	Removes historic resource
A.3. Improve Economic and Social Vitality	◆	Leasability and occupancy of the station are anticipated to decline with increased deterioration of leasable spaces	□	Future beneficial use of the Nursery has not been determined - potential storage or rail/operations support space is likely	□	Future beneficial use of the Nursery has not been determined - potential storage or rail/operations support space is likely	◆	Does not contribute to building or neighborhood revitalization
A.4. Improve Environmental Sustainability	◆	Old and inefficient building systems will remain in place	●	Building systems and sustainability features will be upgraded to meet or exceed City standards	●	Building systems and sustainability features will be upgraded to meet or exceed City standards	□	Neutral impact
B. Cost and Financing								
B.1. Estimated Capital Cost	◆	Capital costs deferred but likely to be higher in the future	□	Comparable among build alternatives	□	Comparable among build alternatives	□	Minimal costs for demolition and Main Building restoration.

Evaluation Criteria		No-Build	A	Rehabilitate Nursery	B	Replace Nursery Building	C	Remove Nursery Building
B.2. Lifecycle Cost Impacts	◆	Likely need for future emergency repairs to prevent further degradation and damage to the Main Building; overhead cost without potential for lease revenue.	●	Eliminates emergency maintenance repair liability and upgrades systems to high efficiency. Nursery becomes potential leasable space.	●	Eliminates emergency maintenance repair liability and upgrades systems to high efficiency. Nursery becomes potential leasable space.	●	Eliminates future O&M costs
B.3. Cost Risk	◆	Likely need for future emergency repairs to prevent further degradation and damage to the Main Building.	●	Eliminates emergency maintenance repair liability and upgrades systems to high efficiency. Nursery becomes potential leasable space.	●	Eliminates emergency maintenance repair liability and upgrades systems to high efficiency. Nursery becomes potential leasable space.	●	Eliminates future O&M costs
B.4. Financial Leverage	◆	Funding improvements is likely to be more difficult as a future stand-alone project	●	Increased funding potential as part of a multifaceted renovation project.	●	Increased funding potential as part of a multifaceted renovation project.	●	Increased funding potential as part of a multifaceted renovation project.
C. Implementability and Constructability								
C.1. Technical Complexity and Constructability	☐	N/A – No capital improvement project	☐	Minimal scope and complexity of work in an very limited area of the project site	☐	Minimal scope and complexity of work in an very limited area of the project site	☐	Minimal scope and complexity of work in an very limited area of the project site
C.2. Schedule and Schedule Risk	☐	N/A – No capital improvement project	☐	No unusual factors anticipated	☐	No unusual factors anticipated	☐	No unusual factors anticipated
C.3. Construction Impact on Passenger and Freight Rail Operations	☐	N/A – No capital improvement project	☐	Minimal impact given localized area	☐	Minimal impact given localized area	☐	Minimal impact given localized area

Evaluation Criteria		No-Build	A	Rehabilitate Nursery	B	Replace Nursery Building	C	Remove Nursery Building
C.4. Construction Impact on Union Station Tenants	□	N/A – No capital improvement project	□	Minimal impact given localized area	□	Minimal impact given localized area	□	Minimal impact given localized area
C.5. Phasing and Project Segmentation	□	N/A – No capital improvement project	□	No unusual factors anticipated	□	No unusual factors anticipated	□	No unusual factors anticipated
C.6. Risks, Assumptions and Unknowns	□	N/A – No capital improvement project	□	No unusual factors anticipated	□	No unusual factors anticipated	□	No unusual factors anticipated
D. Environmental Impacts and Approvals								
D.1. Environmental Impacts and Project Classification	◆	Continued degradation of historic elements will continue; may lead to eventual loss of resources	●	Retains historic resource	◆	Involves permanent loss of historic resource but retains a replacement structure	◆	Involves permanent loss of historic resource
D.2. Historic Impacts and Approvals	◆	Historic spaces and materials will continue to degrade over time.	□	Rehabilitation will require historic consultations and approval	□	New design will require historic consultations and approval	◆	Highest potential historical impact. Potential to incorporate interpretive exhibits as a mitigating measure.
D.3. Decision Making and Approvals	◆	Project approvals and permitting may be hampered if code-mandated upgrades are not implemented	□	Rehabilitation will require historic consultations and approval	□	New design will require historic consultations and approval	◆	Highest potential historical impact. Potential to incorporate interpretive exhibits as a mitigating measure.

6. Core Building Alternatives

This section describes the Core Building Improvements evaluated in conceptual design. These alternatives are organized as follows:

- Structural / Seismic Alternatives
- Mechanical/Electrical/Plumbing

Fire/Life Safety improvements are discussed in the Scope of Proposed Building Improvements Chapter as well as the Conditions Assessment Report. However, discrete alternatives are not presented in this chapter for these largely code-driven improvements.

6.1. Structural/Seismic Improvements

The core building improvements address a number of issues including structural/seismic deficiencies that were identified through the conditions assessment. Mandatory seismic improvements are triggered by the City of Portland code based on project construction value.

During the Union Station Conditions Assessment, the facility was analyzed using ASCE 41-13, *Seismic Evaluation and Retrofit of Existing Buildings.* From this analysis, a list of seismic deficiencies was identified. The objective of the conceptual design phase was to develop alternatives to address these deficiencies.

It is assumed that structural work at the building will include a number of mandated improvements from the City of Portland code. The City of Portland has mandatory upgrade triggers for Unreinforced Masonry (URM) buildings which apply to Union Station. If the overall upgrade of Union Station exceeds a specified dollar amount, the station will be required to receive a full seismic upgrade. Additionally, repurposing of the structure that results in a higher occupancy category will result in a mandatory seismic upgrade.

A key consideration in the development of structural/seismic alternatives is minimizing impacts on historic spaces and materials, particularly impacts of a permanent and visible nature.

Seismic upgrade alternatives were developed using ASCE 41-13, *Seismic Evaluation and Retrofit of Existing Buildings* and the 2014 Oregon Structural Specialty Code which identifies the station as a risk category III structure based on its occupancy type. As a result, per ASCE 41-13, Union Station will be strengthened to meet the structural performance objectives of "limited safety" at the BSE-2E seismic event, and damage control at the BSE-1E seismic event. The BSE-2E event is a much larger event and much less likely to occur than the BSE-1E event and as a result, the structure is held to the lower performance objective of limited safety. With the performance objective of limited safety, the structure will experience a significant amount of damage, potentially more than can be repaired, but will not collapse. The performance objective of damage control represents much less damage and the structure can continue to function with minimal repairs.

Further discussion of code requirements and performance standards is included in the Conditions Assessment Report.

6.1.1. Structural/Seismic Alternatives

The structural alternatives are presented in the following discussion by sub-element:

- Main Building Seismic Strengthening Alternatives
- Diaphragm Alternatives
- Out-of-Plane Strengthening Alternatives
- Tower URM Strengthening Alternatives
- Tower Overturning Resistance Alternatives
- Main Building Chimneys

The complete package of structural/seismic improvements is illustrated in Figures 6.1-1 through 6.1-3. The recommended improvements discussed in the sections below represent a hybrid of strategies based on specific architectural and structural engineering considerations for each element of the building. For lateral elements of the building (walls), the range of feasible technical approaches are illustrated for each wall section. In most locations, a preferred option is feasible (reinforced concrete (shotcrete) shear walls), but there are exceptions and options that need to be evaluated in preliminary design on a case-by-case basis.

Design decisions on related components (e.g., location and framing of vertical circulation elements) may ultimately influence the preferred structural/seismic approach.

Figure 6.1-1 Structural / Seismic Alternatives 1st Floor

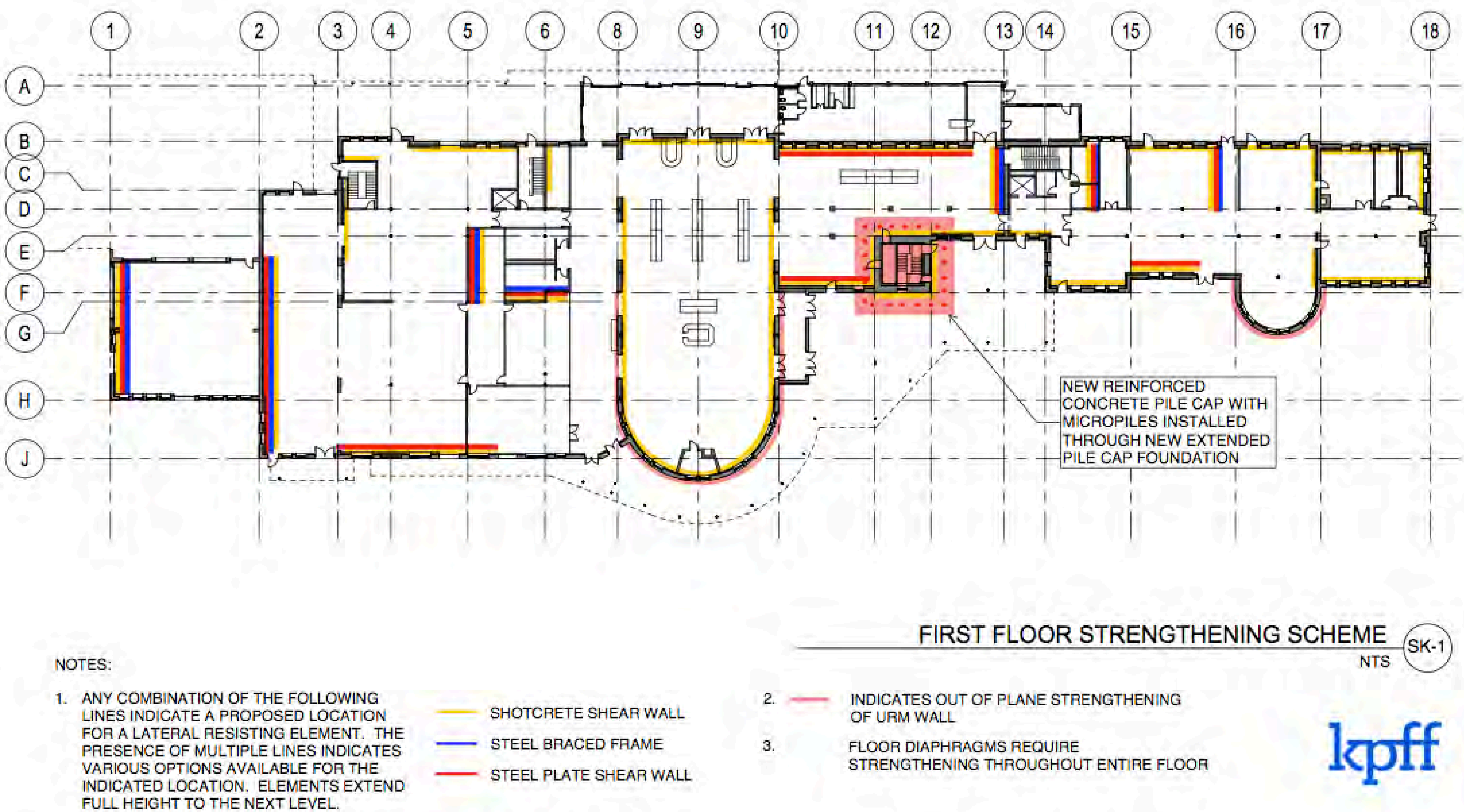
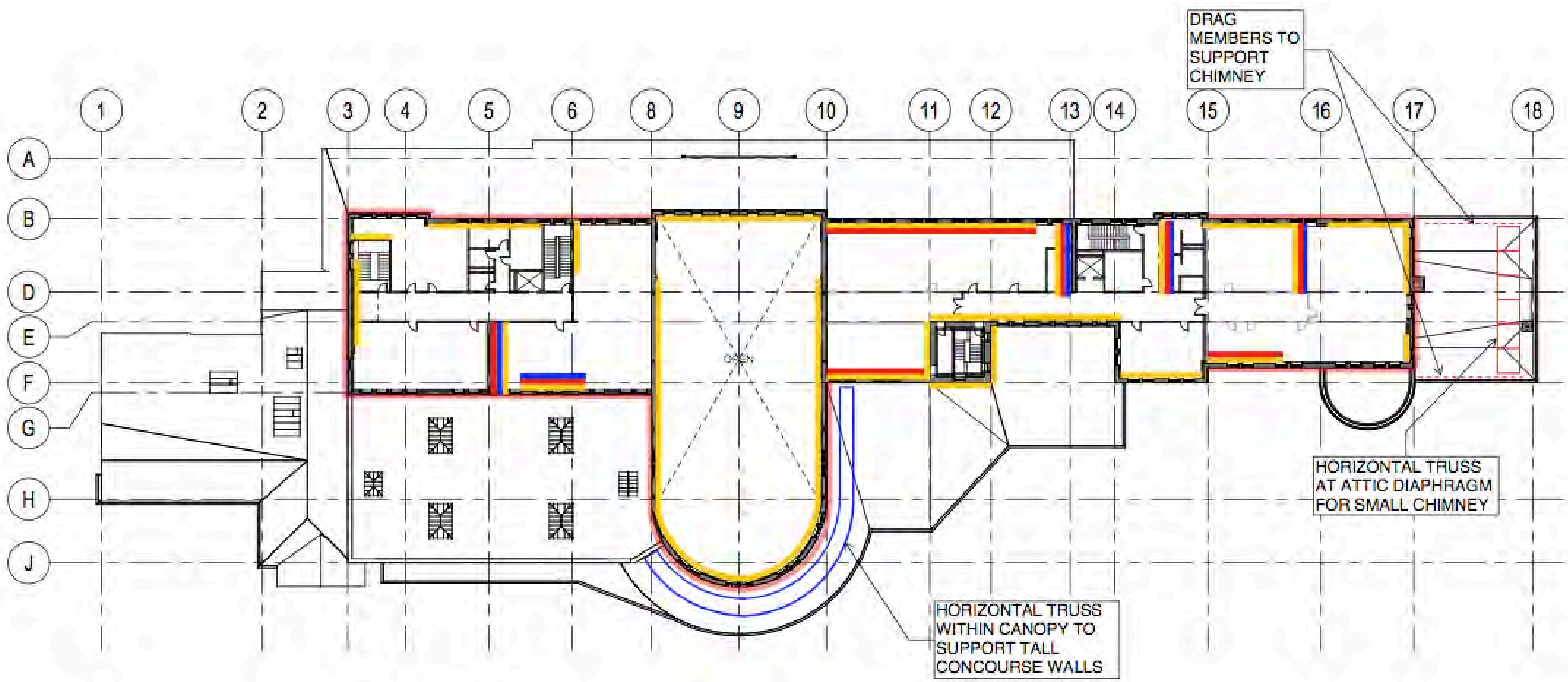


Figure 6.1-2 Structural / Seismic Alternatives 2nd Floor



SECOND FLOOR STRENGTHENING SCHEME

SK-2

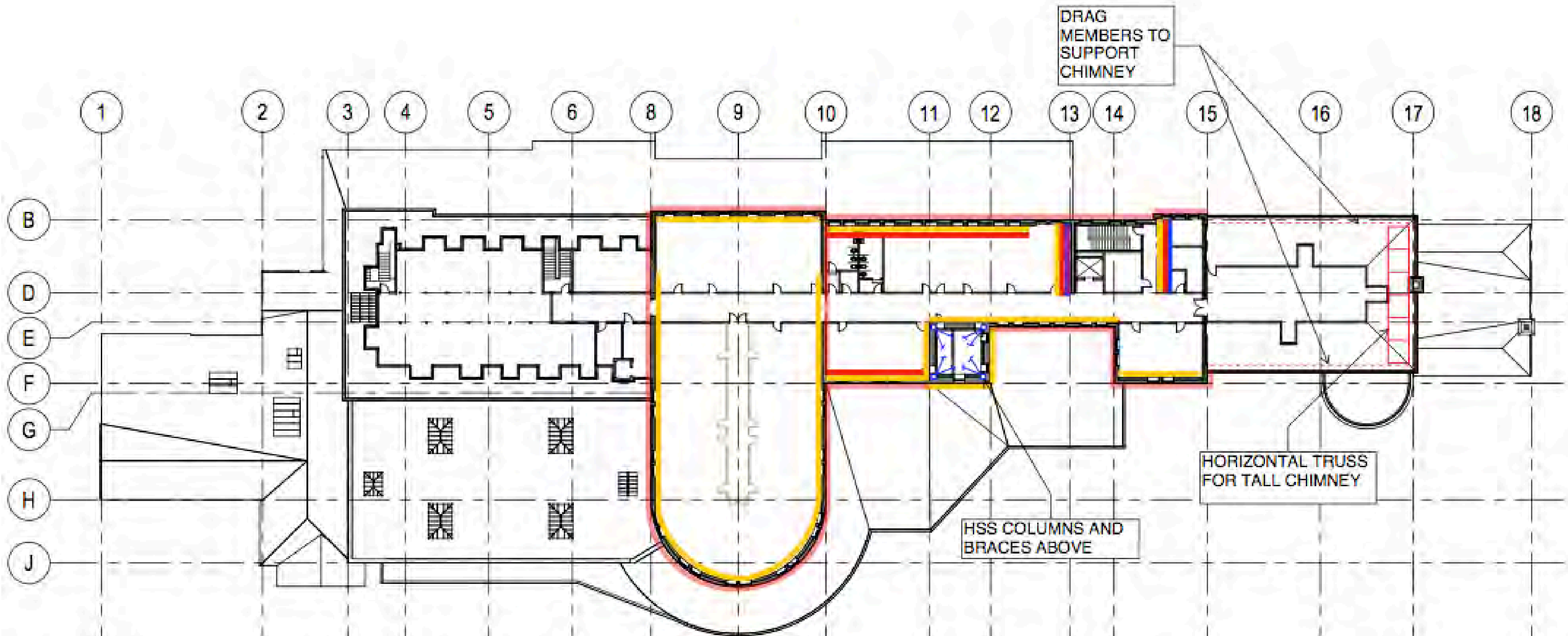
NTS

NOTES:

1. ANY COMBINATION OF THE FOLLOWING LINES INDICATE A POTENTIAL LOCATION FOR A LATERAL RESISTING ELEMENT. THE PRESENCE OF MULTIPLE LINES INDICATES VARIOUS OPTIONS AVAILABLE FOR THE INDICATED LOCATION. ELEMENTS EXTEND FULL HEIGHT TO THE NEXT LEVEL.
   - SHOTCRETE SHEAR WALL
   - STEEL BRACED FRAME
   - STEEL PLATE SHEAR WALL
2. INDICATES OUT OF PLANE STRENGTHENING OF URM WALL
3. FLOOR DIAPHRAGMS REQUIRE STRENGTHENING THROUGHOUT ENTIRE FLOOR
4. INDICATES STRENGTHENING OF (E) CANOPIES

kpff

Figure 6.1-3 Structural / Seismic Alternatives 3rd Floor



THIRD FLOOR STRENGTHENING SCHEME (SK-3)
NTS

NOTES:

1. ANY COMBINATION OF THE FOLLOWING LINES INDICATE A POTENTIAL LOCATION FOR A LATERAL RESISTING ELEMENT. THE PRESENCE OF MULTIPLE LINES INDICATES VARIOUS OPTIONS AVAILABLE FOR THE INDICATED LOCATION. ELEMENTS EXTEND FULL HEIGHT TO THE NEXT LEVEL.
   - SHOTCRETE SHEAR WALL
   - STEEL BRACED FRAME
   - STEEL PLATE SHEAR WALL
2. INDICATES OUT OF PLANE STRENGTHENING OF URM WALL
3. FLOOR DIAPHRAGMS REQUIRE STRENGTHENING THROUGHOUT ENTIRE FLOOR, INCLUDING 3RD FLOOR ATTIC DIAPHRAGM

kpff

6.1.2. Structural/Seismic No-Build Alternative

Under the No-Build Alternative, the Union Station building would remain in its current structural and seismic condition with regular maintenance but no capital investment. Existing structural elements are in a degraded state and were designed well before current seismic hazards were identified. A major seismic event could result in a catastrophic failure of the existing unreinforced masonry structure, with significant risk of loss of life. Deterioration of the structure due to age is evident in cracked foundations, sloping floors, and concrete slabs where the underlying fill has been scoured away. Furthermore, current code requires certain structural/seismic upgrades to accommodate a change in occupancy. Failure to implement these changes would restrict the alternatives for re-use and revitalization of leasable areas of the station.

6.1.3. Main Building Seismic Strengthening Improvements

The following alternatives were evaluated:

- The No-Build Alternative retains the unreinforced building diaphragm as-is, without improvement to the seismic condition or reduction in safety hazard to building occupants due to seismic forces.
- The Reinforced Concrete Shear Walls alternative affixes a layer of reinforced concrete to the interior side of unreinforced masonry walls to provide necessary seismic reinforcement.
- The Steel Braced Frames alternative uses structural steel in truss configurations located to the inside of unreinforced masonry walls to provide necessary seismic reinforcement.
- The Steel Plate Shear Walls alternative inserts steel plates against unreinforced masonry walls in the Main Building to provide necessary seismic reinforcement.

The results of the evaluation of the four alternatives are summarized in Table 6.1-1.

6.1.3.1 Design Requirements and Objectives

The key design requirements for the Main Building strengthening alternatives identified through the conditions assessment and stakeholder discussions include:

- Strengthen unreinforced masonry interior and exterior walls in the Main Building to meet current seismic codes.
- Address structural degradation identified in the conditions assessment.
- Minimize permanent visual impact of structural retrofits on historic spaces and materials.

6.1.3.2 Main Building Seismic Strengthening Alternatives

6.1.3.2.1. Alternative A: Reinforced Concrete Shear Walls

Under Alternative A, reinforced concrete shear walls would be added to the existing structure to provide adequate lateral resistance to the structure and stiffness to resist deformations that would prevent damage to the existing structure. A portion of the new shear walls would be added adjacent to the existing brick walls of the structure while others can be positioned around the new programming of the station and hidden within new walls (around stair/elevator shafts for example). These walls would be very simple and quick to construct and can easily be concealed within architectural features. Where the new walls are added adjacent to existing brick walls, the walls would get thicker. This added thickness can be hidden within architectural features to disguise the increased thickness.

6.1.3.2.2. Alternative B: Steel Braced Frames

Under Alternative B steel braced frames would be used and would require more strengthening locations than the reinforced concrete walls. Braced frames have less stiffness than reinforced concrete walls and as a result more locations would need to be used to prevent damage to the existing structure. Additionally, braced frames work well on the interior of the station, but do not fit well within the configuration of the exterior walls of the station. If braced frames are used along the exterior walls of the station, the braces would likely block some of the windows. Construction of the steel braced frames would be more difficult than the reinforced concrete shear walls. The new lateral elements have to be continuous from the top of the structure all the way to the ground. Aligning columns up the height of the structure while working around the existing floor would be difficult and would not be as flexible as reinforced concrete shear walls.

6.1.3.2.3. Alternative C: Steel Plate Shear Walls

Under Alternative C steel plate shear walls would be used to strengthen the structure. The current programming of Union Station would not allow for steel plate shear walls to be used in their optimum configuration. Steel plate shear walls would be an option for interior locations that could work around the new programming, but the exterior walls of the structure have a lot of windows which would be blocked by the use of steel plate shear walls. Steel plate shear walls also require a large amount of welding which is difficult within the station due to the large amount of existing wood construction.

6.1.3.3 Recommendation: Main Building Seismic Strengthening

The project team recommends implementing reinforced concrete shear walls (Alternative A) because, overall, it would be the most efficient option for strengthening the existing station. Reinforced concrete shear walls would provide the most flexibility in layout and would be the easiest to enclose in architectural features so as to avoid a significant impact on the overall appearance of the station. Reinforced concrete walls also provide the greatest amount of stiffness and would limit the amount of work to brace architectural features. There are some locations in the interior of the building near new stair/elevator cores where the recommended option between a braced frame and a concrete shear wall would be determined during the design process. This decision would consider cost, constructability and space planning based on the final stair/elevator core locations.

Table 6.1-1 Evaluation of Main Building Seismic Strengthening Alternatives

Evaluation Criteria		No-Build	A	Reinforced Concrete Shear Walls	B	Steel Braced Frames	C	Steel Plate Shear Walls
A: Ability to Meet Project Goals								
A.1. Accommodate Future Capacity and Operational Needs of Passenger and Freight Rail	◆	Existing structural deficiencies and seismic hazards will persist.	●	Addresses existing deficiencies and life safety risks	●	Addresses existing deficiencies and life safety risks	●	Addresses existing deficiencies and life safety risks
A.2. Preserve and Protect the Historic Character of Union Station	◆	Degraded structural condition and risk of seismic failure will persist.	●	Reinforced concrete shear walls can fit around existing windows and doorways allowing the majority of the station to remain intact. Reinforced walls will be thicker than the original URM walls, but this option will have the smallest increase in thickness after applying finishes.	◆	Braced frames used at the exterior of the structure will block some window openings. Additionally, furring required to cover the braced frames will increase the overall thickness of existing walls.	◆	In their most efficient configuration, steel plate shear walls will have a significant impact on the current configuration of the station. Large columns and beams are required for steel plate shear walls and the furring to conceal the frames will have a significant impact on the station.
A.3. Improve Economic and Social Vitality	◆	Lack of structural/seismic upgrades limits the ability to reactivate and change occupancies due to code requirements.	●	Addresses existing deficiencies and life safety risks to support revitalization	●	Addresses existing deficiencies and life safety risks to support revitalization	●	Addresses existing deficiencies and life safety risks to support revitalization
A.4. Improve Environmental Sustainability	☐	Minimal impact	☐	Minimal impact anticipated	☐	Minimal impact anticipated	☐	Minimal impact anticipated
B. Cost and Financing								
B.1. Estimated Capital Cost	◆	Likely to be higher in future with deferred action	☐	Comparable among build alternatives	☐	Comparable among build alternatives	☐	Comparable among build alternatives

Evaluation Criteria		No-Build	A	Reinforced Concrete Shear Walls	B	Steel Braced Frames	C	Steel Plate Shear Walls
B.2. Lifecycle Cost Impacts	◆	Likely to increase due to emergency repairs and failures	□	Comparable among build alternatives	□	Comparable among build alternatives	□	Comparable among build alternatives
B.3. Cost Risk	◆	There is a greater risk of unanticipated costs due to emergency repairs, failures, or seismic events	□	Comparable among build alternatives	□	Comparable among build alternatives	□	Comparable among build alternatives
B.4. Financial Leverage	◆	Funding structural/seismic upgrades is likely to be more difficult as a future stand-alone project	●	Increased funding potential as part of a multifaceted renovation project.	●	Increased funding potential as part of a multifaceted renovation project.	●	Increased funding potential as part of a multifaceted renovation project.
C. Implementability and Constructability								
C.1. Technical Complexity and Constructability	□	N/A – No capital improvement project	●	Reinforced concrete shear walls are the simplest to construct of the three alternatives and minimizes overall construction by also bracing the URM walls out of plane.	●	Construction difficulty is similar to reinforced concrete shear walls but cannot be used for out of plane wall bracing.	◆	Steel plate shear walls require more specialized construction and are not effective for bracing the URM walls out of plane.
C.2. Schedule and Schedule Risk	□	N/A – No capital improvement project	□	Comparable among build alternatives	□	Comparable among build alternatives	□	Comparable among build alternatives
C.3. Construction Impact on Passenger and Freight Rail Operations	□	N/A – No capital improvement project	●	Allows for phasing of construction with minimal impact on operations.	●	Allows for phasing of construction with minimal impact on operations.	●	Allows for phasing of construction with minimal impact on operations.

Evaluation Criteria		No-Build	A	Reinforced Concrete Shear Walls	B	Steel Braced Frames	C	Steel Plate Shear Walls
C.4. Construction Impact on Union Station Tenants		N/A – No capital improvement project		Construction of reinforced concrete walls is the fastest of the three options and will have the smallest impact on tenants.		Installation of columns, beams and braces can be difficult and may require re-design after demolition begins to accommodate unknown conditions. Welding will be required and will require a longer duration than typical welded construction due to wood diaphragms and other flammable materials in the station.		Installation of columns and beams can be difficult and may require re-design after demolition begins to accommodate unknown conditions. A large amount of welding will be required and will require a longer duration than typical welded construction due to wood diaphragms and other flammable materials in the station.
C.5. Phasing and Project Segmentation		N/A – No capital improvement project		Allows for phasing of construction with minimal impact on operations.		Allows for phasing of construction with minimal impact on operations.		Allows for phasing of construction with minimal impact on operations.
C.6. Risks, Assumptions and Unknowns		N/A – No capital improvement project		Concrete shear walls allow for much more adaptability to unknown conditions. Alignment requirements are much less strict than the other systems.		Columns have much less tolerance in position than reinforced concrete walls. Placement of the columns, beams and braces are specific and it can be difficult to adapt to unforeseen conditions.		The beams and columns of the steel plate shear walls have specific alignment requirements and have less adaptability to unknown conditions.
D. Environmental Impacts and Approvals								
D.1. Environmental Impacts and Project Classification		Continued degradation of historic elements will continue; may lead to eventual loss of resources		Reduces life safety risk to building occupants		Reduces life safety risk to building occupants		Reduces life safety risk to building occupants

Evaluation Criteria		No-Build	A	Reinforced Concrete Shear Walls	B	Steel Braced Frames	C	Steel Plate Shear Walls
D.2. Historic Impacts and Approvals	◆	Historic spaces and materials will continue to degrade over time.	☐	Locations where the walls will be reinforced with concrete will require the walls increase in thickness, but will have a limited impact on the overall structure.	◆	Braced frames are not an option in the main concourse without a major impact on the marble paneling.	☐	Locations where the walls will be contain steel plate shear walls will require the walls to increase in thickness, but will have a limited impact on the overall structure.
D.3. Decision Making and Approvals	◆	Project approvals and permitting may be hampered if code-mandated upgrades are not implemented	☐	No unusual factors anticipated	☐	No unusual factors anticipated	☐	No unusual factors anticipated

6.1.4. Diaphragm Improvements

This improvement provides resistance to seismic forces in the horizontal diaphragms of the Main Building, addressing a deficiency identified in the conditions assessment.

The following alternatives were evaluated:

- The No-Build Alternative retains the unreinforced building diaphragm as-is, without improvement to the seismic condition or reduction in safety hazard to building occupants due to seismic forces (see Section 6.1-2).
- The Plywood Sheathing alternative uses a plywood layer inserted above or below the existing framing members to provide the necessary seismic resistance.
- The Horizontal Steel Truss alternative inserts structural steel framing at floor/ceiling levels to provide the necessary seismic resistance.

The results of the evaluation of the three alternatives are summarized in Table 6.1-2.

6.1.4.1 Design Requirements and Objectives

The key design requirements for the Diaphragm improvement alternatives identified through the conditions assessment and stakeholder discussions include:

- Strengthen unreinforced masonry interior and exterior walls in the horizontal building diagram to meet current seismic codes.
- Address floor sloping and other structural deficiencies identified in the conditions assessment.
- Minimize permanent visual impact of structural retrofits on historic spaces and materials.

6.1.4.2 Diaphragm Alternatives

6.1.4.2.1. Alternative A: Plywood Sheathing Above/Below Existing Wood Floor Framing

Under Alternative A plywood sheathing would be added above or below the existing diaphragm, which would provide a lot of flexibility for strengthening the diaphragm of the station. In areas where the existing floor finish cannot be disturbed, the plywood sheathing can be added beneath the floor. When the ceiling finish needs to be preserved, the sheathing can be placed on top of the existing floor.

6.1.4.2.2. Alternative B: Horizontal Steel Truss

Under Alternative B the horizontal steel truss floor diaphragm system would be added beneath the existing floor diaphragm and would require the existing ceiling to get significantly lower to accommodate the new structure. All of the existing flooring would be able to be preserved by adding the horizontal truss. Additionally, the vertical lateral elements (reinforced concrete walls, steel plate shear walls or braced frames) could be placed further apart.

6.1.4.3 Recommendation: Diaphragm

The project team recommends adding plywood sheathing above or below the existing floor diaphragm (Alternative A). A horizontal truss would reduce the amount of shear walls to be added to the structure, but would be have a significant impact on the ceiling of the station. The horizontal truss would have to be located below the existing floor diaphragm and is not an option in areas where the ceiling is to be preserved. Additionally, reducing the number of shear walls would increase the load to each shear wall and as a result could require a large amount of foundation work.

Table 6.1-2 Evaluation of Diaphragm Alternatives

Evaluation Criteria		No-Build	A	Plywood Sheathing Above/Below Existing Wood Floor Framing	B	Horizontal Steel Truss
A: Ability to Meet Project Goals						
A.1. Accommodate Future Capacity and Operational Needs of Passenger and Freight Rail	◆	Existing structural deficiencies and seismic hazards will persist.	●	Addresses existing deficiencies and life safety risks	●	Addresses existing deficiencies and life safety risks
A.2. Preserve and Protect the Historic Character of Union Station	◆	Degraded structural condition and risk of seismic failure will persist.	●	Both options could be hidden above ceiling. The plywood sheathing will be easier to also hide under the flooring.	□	Both options could be hidden above ceiling.
A.3. Improve Economic and Social Vitality	◆	Lack of structural/seismic upgrades limits the ability to reactivate and change occupancies due to code requirements.	●	Addresses existing deficiencies and life safety risks to support revitalization	●	Addresses existing deficiencies and life safety risks to support revitalization
A.4. Improve Environmental Sustainability	□	Minimal impact anticipated	□	Minimal impact anticipated	□	Minimal impact anticipated
B. Cost and Financing						
B.1. Estimated Capital Cost	◆	Likely to be higher in future with deferred action	●	Materials/labor will cost less for plywood sheathing than a steel horizontal truss with welded connections.	◆	More complex steel system with welding.
B.2. Lifecycle Cost Impacts	◆	Likely to increase due to emergency repairs and failures	□	Minimal impact anticipated	□	Minimal impact anticipated
B.3. Cost Risk	◆	There is a greater risk of unanticipated costs due to emergency repairs, failures, or seismic events	□	Comparable among build alternatives	□	Comparable among build alternatives
B.4. Financial Leverage	◆	Funding structural/seismic upgrades is likely to be more difficult as a future stand-alone project	□	Comparable among build alternatives	□	Comparable among build alternatives

Evaluation Criteria		No-Build	A	Plywood Sheathing Above/Below Existing Wood Floor Framing	B	Horizontal Steel Truss
C. Implementability and Constructability						
C.1. Technical Complexity and Constructability	☐	N/A – No capital improvement project	●	Plywood is easy to work with and customize.	◆	Pre-fabrication is difficult in an existing building.
C.2. Schedule and Schedule Risk	☐	N/A – No capital improvement project	☐	No unusual schedule risks	◆	Pre-fabrication based on as-built dimensions could take time.
C.3. Construction Impact on Passenger and Freight Rail Operations	☐	N/A – No capital improvement project	☐	Comparable among build alternatives	☐	Comparable among build alternatives
C.4. Construction Impact on Union Station Tenants	☐	N/A – No capital improvement project	☐	Comparable among build alternatives	☐	Comparable among build alternatives
C.5. Phasing and Project Segmentation	☐	N/A – No capital improvement project	☐	Comparable among build alternatives	☐	Comparable among build alternatives
C.6. Risks, Assumptions and Unknowns	☐	N/A – No capital improvement project	☐	Unknowns about existing structural condition of floors and walls pose risks	☐	Unknowns about existing structural condition of walls and walls pose risks
D. Environmental Impacts and Approvals						
D.1. Environmental Impacts and Project Classification	◆	Continued degradation of historic elements will continue; may lead to eventual loss of resources	●	Reduces life safety risk to building occupants	●	Reduces life safety risk to building occupants
D.2. Historic Impacts and Approvals	◆	Historic spaces and materials will continue to degrade over time.	☐	Comparable among build alternatives	☐	Comparable among build alternatives
D.3. Decision Making and Approvals	◆	Project approvals and permitting may be hampered if code-mandated upgrades are not implemented	☐	Comparable among build alternatives	☐	Comparable among build alternatives

6.1.5. Out-of-Plane Strengthening

This improvement addresses existing seismic deficiencies of the unreinforced masonry walls throughout Union Station that lack resistance to out of plane seismic forces.

The following alternatives were evaluated:

- The No-Build Alternative retains the unreinforced masonry walls as-is, without improvement to the seismic condition or reduction in safety hazard to building occupants due to out of plane forces (see Section 6.1.2).
- The Reinforced Concrete Shear Walls alternative attaches a layer of reinforced concrete to the interior side of URM walls.
- The Steel Tube Strongback System uses a tubular steel system to provide the necessary out of plane strengthening.
- The Vertical Core Drilling alternative provides strengthening by drilling vertically from the roof level to the ground and grouting in reinforcing bars inside the URM walls.

The results of the evaluation of the four alternatives are summarized in Table 6.1-3.

6.1.5.1 Design Requirements and Objectives

The key design requirements for the Out of Plane Strengthening alternatives identified through the conditions assessment and stakeholder discussions include:

- Strengthen unreinforced masonry interior and exterior walls in the horizontal building diagram to meet current seismic codes.
- Address structural degradation identified in the conditions assessment.
- Minimize permanent visual impact of structural retrofits on historic spaces and materials.

6.1.5.2 Out-of-Plane Strengthening Alternatives

6.1.5.2.1. Alternative A: Reinforced Concrete Shear Walls

Under Alternative A reinforced concrete shear walls would likely be used as part of the lateral system for the structure and as such, the walls can be used for two purposes (both in-plane and out-of-plane). Reinforced concrete shear walls would also provide a simple method for attaching to the existing brick walls.

6.1.5.2.2. Alternative B: Steel Tube Strongback System

Under Alternative B the steel tube strongback system has a thinner profile than the reinforced concrete system and would take up slightly less floor space. Additionally, the steel tube option would be the least expensive to install.

6.1.5.2.3. Alternative C: Vertical Core Drilling

Under Alternative C vertical core drilling would change the aesthetic the least of the three options. By drilling vertically from the roof level to the ground and grouting in reinforcing bars, the out of plane capacity of the existing walls can be increased without disturbing the finishes on the inside or outside of the station. Vertical core drilling can be implemented without disturbing the historic finishes on the inside or outside of the station; however vertical core drilling would be the most expensive option and the most difficult to construct, and may not meet all needs for in-plane and out-of-plane strengthening.

6.1.5.3 Recommendation: Out-of-Plane Strengthening

The project team recommends implementing the reinforced concrete shear walls (Alternative A). Reinforced concrete shear walls would be relatively simple to attach to the existing URM brick walls. As part of the lateral system for the structure and as such, concrete shear walls can be used for both in-plane and out-of-plane strengthening.

Where historic finishes and materials exist (such as the walls of the main concourse), the concrete shear wall reinforcement can be implemented behind the historic material by temporarily removing the marble panels, replacing existing hollow clay tile with a shotcrete shear wall, and replacing the marble panels. This process may result in minor changes to finish room dimensions due to the slight increase in wall thickness, but the restored structural reinforcement will be hidden from view behind the restored marble panels with relatively small permanent dimensional changes anticipated. In less historic locations, such as the baggage room or leasable tenant spaces, the introduction of concrete shear walls on the inside of the existing URM wall would result in an increase in the overall wall thickness. However unlike braced framing, there is no risk of steel structural members blocking existing historic windows.

The use of concrete shear walls would also create opportunities to introduce new building insulation, acoustic window treatments, and mechanical/electrical conduit within new the wall system. These opportunities would be explored in preliminary design.

In certain locations, the steel tube strongback system may be considered as an alternative base. Exceptions to the use of concrete shear walls would be further explored in preliminary design based on overall architectural and structural design considerations.

Table 6.1-3 Evaluation of Out-of-Plane Strengthening Alternatives

Evaluation Criteria		No-Build	A	Reinforced Concrete Shear Walls	B	Steel Tube Strongback System	C	Vertical Core Drilling
A: Ability to Meet Project Goals								
A.1. Accommodate Future Capacity and Operational Needs of Passenger and Freight Rail	◆	Existing structural deficiencies and seismic hazards will persist.	●	Addresses existing deficiencies and life safety risks	●	Addresses existing deficiencies and life safety risks	●	Addresses existing deficiencies and life safety risks
A.2. Preserve and Protect the Historic Character of Union Station	◆	Degraded structural condition and risk of seismic failure will persist.	☐	Minimal visual impact	◆	Potential for higher visual impact based on design	●	No visual impact.
A.3. Improve Economic and Social Vitality	◆	Lack of structural/seismic upgrades limits the ability to reactivate and change occupancies due to code requirements.	●	Addresses existing deficiencies and life safety risks to support revitalization	●	Addresses existing deficiencies and life safety risks to support revitalization	●	Addresses existing deficiencies and life safety risks to support revitalization
A.4. Improve Environmental Sustainability	☐	Minimal impact anticipated	☐	Minimal impact anticipated	☐	Minimal impact anticipated	☐	Minimal impact anticipated
B. Cost and Financing								
B.1. Estimated Capital Cost	◆	Likely to be higher in future with deferred action	☐	Shotcrete shear walls would be used over steel strongbacks if also needed for shear strengthening.	●	Steel strongbacks are the least expensive option.	◆	Vertical Core Drilling is the most expensive option.
B.2. Lifecycle Cost Impacts	◆	Likely to increase due to emergency repairs and failures	☐	Comparable among build alternatives	☐	Comparable among build alternatives	☐	Comparable among build alternatives
B.3. Cost Risk	◆	There is a greater risk of unanticipated costs due to emergency repairs, failures, or seismic events	☐	No unusual cost risks	☐	No unusual cost risks	◆	Vertical Core Drilling is the riskiest option due to unknowns within the existing brick wall.

Evaluation Criteria		No-Build	A	Reinforced Concrete Shear Walls	B	Steel Tube Strongback System	C	Vertical Core Drilling
B.4. Financial Leverage	◆	Funding structural/seismic upgrades is likely to be more difficult as a future stand-alone project	☐	Comparable among build alternatives	☐	Comparable among build alternatives	☐	Comparable among build alternatives
C. Implementability and Constructability								
C.1. Technical Complexity and Constructability	☐	N/A – No capital improvement project	☐	No unusual risks anticipated	☐	No unusual risks anticipated	◆	Most complex due to sensitivity to core drilling vertically down. Drill must be kept plumb and straight to avoid protruding out of the face of the wall.
C.2. Schedule and Schedule Risk	☐	N/A – No capital improvement project	☐	No unusual risks anticipated	☐	No unusual risks anticipated	◆	Schedule risk due to unknowns.
C.3. Construction Impact on Passenger and Freight Rail Operations	☐	N/A – No capital improvement project	☐	Comparable among build alternatives	☐	Comparable among build alternatives	☐	Comparable among build alternatives
C.4. Construction Impact on Union Station Tenants	☐	N/A – No capital improvement project	☐	Moderate impact	☐	-Moderate impact	●	This will be the least impactful since it is installed from the roof.
C.5. Phasing and Project Segmentation	☐	N/A – No capital improvement project	☐	Comparable among build alternatives	☐	Comparable among build alternatives	☐	Comparable among build alternatives
C.6. Risks, Assumptions and Unknowns	☐	N/A – No capital improvement project	☐	Unknowns about existing structural condition of walls and foundations pose risks	☐	Unknowns about existing structural condition of walls and foundations pose risks	◆	Vertical Core Drilling is the riskiest option due to unknowns within the existing brick wall.

Evaluation Criteria		No-Build	A	Reinforced Concrete Shear Walls	B	Steel Tube Strongback System	C	Vertical Core Drilling
D. Environmental Impacts and Approvals								
D.1. Environmental Impacts and Project Classification	◆	Continued degradation of historic elements will continue; may lead to eventual loss of resources	●	Reduces life safety risk to building occupants	●	Reduces life safety risk to building occupants	●	Reduces life safety risk to building occupants
D.2. Historic Impacts and Approvals	◆	Historic spaces and materials will continue to degrade over time.	●	Preserves structure with minimal permanent visual impact	●	Preserves structure with minimal permanent visual impact	●	Preserves structure with least permanent visual impact
D.3. Decision Making and Approvals	◆	Project approvals and permitting may be hampered if code-mandated upgrades are not implemented	□	Comparable among build alternatives	□	Comparable among build alternatives	□	Comparable among build alternatives

6.1.6. Tower URM Strengthening Alternatives

This improvement provides seismic strengthening to the unreinforced masonry (URM) clock tower to address deficiencies identified in the conditions assessment.

The following alternatives were evaluated:

- The No-Build Alternative retains the clock tower as-is, without improvement to the seismic condition or reduction in safety hazard to building occupants (see Section 6.1-2).
- The Steel Braced Frames above Reinforced Concrete Shear Walls alternative uses a combination of reinforced concrete shear walls (lower level) and steel braced frames (upper level) to provide seismic strengthening.
- The Steel Braced Frames Full Height alternative provides an interior steel braced frame against the inside face of the clock tower walls for its full height.
- The Reinforced Concrete Shear Walls - Full Height alternative applies reinforced concrete shear walls cast against the inside face of the clock tower walls for its full height.

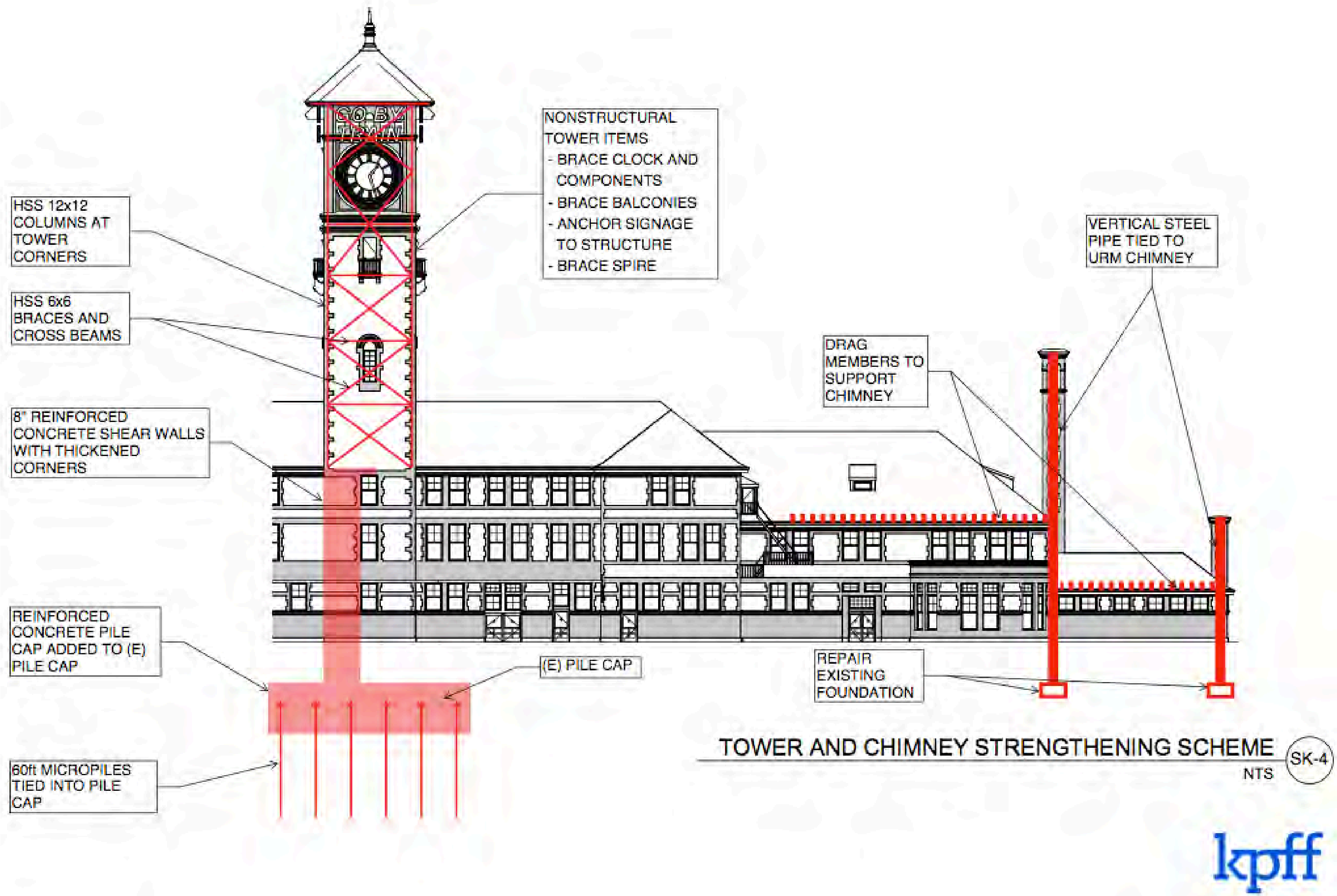
The results of the evaluation of the four alternatives are summarized in Table 6.1-4.

6.1.6.1 Design Requirements and Objectives

The key design requirements for the Tower URM Strengthening Alternatives identified through the conditions assessment and stakeholder discussions include:

- Strengthen unreinforced masonry of the clock tower to meet current seismic codes.
- Address structural degradation identified in the conditions assessment.
- Provide seismic reinforcement of non-structural tower elements such as the clock, balconies, and “Go by Train” sign.
- Minimize permanent visual impact of structural retrofits in the clock tower.

Figure 6.1-4 Tower and Chimney Strengthening Scheme



6.1.6.2 Tower URM Strengthening Alternatives

6.1.6.2.1. Alternative A: Steel Braced Frames above Reinforced Concrete Shear Walls

Under Alternative A reinforced concrete shear walls would be added to the inside face of the tower walls from the base up to the attic level of the station then steel braced frames would be added for the remaining height of the tower. Braces in the upper portion of the tower would have minimal impact on the interior and exterior aesthetic of the tower. The light steel braced frame would add stiffness to the tower without adding a significant amount of weight that is proportional to the lateral load. Steel braced frame pieces are also light and can be broken up and spliced which makes construction in the tight tower easier than other systems. Steel braced frames for the upper levels of the tower can be worked around the majority of the windows leaving the exterior aesthetic of the tower essentially unchanged. Reinforced concrete shear walls installed up to the height of the attic allow for the main station to be braced back to the tower, reducing the amount of interior work on the station. Additionally, the reinforced concrete shear walls would distribute the bending moment at the base of the tower that would reduce the concentration of pin piles below the tower if that system is chosen for the foundation strengthening.

The steel braced frame above reinforced concrete shear walls is the most efficient method for strengthening the tower.

6.1.6.2.2. Alternative B: Steel Braced Frames Full Height

Under Alternative B would provide an interior steel braced frame against the inside face of the clock tower walls for its full height. The full height steel braced frame option is very light, and would add little additional weight and lateral load to the existing structure and would have the least impact on the interior aesthetic. The aspect ratio (height to width) of the tower is not ideal for a braced frame system to extend the full height of the tower. This means there would be heavier members at the base of the tower that would not be the most efficient use of a braced frame system. Discrete structural member size and adjustability make the steel braced frame the simplest system for construction. The steel braced frame system is likely not stiff enough or strong enough to support additional load from the main station thus adding to the amount of interior work in the main portion of the station. There would also be visual conflicts between the braces and exterior windows at the lower levels.

6.1.6.2.3. Alternative C: Reinforced Concrete Shear Walls Full Height

Under Alternative C improvements would include reinforced concrete shear walls cast against the inside face of the clock tower walls for its full height. Reinforced concrete shear walls can be cast against the inside face of the tower around the existing openings allowing the outside look of the tower to remain the same as today, however the inside face of the tower would be concrete rather than brick. Concrete shear walls also add a large amount of weight to the structure and increase the lateral demand on the walls and foundations. Using the new walls in the tower to brace the main station can still be done, but would likely require thicker walls than the option with braced frames above concrete shear walls. Due to the higher weight of the concrete walls in the tower, this option would require more foundation work than other options.

6.1.6.3 Recommendation: Tower URM Strengthening

The project team recommends implementing a combination of reinforced concrete shear walls in the lower levels and steel braced frames in the upper levels (Alternative A). The light weight of the braces in the upper levels would provide lateral resistance without adding a significant amount of mass. Reinforced concrete shear walls would anchor the braces from above and at the same time can be used to provide lateral support to the main station structure.

Table 6.1-4 Evaluation of Tower URM Strengthening Alternatives

Evaluation Criteria		No-Build	A	Steel Braced Frames Above Reinforced Concrete Shear Walls	B	Steel Braced Frames Full Height	C	Reinforced Concrete Shear Walls Full Height
A: Ability to Meet Project Goals								
A.1. Accommodate Future Capacity and Operational Needs of Passenger and Freight Rail	◆	Existing structural deficiencies and seismic hazards will persist.	●	- Reduces life safety risk to building occupants	●	- Reduces life safety risk to building occupants	●	- Reduces life safety risk to building occupants
A.2. Preserve and Protect the Historic Character of Union Station	◆	Degraded structural condition and risk of seismic failure will persist.	●	From the exterior, there will be little impact if any on the appearance of the tower.	◆	From the exterior, there will be an impact of braces crossing in front of windows on the lower floor levels.	◆	From the exterior, there will be little impact if any on the appearance of the tower but inside of tower will be reinforced concrete the entire height rather than a brick finish.
A.3. Improve Economic and Social Vitality	◆	Lack of structural/seismic upgrades limits the ability to reactivate and change occupancies due to code requirements.	●	Addresses existing deficiencies and life safety risks to support revitalization	●	Addresses existing deficiencies and life safety risks to support revitalization	●	Addresses existing deficiencies and life safety risks to support revitalization
A.4. Improve Environmental Sustainability	□	Minimal impact anticipated	□	Minimal impact anticipated	□	Minimal impact anticipated	□	Minimal impact anticipated

Evaluation Criteria		No-Build	A	Steel Braced Frames Above Reinforced Concrete Shear Walls	B	Steel Braced Frames Full Height	C	Reinforced Concrete Shear Walls Full Height
B. Cost and Financing								
B.1. Estimated Capital Cost	☐	N/A	☐	Costs for option B and C are similar.	☐	Costs for option B and C are similar.	◆	High cost for installation of concrete and reinforcing the full height of the tower. Larger foundation required due to heavier concrete structure.
B.2. Lifecycle Cost Impacts	◆	Likely to increase due to emergency repairs and failures.	☐	Little maintenance required after installation.	☐	Little maintenance required after installation.	☐	Little maintenance required after installation.
B.3. Cost Risk	◆	There is a greater risk of unanticipated costs due to emergency repairs and failures.	☐	Comparable among build alternatives	☐	Comparable among build alternatives	☐	Comparable among build alternatives
B.4. Financial Leverage	◆	Funding structural/seismic upgrades is likely to be more difficult as a future stand-alone project.	●	Increased funding potential as part of a multifaceted renovation project.	●	Increased funding potential as part of a multifaceted renovation project.	●	Increased funding potential as part of a multifaceted renovation project.

Evaluation Criteria		No-Build	A	Steel Braced Frames Above Reinforced Concrete Shear Walls	B	Steel Braced Frames Full Height	C	Reinforced Concrete Shear Walls Full Height
C. Implementability and Constructability								
C.1. Technical Complexity and Constructability	☐	N/A – No capital improvement project	●	Limited impact to inside appearance of tower, works around existing clock face, braced frame pieces simpler to bring into tower, lower level shear walls can be used to brace the station as well.	☐	Limited impact to inside appearance of tower, works around existing clock face, braced frame pieces simpler to bring into tower.	◆	Shear walls can be worked around clock face and lower level windows, adds significant mass to structure, difficult to pump concrete to top of tower.
C.2. Schedule and Schedule Risk	☐	N/A – No capital improvement project	☐	Comparable among build alternatives	☐	Comparable among build alternatives	☐	Comparable among build alternatives
C.3. Construction Impact on Passenger and Freight Rail Operations	☐	N/A – No capital improvement project	☐	Comparable among build alternatives	☐	Comparable among build alternatives	☐	Comparable among build alternatives
C.4. Construction Impact on Union Station Tenants	☐	N/A – No capital improvement project	☐	Comparable among build alternatives	☐	Comparable among build alternatives	☐	Comparable among build alternatives
C.5. Phasing and Project Segmentation	☐	N/A – No capital improvement project	☐	Option B, C, or D needs to occur at the same time as a Tower Overturning Strengthening Option.	☐	Option B, C, or D needs to occur at the same time as a Tower Overturning Strengthening Option.	☐	Option B, C, or D needs to occur at the same time as a Tower Overturning Strengthening Option.
C.6. Risks, Assumptions and Unknowns	☐	N/A – No capital improvement project	☐	Unknowns about existing structural condition of walls and foundations pose risks	☐	Unknowns about existing structural condition of walls and foundations pose risks	☐	Unknowns about existing structural condition of walls and foundations pose risks

Evaluation Criteria		No-Build	A	Steel Braced Frames Above Reinforced Concrete Shear Walls	B	Steel Braced Frames Full Height	C	Reinforced Concrete Shear Walls Full Height
D. Environmental Impacts and Approvals								
D.1. Environmental Impacts and Project Classification	◆	Continued degradation of historic elements will continue; may lead to eventual loss of resources	●	Reduces life safety risk to building occupants	●	Reduces life safety risk to building occupants	●	Reduces life safety risk to building occupants
D.2. Historic Impacts and Approvals	◆	Historic spaces and materials will continue to degrade over time.	□	No significant impacts anticipated	◆	Larger impact to historic features of building with braces cutting in front of bottom 3 floors of windows.	□	No significant impacts anticipated
D.3. Decision Making and Approvals	◆	Project approvals and permitting may be hampered if code-mandated upgrades are not implemented	□	No significant impacts anticipated	◆	Visible steel framing may require additional review	□	No significant impacts anticipated

6.1.7. Tower Overturning Resistance

This improvement provides needed overturning resistance strength to withstand seismic forces on the clock tower.

The following alternatives were evaluated:

- The No-Build Alternative retains the clock tower as-is, without improvement to the seismic condition or reduction in safety hazard to building occupants (see Section 6.1.2).
- The Pile Foundations Improvement alternative adds new piles and a larger pile cap to the existing tower foundation underneath the clock tower.
- The Horizontal Trusses at Floor Levels alternative adds structural steel connections to each floor level to distribute the lateral load from the clock tower out to the rest of the Main Building.

The results of the evaluation of the three alternatives are summarized in Table 6.1-5.

6.1.7.1 Design Requirements and Objectives

The key design requirements for the Tower Overturning Resistance Alternatives identified through the conditions assessment and stakeholder discussions include:

- Reduce the life safety risk posed by overturning of the clock tower due to its current inability to resist seismic forces.
- Address foundation degradation identified in the conditions assessment.
- Minimize construction and permanent impact of subsurface/foundation retrofits on adjacent historic spaces and materials.

6.1.7.2 Tower Overturning Resistance Alternatives

6.1.7.2.1. Alternative A: Pile Foundations Improvement

Improvements under Alternative A would add piles and a larger pile cap to the existing tower foundation concentrates the work to a minimal area. The construction would require a portion of the exterior sidewalk to be removed and soil excavated from around the base to accommodate the drilling equipment, but impact on the final aesthetic of the station would be minimal. This option also allows for the lateral system of the tower to be used to support the Main Building.

6.1.7.2.2. Alternative B: Horizontal Trusses at Floor Levels

Under Alternative B a horizontal truss would be added at each floor level to distribute the lateral load from the tower out to the rest of the Main Building and eliminate foundation work at the base of the tower. However, the horizontal trusses would be extensive and have a significant impact on the ceiling finishes of the station. Additionally, while the foundation work below the tower would be eliminated, redistributing the forces to the main station may still result in some foundation work elsewhere.

6.1.7.3 Recommendation: Tower Overturning Resistance

The project team recommends implementing the addition of piles to the existing pile cap (Alternative A). Drilled pile foundations can be challenging to construct, but the work would be concentrated to a small area. Additionally, by adding the piles below the tower, the lateral elements of the tower can be used to support the main station. Without the addition of these piles, the loads from the tower would have to be redistributed to the rest of the station.

Table 6.1-5 Evaluation of Tower Overturning Resistance Alternatives

Evaluation Criteria		No-Build	A	Pile Foundations Improvement	B	Horizontal Trusses at Floor Levels
A: Ability to Meet Project Goals						
A.1. Accommodate Future Capacity and Operational Needs of Passenger and Freight Rail	◆	Existing structural deficiencies and seismic hazards will persist.	●	Reduces life safety risk to building occupants	●	Reduces life safety risk to building occupants
A.2. Preserve and Protect the Historic Character of Union Station	◆	Degraded structural condition and risk of seismic failure will persist.	☐	Small impact to main floor finishes.	◆	Significant impact to each floor level, likely change to ceiling configuration in impacted areas to accommodate horizontal truss below existing floor gravity support.
A.3. Improve Economic and Social Vitality	◆	Lack of structural/seismic upgrades limits the ability to reactivate and change occupancies due to code requirements.	●	Addresses existing deficiencies and life safety risks to support revitalization	●	Addresses existing deficiencies and life safety risks to support revitalization
A.4. Improve Environmental Sustainability	☐	Minimal impact anticipated	☐	Minimal impact anticipated	☐	Minimal impact anticipated
B. Cost and Financing						
B.1. Estimated Capital Cost	◆	Likely to be higher in future with deferred action	☐	Localized high cost of new piles at existing foundation pile cap.	◆	High cost for installation of truss system at floor levels and additional interior lateral elements.
B.2. Lifecycle Cost Impacts	◆	Likely to increase due to emergency repairs and failures.	☐	Little maintenance required after installation.	☐	Little maintenance required after installation.

Evaluation Criteria		No-Build	A	Pile Foundations Improvement	B	Horizontal Trusses at Floor Levels
B.3. Cost Risk	◆	There is a greater risk of unanticipated costs due to emergency repairs and failures.	●	Pile foundations are concentrated to one area has less potential for construction conflicts.	◆	A horizontal truss creates much more construction than pile foundation strengthening and greater potential for construction conflicts.
B.4. Financial Leverage	◆	Funding structural/seismic upgrades is likely to be more difficult as a future stand-alone project.	●	Increased funding leverage as part of a multi-faceted rehabilitation project	●	Increased funding leverage as part of a multi-faceted rehabilitation project
C. Implementability and Constructability						
C.1. Technical Complexity and Constructability	□	N/A – No capital improvement project	●	Requires less construction and has limited impact to main portion of the station, requires below grade excavation.	◆	Requires no below grade foundation work, has significant impact of main floor levels of the station and will require additional distributed lateral elements to transfer loads.
C.2. Schedule and Schedule Risk	□	N/A – No capital improvement project	●	Pile foundations are concentrated to one area has less potential for construction conflicts.	◆	A horizontal truss creates much more construction than pile foundation strengthening and greater potential for construction conflicts.
C.3. Construction Impact on Passenger and Freight Rail Operations	□	N/A – No capital improvement project	●	Minimal tenant impacts anticipated	◆	The horizontal truss option has a larger impact on the station overall and is not just concentrated around the tower.
C.4. Construction Impact on Union Station Tenants	□	N/A – No capital improvement project	□	Tenants immediately adjacent to tower will have to be relocated or closed during foundation work.	◆	Horizontal trusses require extensive floor level work and will require additional closure time of occupied spaces.
C.5. Phasing and Project Segmentation	□	N/A – No capital improvement project	●	Option B could be performed before a Tower URM Strengthening Option if phasing is important.	◆	Option C would need to occur at the same time as a Tower URM Strengthening Option since they work integrally together.

Evaluation Criteria		No-Build	A	Pile Foundations Improvement	B	Horizontal Trusses at Floor Levels
C.6. Risks, Assumptions and Unknowns	□	N/A – No capital improvement project	◆	Risk/unknown conditions regarding new pile foundation system through existing pile foundation system.	◆	Risk/unknown conditions of as-built conditions over a large area of the building.
D. Environmental Impacts and Approvals						
D.1. Environmental Impacts and Project Classification	◆	Continued degradation of historic elements will continue; may lead to eventual loss of resources	●	Reduces life safety risk to building occupants	●	Reduces life safety risk to building occupants
D.2. Historic Impacts and Approvals	◆	Historic spaces and materials will continue to degrade over time.	●	-Improves condition with minimal historic impact	◆	Large impact to historic features over a larger area of the Main Building.
D.3. Decision Making and Approvals	◆	Project approvals and permitting may be hampered if code-mandated upgrades are not implemented	◆	If a decision is not made between Option B and C, this will impact how the rest of the Main Building's retrofit is designed. If Option C is chosen, this has a larger impact on the overall building design than Option B which is localized.	◆	If a decision is not made between Option B and C, this will impact how the rest of the Main Building's retrofit is designed. If Option C is chosen, this has a larger impact on the overall building design than Option B which is localized.

6.1.8. Main Building Chimney Alternatives

This improvement addresses existing structural deterioration and seismic deficiency in the unreinforced masonry chimneys of the Main Building.

The following alternatives were evaluated:

- The No-Build Alternative retains the Main Building chimneys as-is, without improvement to the seismic condition or reduction in safety hazard to building occupants (see Section 6.1-2).
- The Steel Pipe Propped to Diaphragms alternative reinforces the chimney by inserting an interior steel tube that is tied to the building diaphragm.
- The Exterior Braces alternative uses steel reinforcement or banding on the exterior of the masonry chimneys, creating a permanent visual impact
- The Remove Chimneys alternative removes the Main Building chimneys entirely instead of seismically reinforcing them.

The results of the evaluation of the four alternatives are summarized in Table 6.1-6.

6.1.8.1 Design Requirements and Objectives

The key design requirements for the Main Building Chimney Alternatives identified through the conditions assessment and stakeholder discussions include:

- Preserve the non-functional Main Building chimneys as a historic character-defining feature of Union Station.
- Reduce the life safety risk posed by seismic failure of the chimneys
- Address structural degradation identified in the conditions assessment.
- Minimize permanent visual impact of the chimney seismic retrofit.

6.1.8.2 Main Building Chimney Alternatives

6.1.8.2.1. Alternative A: Steel Pipe Propped to Diaphragms

Improvements under Alternative A would reinforce the chimney by inserting an interior steel tube that is tied to the building diaphragm. Adding a steel pipe to the interior of the chimneys to support the chimney would have minimal impact on the historic appearance of the station. The steel pipe can be fully hidden inside the chimney and would not change the look of the chimney. This steel pipe would be braced back to the Main Building at the roof level. Foundation strengthening at the chimneys would also be required.

6.1.8.2.2. Alternative B: Exterior Braces

Improvements under Alternative B would use steel reinforcement or banding on the exterior of the masonry chimneys, creating a permanent visual impact. Exterior chimney braces would be easier to construct than the pipe placed inside the chimney, but would have a significant impact on the appearance of the chimneys and the historic character of the building.

6.1.8.2.3. Alternative C: Remove Chimney

Alternative C would remove the Main Building chimneys entirely instead of seismically reinforcing them. Removing the chimneys is the simplest of the alternatives. Additionally, removing the chimneys would decrease the overall lateral load thus reducing the amount of lateral strengthening required for the structure. However, this would have the most major impact on the appearance of the station and would negatively impact the historical character of the building.

6.1.8.3 Recommendation: Main Building Chimney

The project team recommends adding a pipe column inside the chimneys (Alternative A). This would have no permanent impact on the exterior appearance of the chimney structures. The chimneys are non-functional, and therefore the primary objective for a structural/seismic retrofit is to preserve their historic appearance and character.

Table 6.1-6 Evaluation of Main Building Chimney Alternatives

Evaluation Criteria		No-Build	A	Steel Pipe Propped to Diaphragms	B	Exterior Braces	C	Remove Chimney
A: Ability to Meet Project Goals								
A.1. Accommodate Future Capacity and Operational Needs of Passenger and Freight Rail	◆	Existing structural deficiencies and seismic hazards will persist.	●	- Reduces life safety risk to building occupants	●	- Reduces life safety risk to building occupants	●	- Reduces life safety risk to building occupants
A.2. Preserve and Protect the Historic Character of Union Station	◆	Degraded structural condition and risk of seismic failure will persist.	●	Small impact on historic character.	◆	Large change in historic character.	◆	Large change in historic character.
A.3. Improve Economic and Social Vitality	◆	Lack of structural/seismic upgrades limits the ability to reactivate and change occupancies due to code requirements.	●	Addresses existing deficiencies and life safety risks to support revitalization	●	Addresses existing deficiencies and life safety risks to support revitalization	●	Addresses existing deficiencies and life safety risks to support revitalization
A.4. Improve Environmental Sustainability	□	Minimal impact anticipated	□	Minimal impact anticipated	□	Minimal impact anticipated	□	Minimal impact anticipated
B. Cost and Financing								
B.1. Estimated Capital Cost	◆	Likely to be higher in future with deferred action	□	Comparable among build alternatives	□	Comparable among build alternatives	□	Comparable among build alternatives

Evaluation Criteria		No-Build	A	Steel Pipe Propped to Diaphragms	B	Exterior Braces	C	Remove Chimney
B.2. Lifecycle Cost Impacts	◆	Likely to be higher in future with deferred action	☐	Comparable among build alternatives	☐	Comparable among build alternatives	☐	Comparable among build alternatives
B.3. Cost Risk	◆	Costs likely to be higher as a future stand-alone project with ongoing degradation. Higher risk of future seismic damage repair costs.	☐	Comparable among build alternatives	☐	Comparable among build alternatives	☐	Comparable among build alternatives
B.4. Financial Leverage	◆	Likely to be more difficult to finance as a future stand-alone project	☐	Comparable among build alternatives	☐	Comparable among build alternatives	☐	Comparable among build alternatives
C. Implementability and Constructability								
C.1. Technical Complexity and Constructability	☐	N/A – No capital improvement project	☐	Comparable among build alternatives	☐	Comparable among build alternatives	☐	Comparable among build alternatives
C.2. Schedule and Schedule Risk	☐	N/A – No capital improvement project	☐	Comparable among build alternatives	☐	Comparable among build alternatives	☐	Comparable among build alternatives
C.3. Construction Impact on Passenger and Freight Rail Operations	☐	N/A – No capital improvement project	☐	Comparable among build alternatives	☐	Comparable among build alternatives	☐	Comparable among build alternatives
C.4. Construction Impact on Union Station Tenants	☐	N/A – No capital improvement project	☐	Comparable among build alternatives	☐	Comparable among build alternatives	☐	Comparable among build alternatives

Evaluation Criteria		No-Build	A	Steel Pipe Propped to Diaphragms	B	Exterior Braces	C	Remove Chimney
C.5. Phasing and Project Segmentation	□	N/A – No capital improvement project	●	Allows for phasing of construction with minimal impact on operations.	●	Allows for phasing of construction with minimal impact on operations.	●	Allows for phasing of construction with minimal impact on operations.
C.6. Risks, Assumptions and Unknowns	□	N/A – No capital improvement project	□	Unknowns about existing structural condition of chimney brick and foundations pose risks	□	Unknowns about existing structural condition of chimney brick and foundations pose risks	□	Unknowns about existing structural condition of chimney brick and foundations pose risks
D. Environmental Impacts and Approvals								
D.1. Environmental Impacts and Project Classification	◆	Continued degradation of historic elements will continue; may lead to eventual loss of resources	●	Reduces life safety risk to building occupants	●	Reduces life safety risk to building occupants	●	Reduces life safety risk to building occupants
D.2. Historic Impacts and Approvals	◆	Historic spaces and materials will continue to degrade over time.	●	Minimum impact on historic appearance.	◆	Large change in historic character with exterior braces framing back to the roof.	◆	Significant change in historic appearance without the chimneys.
D.3. Decision Making and Approvals	◆	Project approvals and permitting may be hampered if code-mandated upgrades are not implemented	□	Comparable among build alternatives	□	Comparable among build alternatives	□	Comparable among build alternatives

6.2. Mechanical, Electrical, and Plumbing

The Mechanical, Electrical, and Plumbing alternatives cover building systems for both the Main Building and the Annex. Rail operations support systems such as 480v power, yard air, and potable water used to service trains are excluded from this discussion and are addressed in Rail Conceptual Design Report.

6.2.1. Key Design Requirements

The key design requirements for Mechanical, Electrical, and Plumbing Alternatives identified through the conditions assessment and stakeholder discussions include:

- Replacing outdated mechanical, electrical, and plumbing systems nearing or beyond the end of their useful lives
- Reducing total lifecycle costs of building operations through improved efficiency
- Relocating mechanical systems from the Annex to allow for refurbishment and reuse of the Annex
- Relocating the existing electrical vault from current flood-susceptible basement location
- Increasing environmental sustainability of Union Station, such as through reduced energy and water consumption.

6.2.2. Mechanical, Electrical, and Plumbing Alternatives

This improvement would replace aging mechanical, electrical, plumbing and lighting systems that have reached or exceeded their useful lives. As part of this wok, the build alternatives would relocate and consolidate existing HVAC and electrical support equipment to the north end of the building, in the location of the existing City of Portland workshop. Existing systems would be decommissioned and removed, including surface-mounted wires, pipes, and conduits currently visible in historic portions of the building.

Four alternatives were evaluated:

- The No-Build option leaves the existing mechanical, electrical, plumbing and lighting systems with no modifications;
- The LEED Gold alternative upgrades systems to meet the City of Portland's minimum LEED Gold sustainability standards
- The LEED Platinum alternative would include further sustainability features to reach the LEED Platinum level; and,
- The New Zero alternative includes LEED Platinum sustainability features and also introduces a photovoltaic system for on-site electricity generation that meets or exceeds the power demand of Union Station ("net zero").

The results of the evaluation of the four alternatives are summarized in Table 6.2-1.

6.2.2.1 Mechanical, Electrical, and Plumbing No-Build Alternative

This alternative would maintain existing mechanical, electrical, and plumbing systems as-is in their current configuration. Most of the Main Building and Annex would lack ventilation systems consistent with current design standards. The Annex building would continue to house heaving equipment in the Boiler Room, precluding re-use and repurposing of this structure as a leasable space. Existing systems, many at or beyond the end of their useful life, would continue to be maintained in their current state, with emergency repairs anticipated from time to time due to systems failures. The quality of climate control, restrooms, illumination levels, data communications, and other tenant and passenger services that were determined to be deficient in the needs assessment would remain deficient with only minor incremental improvements over time.

6.2.2.2 Alternative A: Upgrade to LEED Gold Standard

This alternative would upgrade building systems to meet the minimum the City of Portland's LEED Gold standard. This may include upgraded, high efficiency lighting and energy reduction features such as occupancy sensors and/or photocells to automatically respond to ambient daylight. Based on building occupancy and historic significance, HVAC systems would be upgraded with new natural ventilation controls, mixed-mode systems, and/or provisions for future tenant systems fit-out.

6.2.2.3 Alternative B: Upgrade to LEED Platinum Standard

This alternative would incorporate the basic components of the LEED Gold alternative with additional sustainability features. This may include a ground source bore field to act as a heat pump to reduce HVAC energy and fossil fuel consumption. Additionally sub-metering sensor technology and LED retrofit would help to improve electrical energy efficiency. Another option is the introduction of a rainwater retention cistern to allow for partial recycling and reuse of rainwater for building services.

6.2.2.4 Alternative C: Upgrade to Net Zero

This alternative would build on the LEED Gold and Platinum alternatives, with the addition of a photovoltaic (PV) array on the reconstructed platform canopies. Preliminary analysis suggests that a PV array could generate sufficient electrical power to meet or exceed building electrical consumption needs.

6.2.3. Recommendation: Mechanical, Electrical, and Plumbing

Based on consideration of sustainability benefits and potential reduction in lifecycle cost, the project team recommends implementing Alternative C (Upgrade to Net Zero for Electricity Consumption). Refinement of this alternative is contingent upon energy modeling of existing and future Union Station electricity consumption as well as development of a feasible photovoltaic (PV) solar panel field as part of the preferred platform canopy alternative during preliminary engineering.

Figure 6.2-1 Mechanical and Plumbing Alternative A – LEED Gold Standard

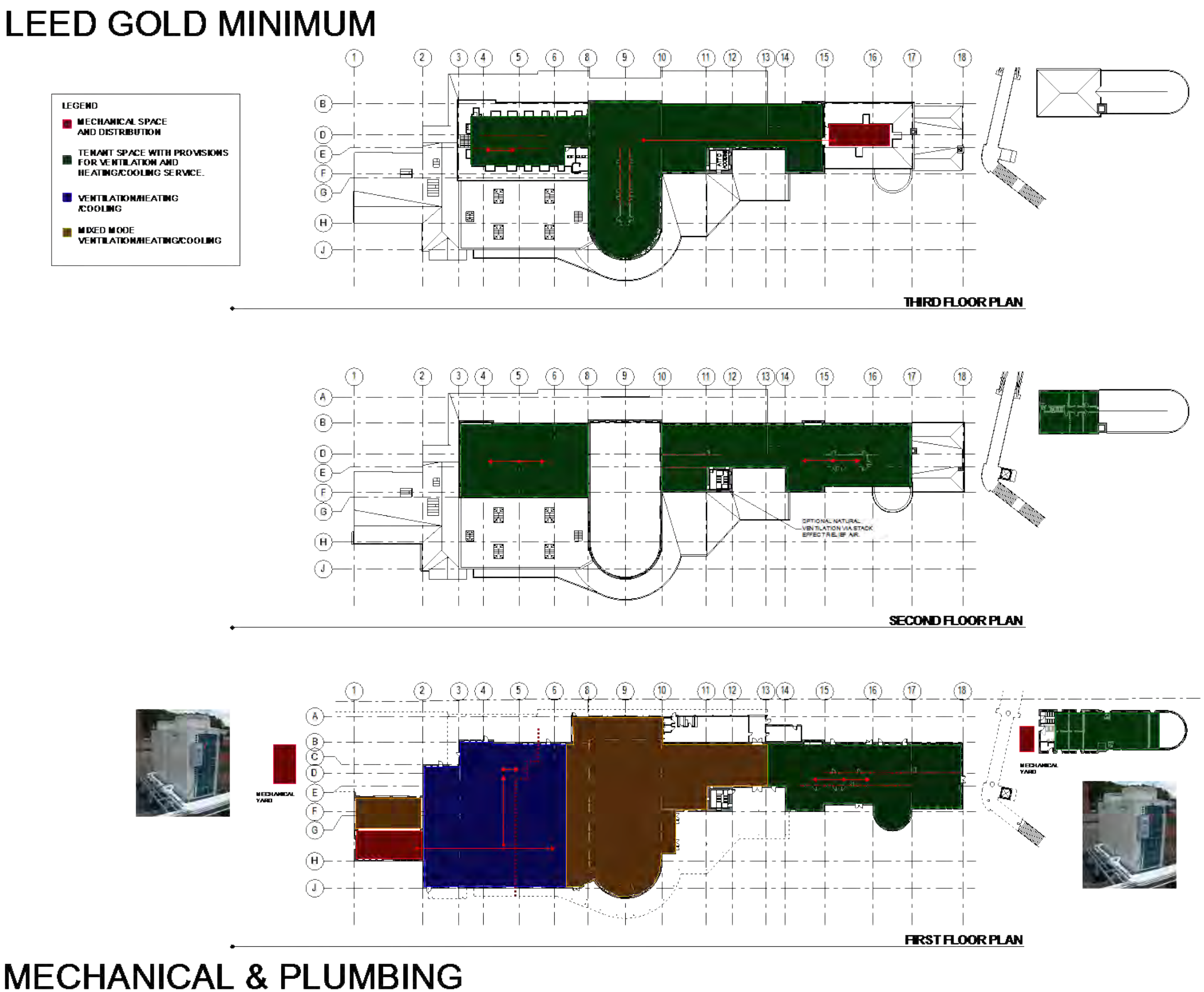


Figure 6.2-2 Electrical Alternative A – LEED Gold Standard

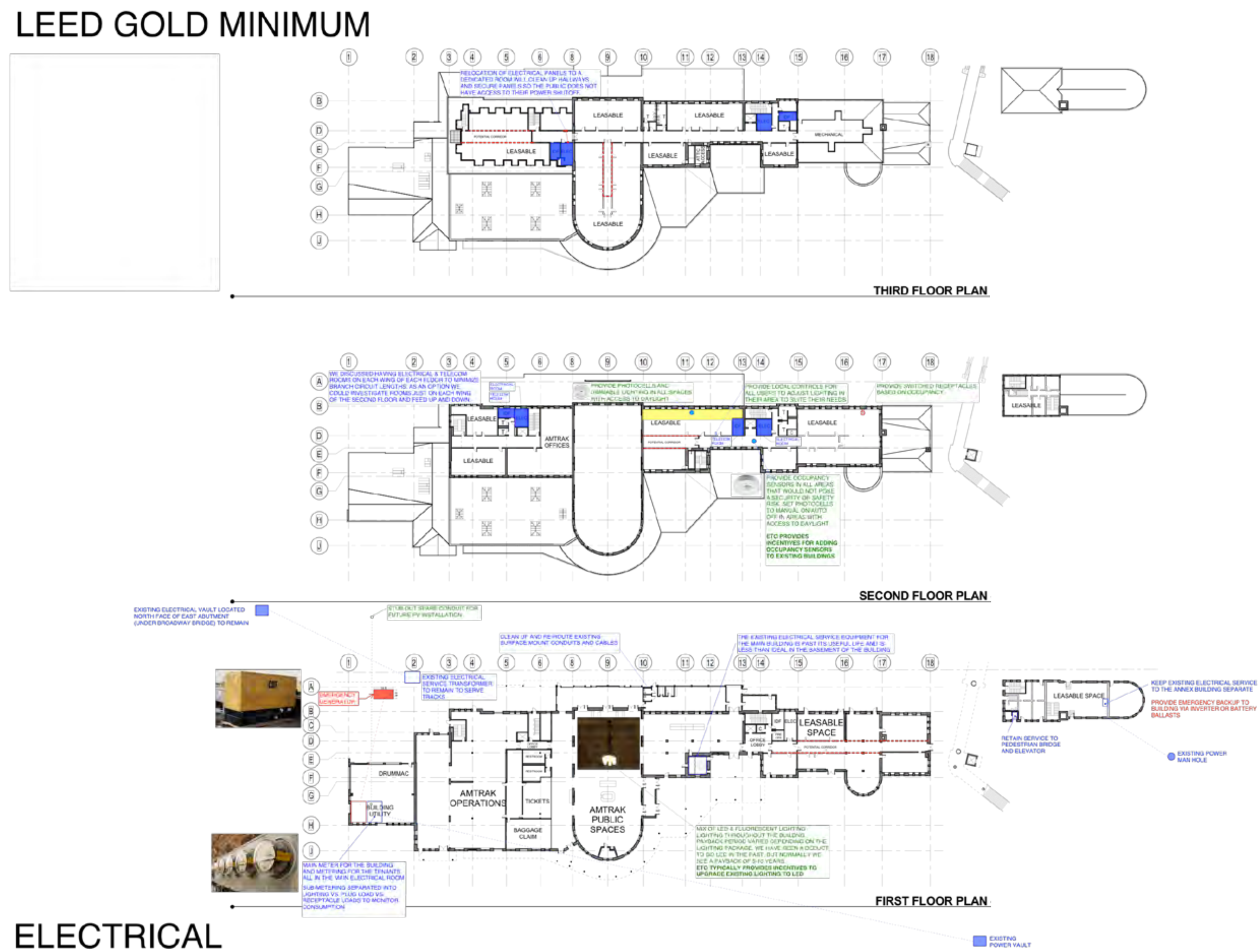


Figure 6.2-3 Mechanical and Plumbing Alternative B – LEED Platinum Standard

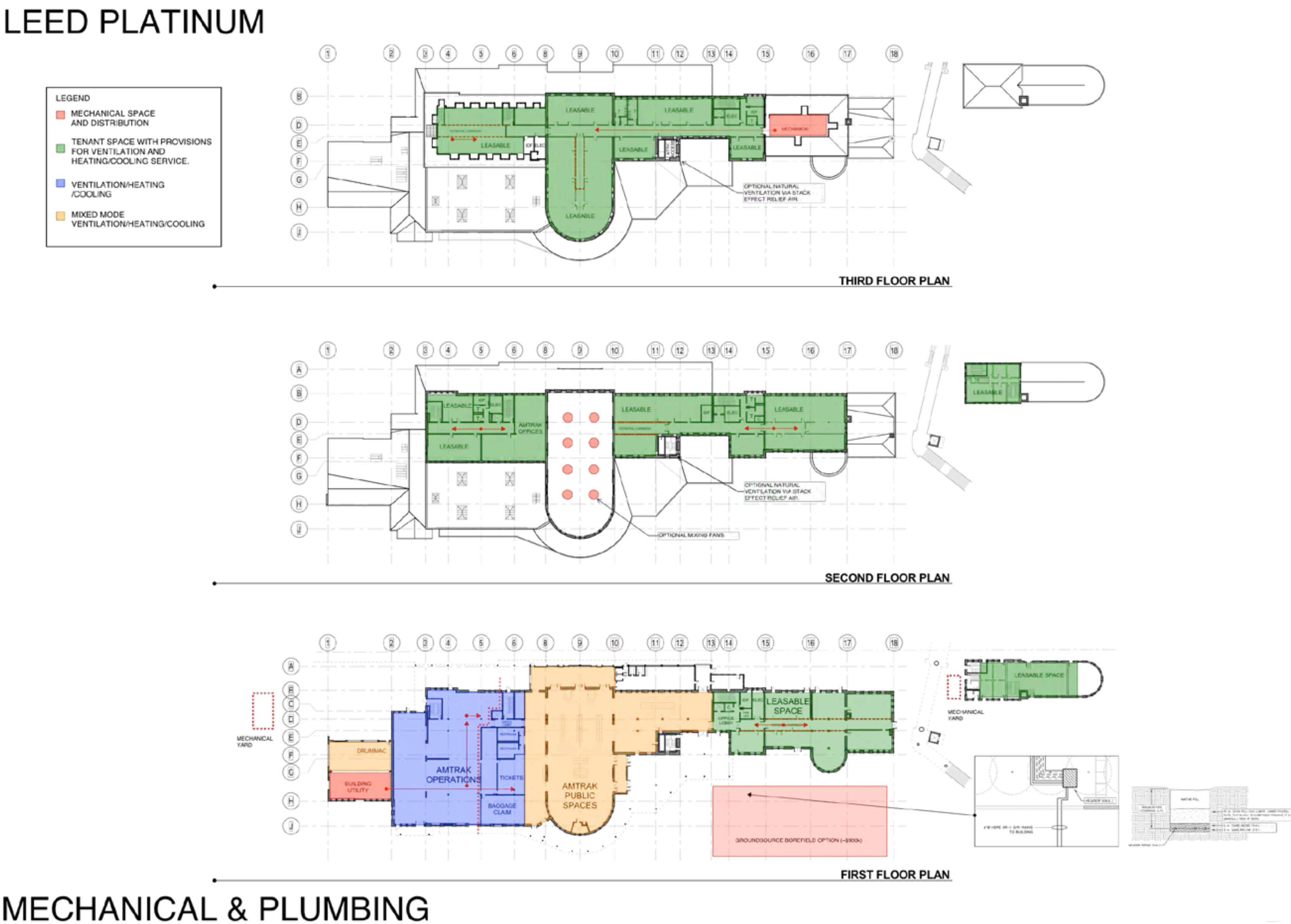


Figure 6.2-4 Electrical Alternative B – LEED Platinum Standard

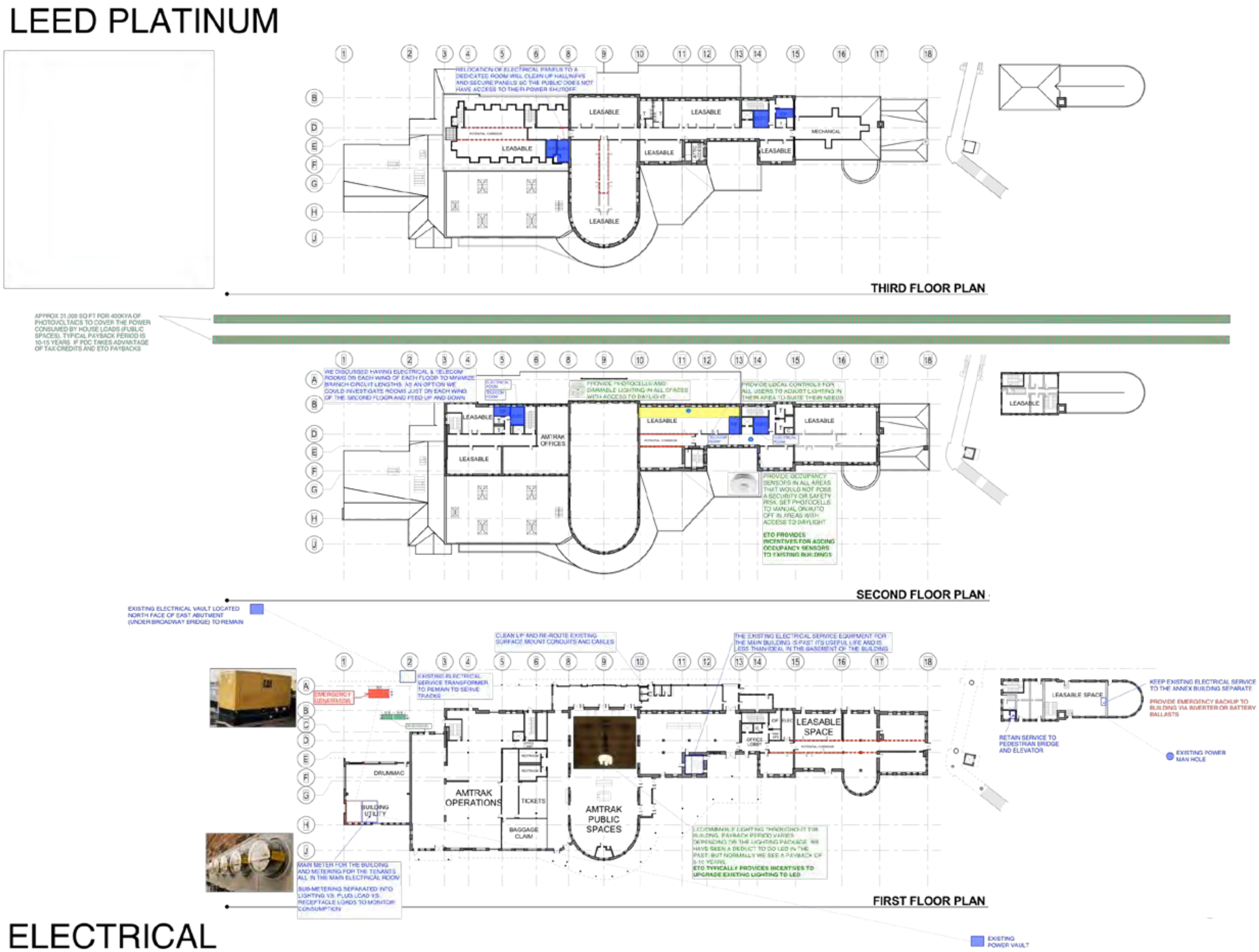


Figure 6.2-5 Mechanical and Plumbing Alternative C – Net Zero

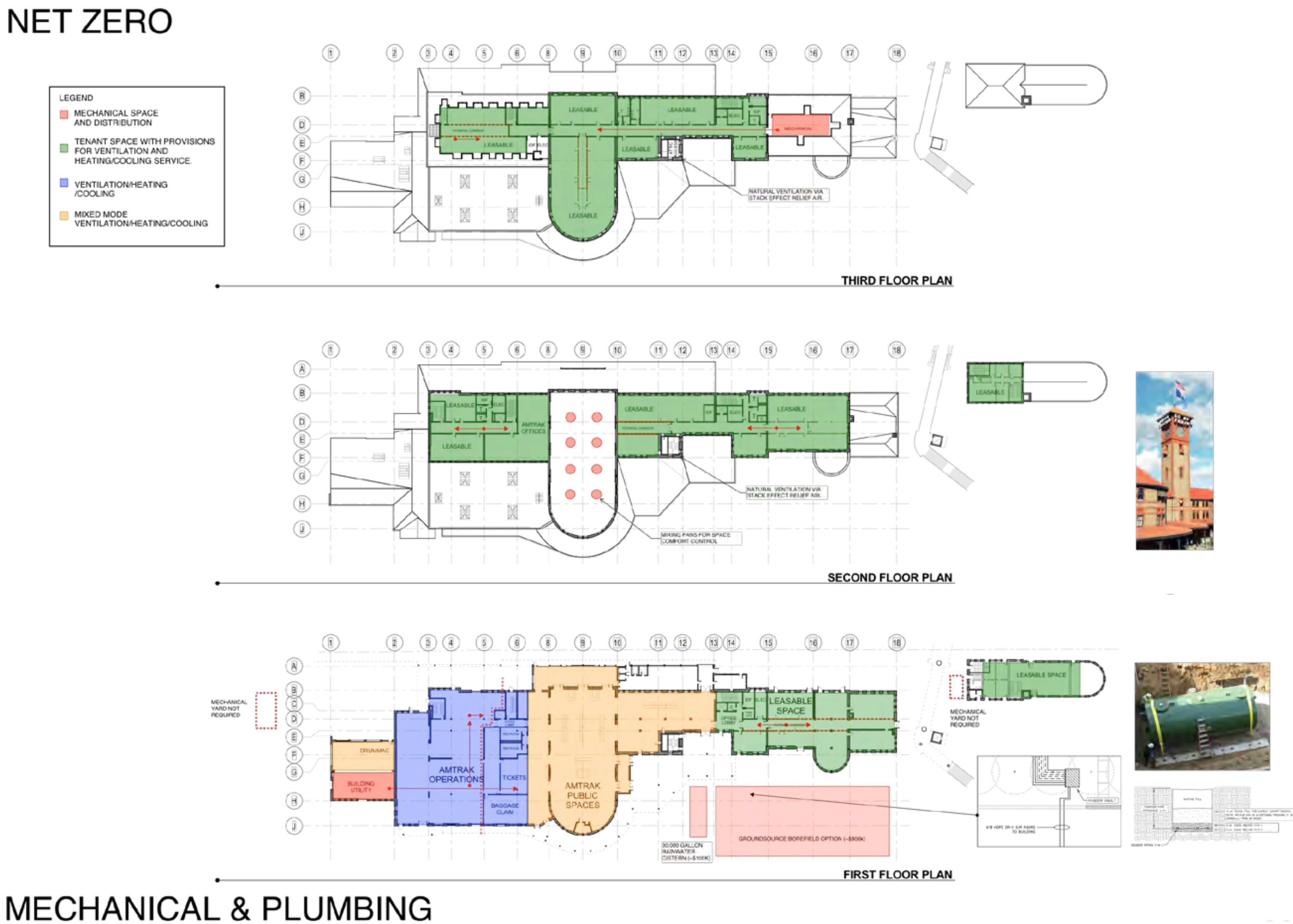


Figure 6.2-6 Electrical Alternative C – Net Zero

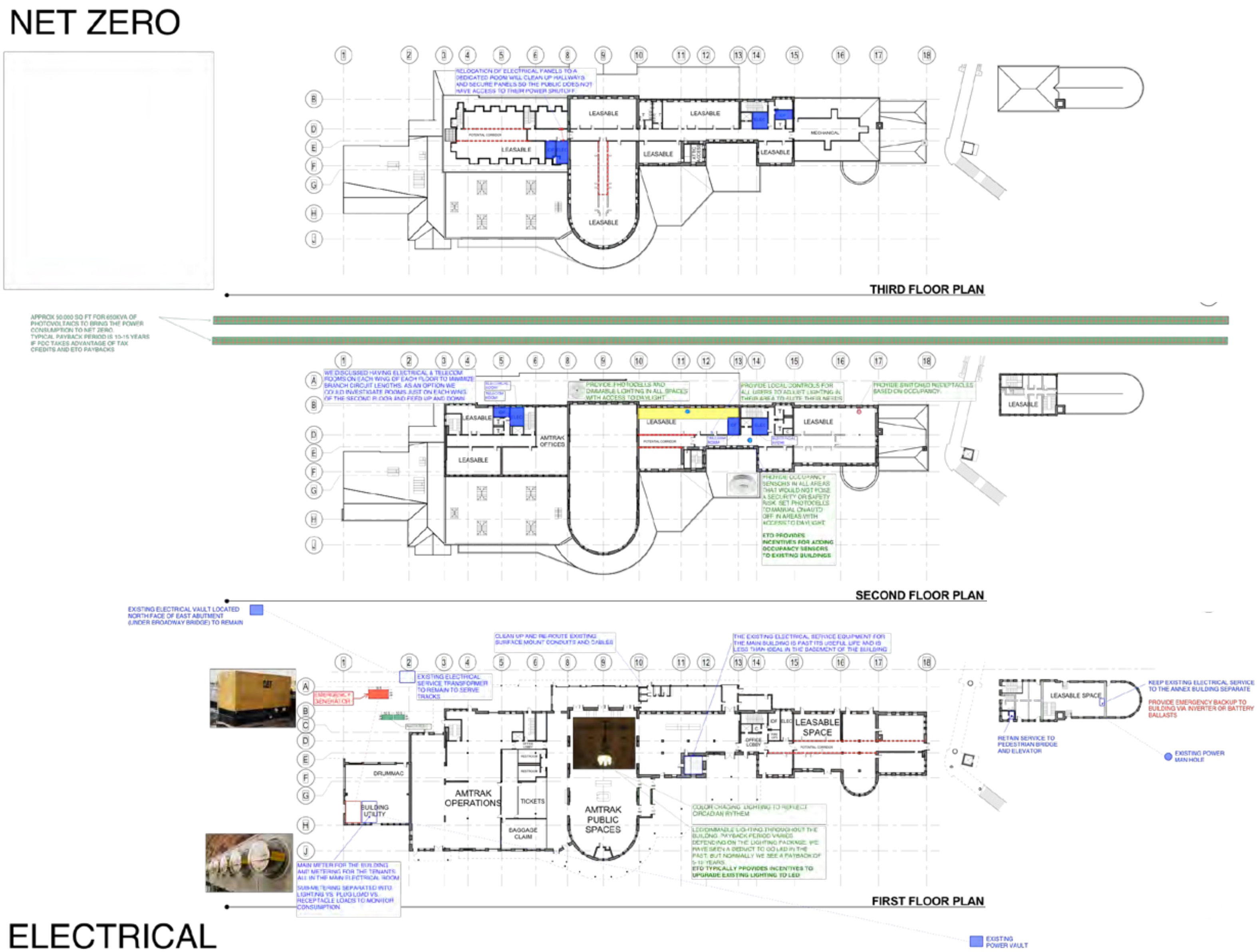


Table 6.2-1 Evaluation of Mechanical, Electrical, and Plumbing Alternatives

Evaluation Criteria		No-Build	A	LEED Gold Target (min standard per City of Portland)	B	LEED Platinum Target	C	Net Zero Target
A: Ability to Meet Project Goals								
A.1. Accommodate Future Capacity and Operational Needs of Passenger and Freight Rail	◆	Failing, obsolete, and inefficient systems will continue to detract from the passenger experience and will hamper current and future rail operations.	●	The upgraded lighting will enhance the visitors experience as well as increase the site and facilities security. HVAC systems will provide comfort as necessary.	●	The upgraded lighting will enhance the visitors experience as well as increase the site and facilities security. HVAC systems will provide comfort as necessary.	●	The upgraded lighting will enhance the visitors experience as well as increase the site and facilities security. HVAC systems will provide comfort as necessary.
A.2. Preserve and Protect the Historic Character of Union Station	◆	System retrofits and unused equipment installed over the years will continue to detract from the historic character of the building.	●	Upgrades historic lighting features to high-efficiency standards and removes exposed legacy plumbing, wiring, and conduit	●	The optional photovoltaics proposed for the platform canopies could be seen as a change to the historic character of the roofs. But the groundsource systems completely hide all HVAC.	□	The Photovoltaics proposed for the platform canopies could be seen as a change to the historic character of the roofs. But the groundsource systems completely hide all HVAC.

Evaluation Criteria		No-Build	A	LEED Gold Target (min standard per City of Portland)	B	LEED Platinum Target	C	Net Zero Target
A.3. Improve Economic and Social Vitality	◆	The conditions of systems will continue to diminish the easing potential and vitality of the station	●	Upgraded LED lighting and controls should have a very positive impact on the quality of the tenant spaces.	●	The proposed sustainable features for the building should have a positive marketing impact for leased spaces. Upgraded LED lighting and controls should have a very positive impact on the quality of the tenant spaces.	●	The proposed sustainable features for the building should have a positive marketing impact for leased spaces. Upgraded LED lighting and controls should have a very positive impact on the quality of the tenant spaces.
A.4. Improve Environmental Sustainability	◆	Older and less efficient systems will continue to use more energy and will have higher environmental impact.	□	This option provides a pretty standard LEED gold strategy, so there are some sustainable features such as LED lighting. Energy and water savings will be baseline compared to the other two options.	●	This option did not include rain water harvesting, so water consumption and stormwater management will not be as great as the net zero option. The PV array size is reduced in this option so the amount of energy consumed from the grid will be greater than the Net Zero option.	●	The Net Zero option will satisfy all of the contributing factors listed under this category related to MEP.
B. Cost and Financing								
B.1. Estimated Capital Cost	□	N/A – No capital improvement project	□	Costs for the LEED Gold option should be comparable to average construction costs of a comparable building type/size/condition.	◆	The LEED Platinum option will have the second largest upfront cost of the options presented. (Order of Magnitude costs TBD)	◆	The Net Zero option will have the largest upfront cost. There should be incentives from ETO to help recapture some of this cost. (Order of Magnitude costs TBD)

Evaluation Criteria		No-Build	A	LEED Gold Target (min standard per City of Portland)	B	LEED Platinum Target	C	Net Zero Target
B.2. Lifecycle Cost Impacts	◆	Costs of operation will be higher for older systems.	●	LED lighting will require less costs associated with relamping.	●	Overall decrease in lifecycle building costs anticipated due to high efficiency systems	●	Overall decrease in lifecycle building costs anticipated due to high efficiency systems
B.3. Cost Risk	◆	Costs of operation will be higher for older systems.	□	No unusual cost risks anticipated	◆	Potential costs risks associated with groundsource borefield excavation and more complex systems	◆	Potentially higher cost risk due to more sophisticated systems and integration of PVs with platform canopy system
B.4. Financial Leverage	◆	There is less cost sharing potential and financial leveraging potential if systems are upgraded as a stand-alone	●	ETO will incentivize the LED lighting upgrade and lighting controls upgrade.	●	ETO will incentivize the PV installation, LED lighting upgrade and lighting controls upgrade.	●	ETO will incentivize the PV installation, LED lighting upgrade and lighting controls upgrade.
C. Implementability and Constructability								
C.1. Technical Complexity and Constructability	□	N/A – No capital improvement project	□	No unusual risk factors anticipated	□	The groundsource system will have to be installed early in the schedule, sometimes creating additional complexity.	□	The groundsource system will have to be installed early in the schedule, sometimes creating additional complexity.
C.2. Schedule and Schedule Risk	□	N/A – No capital improvement project	□	No unusual risk factors anticipated	□	Potential for increased risk with increased complexity	□	Potential for increased risk with increased complexity
C.3. Construction Impact on Passenger and Freight Rail Operations	□	N/A – No capital improvement project	□	Comparable among alternatives	□	Comparable among alternatives	□	Comparable among alternatives

Evaluation Criteria		No-Build	A	LEED Gold Target (min standard per City of Portland)	B	LEED Platinum Target	C	Net Zero Target
C.4. Construction Impact on Union Station Tenants	☐	N/A – No capital improvement project	◆	All options will have an impact on tenants. Existing lighting and electrical infrastructure have reached an age where it needs to be replaced and the replacement will cause a disruption to the tenant if all spaces are to remain occupied.	◆	All options will have an impact on tenants. Existing lighting and electrical infrastructure have reached an age where it needs to be replaced and the replacement will cause a disruption to the tenant if all spaces are to remain occupied.	◆	All options will have an impact on tenants. Existing lighting and electrical infrastructure have reached an age where it needs to be replaced and the replacement will cause a disruption to the tenant if all spaces are to remain occupied.
C.5. Phasing and Project Segmentation	☐	N/A – No capital improvement project	☐	All options presented are compatible with a phased Main Building approach.	☐	All options presented are compatible with a phased Main Building approach.	☐	All options presented are compatible with a phased Main Building approach.
C.6. Risks, Assumptions and Unknowns	☐	N/A – No capital improvement project	☐	No unusual risk factors anticipated	☐	Potential for increased risk with increased complexity	☐	Potential for increased risk with increased complexity
D. Environmental Impacts and Approvals								
D.1. Environmental Impacts and Project Classification	◆	Continued visual impact of obsolete wiring, piping, and conduit on historic spaces	●	Reduced visual impact due to removal of obsolete wiring, piping, and conduit on historic spaces	●	Reduced visual impact due to removal of obsolete wiring, piping, and conduit on historic spaces	●	Reduced visual impact due to removal of obsolete wiring, piping, and conduit on historic spaces
D.2. Historic Impacts and Approvals	◆	Continued visual impact of obsolete wiring, piping, and conduit on historic spaces	●	Reduced visual impact due to removal of obsolete wiring, piping, and conduit on historic spaces	●	Reduced visual impact due to removal of obsolete wiring, piping, and conduit on historic spaces	●	Reduced visual impact due to removal of obsolete wiring, piping, and conduit on historic spaces

Evaluation Criteria		No-Build	A	LEED Gold Target (min standard per City of Portland)	B	LEED Platinum Target	C	Net Zero Target
D.3. Decision Making and Approvals	☐	N/A - No capital improvement project	☐	Comparable among build alternatives	☐	Comparable among build alternatives	☐	Comparable among build alternatives

7. Railside Improvements

This section describes the Railside Improvements evaluated in conceptual design. These alternatives are organized as follows:

- Platform Canopies and High Shed
- Rail and Building Maintenance Areas

7.1. Platform Canopies and High Shed

The platform canopy system consists of the umbrella canopies over the Track 2/3 and Track 4/5 platforms, as well as the perpendicular high shed covering the walkway and connecting the platforms to the Main Building.

Figure 7.1-1 Existing Platform Canopies and High Shed

7.1.1. Key Design Requirements

The key design requirements of the Platform Canopies and High Shed identified through the conditions assessment and stakeholder discussions include:

- Accommodating future capacity, operational, safety, and passenger comfort needs of passenger and freight rail.
- Addressing seismic/structural deficiencies of the Existing Platform Canopies and High Shed to meet current code and safety standards.
- Repairing/replacing failing and end-of-life mechanical, electrical, plumbing, and stormwater systems.
- Accommodating changes to track geometry to accommodate future rail capacity needs, e.g. Track 6 and/or reconfiguration of the passenger walkway.
- Compatibility with new platforms that are compliant with the FRA Level Boarding Final Rule.
- Upgrading rail support equipment, utilities, lighting, wayfinding, and security systems.
- Honoring the historic character of Union Station

7.1.2. Existing Platform Canopy and High Shed Condition

Strengthening the structural members and foundations of the existing Platform Canopies and High Shed to provide seismic reinforcements base of the existing canopies was considered. This alternative would also involve replacement of damaged/corroded materials and decommissioned/obsolete systems. Such systems, along with lighting, wayfinding, security, and other improvements, would be installed on the refurbished canopies.

The removed triangular Track 4 edge of the Track 4/5 Canopy, which was cut off of the canopy structures to increase horizontal train clearance, would presumably be restored. However, this would re-introduce a conflict with train clearances, and it is not clear whether this is a viable option without relocating the canopies or tracks.

The canopies would need to be removed to be repaired/cleaned while the existing foundations and connections strengthened. The umbrella canopies require strengthening of the base of every column, foundation improvements and damaged elements need to be repaired, presumably with new structural steel that mimics the appearance of the historic materials as closely as possible. In order to accomplish the rehabilitation, each canopy will likely need to be cut into sections, taken to a fabrication shop, cleaned, repaired and then reassembled on site in conjunction with a new, strengthened foundation system.

This repair/reconstruction approach for the existing canopies, however, would propagate many of the existing operational shortcomings of the existing Platform Canopies. Meeting current clearance requirements would require the platform canopies bottom edges to be raised from the existing height of approximately 11' above the top of rail to 23' above top of rail. This change would compromise the historic appearance of the platform canopy, and would introduce conflicts between the umbrella canopies and the perpendicular High Shed, Broadway Bridge, and Pedestrian Bridge. Furthermore, the added height combined with the relatively narrow width of the existing canopies would provide insufficient weather protection for passengers and train crew on the platforms.

Additionally, the High Shed is seismically insufficient due to the length and slenderness of its support columns, two of which are shared with the Main Building structure (insufficient seismic isolation). The current high shed requires a large amount of strengthening to achieve lateral performance. Based on the structural/seismic assessment, it is recommended that the existing shed be replaced. There is so little lateral capacity in the existing high shed that the retrofit required would have a dramatic and intrusive effect on the appearance of the existing High Shed.

For these reasons, retrofit of the existing Platform Canopies was not considered as part of the set of feasible alternatives.

7.1.3. Replacement Canopy Alternatives

The proposed new Platform Canopy replacement alternatives are intended to address the operational, structural, and systems deficiencies of the existing platform canopies, as well as corrosion and deterioration of materials due to over 100 years of continuous use. The improvements to the rail side also include a replacement of the existing platform systems to current standards, including structural/foundations, systems, rail support equipment, and ADA accessibility.

The objective of the platform canopy conceptual design alternatives analysis was to narrow the range of potential architectural styles and forms to a preliminary preferred alternative. After public review and selection of a preferred alternative, a number of future design decisions would be required in terms of architectural detailing, structural design, materials, finishes, colors, lighting, etc.

Therefore the designs presented for each alternative should be considered conceptual renderings for comparison purposes, and not necessarily reflective of the final design.

7.1.3.1 Architectural Styling

Both traditional and contemporary styles were considered in the canopy alternatives:

- **Traditional** – This style uses materials and trussed structural members to reproduce the look and feel of the existing Platform Canopies of early 20th century vintage. The new structure, however, would be designed to meet current clearance and structural requirements, and therefore would not be an exact replica of the exiting platform canopy and high sheds.

  An advantage of this style is that it can replicate the existing historic structure and nearby historic industrial artifacts (e.g. Willamette River bridges). However, replicating historical elements can also be seen as detracting from the authentic historic elements of the building, so the design approach must be carefully considered. Additionally, nuisance bird activity can be more problematic with conventional truss members (due to horizontal members and nooks for nesting), and the visual weight of the trusses will could reduce the amount of light penetrating to the platform level through a glass canopy roof if used.

- **Contemporary** – This style uses any of a number of current structural and construction techniques. The form does not seek to duplicate the designs and construction methods of the late 19th to early 20th century. There are a number of examples of introducing new platform canopies adjacent to historic rail stations in the U.S., including Seattle King Street Station, Denver Union Station, Boston South Station, and proposals for Union Station in Washington, D.C.

  An advantage of the contemporary form is that it opens up a wider array of structural design approaches, materials, and finishes may be considered. Current best practices for structural design and materials can be applied to the design. It may be perceived as a benefit to introduce a canopy design "of its time," much like the original 1896 Queen Anne structure and the 1930s Belluschi renovation. There may also be positive connotations of a contemporary platform canopy form with high-quality intercity passenger rail service. However, ensuring harmony and compatibility with the adjacent historic structure is a concern and requires careful design consideration.

7.1.3.2 Canopy Form

Two alternative forms were considered in the alternatives:

- **Umbrella Canopy with High Shed** (Existing Condition) – This form consists of parallel "umbrella" canopies along each platform, supported by a center column. A perpendicular High Shed element provided coverage over the passenger walkway.

  The umbrella canopy/high shed concept preserves the form that has existed at Union Station for over 100 years, since the 1910s. It also generally results in a smaller structure, which reduces the overall cost and visual impact. It also provides open-air ventilation for diesel exhaust. A drawback is that weather protection coverage is not as substantial as a train shed form.

- **Train Shed** - Consists of a large roof structure that covers all terminal tracks and platforms. At Union Station, because of the clearance limitations imposed by the Broadway Bridge and the pedestrian bridge, the High Shed form is anticipated to span between these two bridges, with umbrella canopies providing platform coverage to the north of the Broadway Bridge and the south of the Pedestrian Bridge.

  An advantage of the train shed form is that it provides continuous coverage and improved weather protection over the entire train boarding and servicing area. Potential issues to mitigate include diesel exhaust and additional area to clean and maintain. The cost of a train shed is also generally higher given the larger structure and surface area.

These styles are characterized in Table 7.1-1.

Table 7.1-1 Platform Canopy Alternatives Considered

Form	Architectural Styling	
	Traditional	Contemporary
Umbrella Canopy with High Shed	Alternative A	Alternative B
Train Shed	Alternative C	Alternative D

7.1.4. Train Clearance Requirements

The current Platform Canopies at Union Station do not meet current horizontal or vertical rail clearance requirements. On the Track 4 canopy edge (a shared freight track, the existing canopy was cut away to increase freight clearance, compromising the historic integrity of the canopy structure.

Amtrak has provided design direction that any replacement canopies must be built to their current Minimum Roadway Clearances. This includes a 23-foot minimum vertical clearance above top of rail, 7'-7" horizontal clearance from the track center to the edge of rail, and 9'-0" horizontal clearance from the track center to any permanent obstructions. Minimum clearance envelopes are shown on section plans for conceptual design alternatives.

To improve weather protection, the conceptual designs assumes that new umbrella canopies extend to the centerline of the adjacent track. This is similar to the platform canopies at Amtrak's King Street Station in

Seattle. The overall effect is a significantly higher and wider umbrella canopy structure than the existing canopies.

7.1.5. Photovoltaic Electricity Generation on Platform Canopies

The opportunity to include photovoltaic (PV) cells (solar panels) on the roof of a new platform canopy structure was identified as a potential sustainability benefit of new platform canopy construction. A PV installation on the platform canopies may be able to produce enough energy to meet the total needs of the Union Station facility when outfitted with high-performance MEP systems in the future (a total estimated future demand of approximately 650 kWh).

All platform canopy alternatives are compatible with the use of PV cells, using one of several methods of installation, depending on the choice of roofing material(s) on the canopy. Conventional solar panels can be mounted on top of a solid roofing surface material such as sheet metal; in a glazed structure, PV panels can be embedded within the laminated glass panels themselves (Figures 7.1-2 through 4). A combination of these approaches can be used based on the detailed design considerations of the preferred option.

Figure 7.1-2 Examples of Glass Canopies with Embedded Photovoltaic Cells

Figure 7.1-3 Solar Canopy, Stillwell Avenue Station, NYC Subway

Figure 7.1-4 Tri-Met MAX Orange Line, Solar Platform Canopies

A PV installation is estimated to add approximately $1.8-3.2 million of additional cost to the Platform Canopy system (approximately $1.8-$2.2 million after incentives). Further analysis of building energy load requirements, PV generation potential, and lifecycle costs and benefits for a PV system will be undertaken during preliminary engineering based on the preferred alternative and further development of replacement MEP systems and building uses.

7.1.6. Impact of Track/Crossing Reconfiguration

Through the Union Station PE/NEPA project, the configuration of tracks at Union Station is undergoing engineering design to accommodate future passenger volumes and train lengths. A consequence of this discussion is the potential shifting and/or narrowing of the passenger walkway that is currently covered by the High Shed. The High Shed itself is currently aligned with an axis centering on the Main Concourse. For purposes of this alternatives analysis, it is assumed that the walkway is located in approximately the same location as the existing walkway so was to closely preserve this existing line of symmetry for the High Shed included as part of Alternatives A and B.

Under Alternatives A and B, the High Shed would attempt to preserve the existing symmetry of the Main Concourse, making accommodations in width if necessary to ensure coverage of the passenger crossing if track design necessitates that the passenger crossing is shifted.

If the final design for the crossing varies significantly from the existing location, it may be more aesthetically desirable to consider a Train Shed Alternative rather than breaking the existing symmetry.

7.1.7. Compatibility with Rail Maintenance Shed

During the Conditions Assessment, the existing rail maintenance shed (Butler-type shed) was found to be structurally and seismically deficient, and is proposed for replacement. A new Maintenance Shed would likely resemble the form and materials of the preferred Platform Canopy alternatives. The detailed design requirements and alternatives for the Maintenance Shed will be explored in detail during the Preliminary Engineering phase of design.

Figure 7.1-5 Schematic of Proposed Railside Improvements

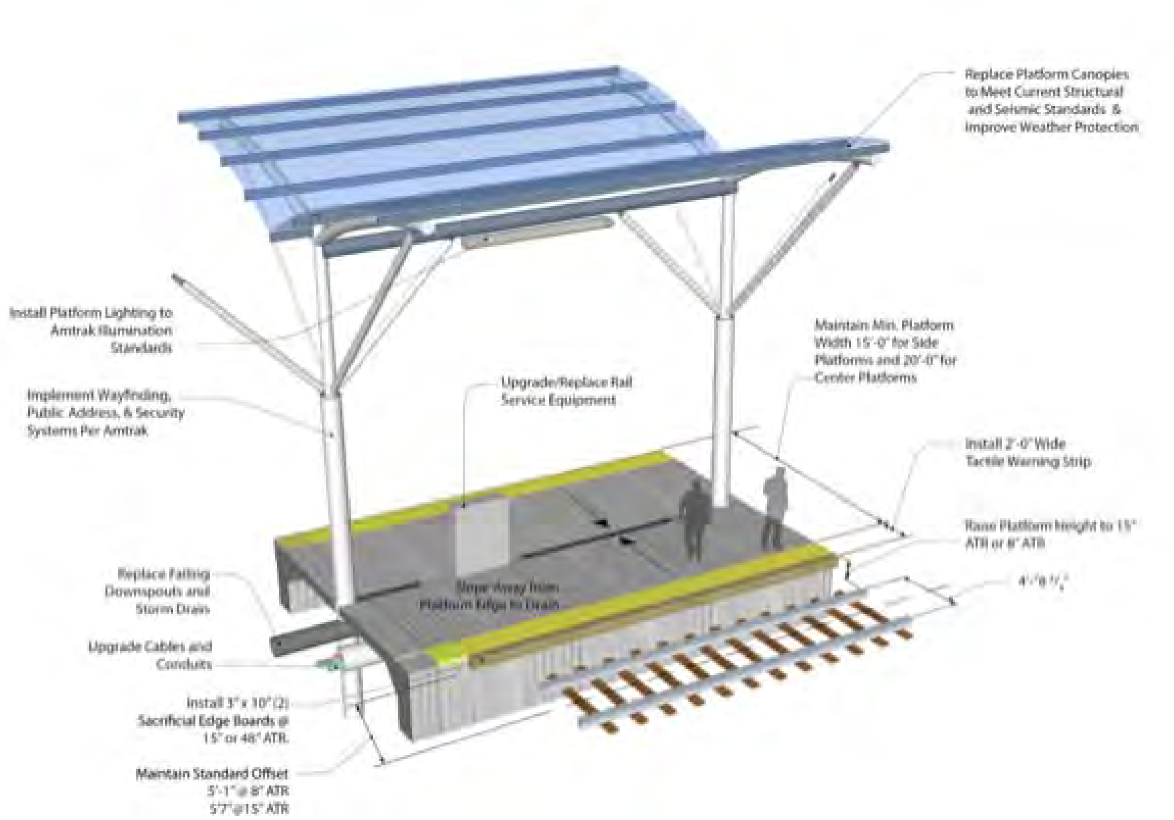
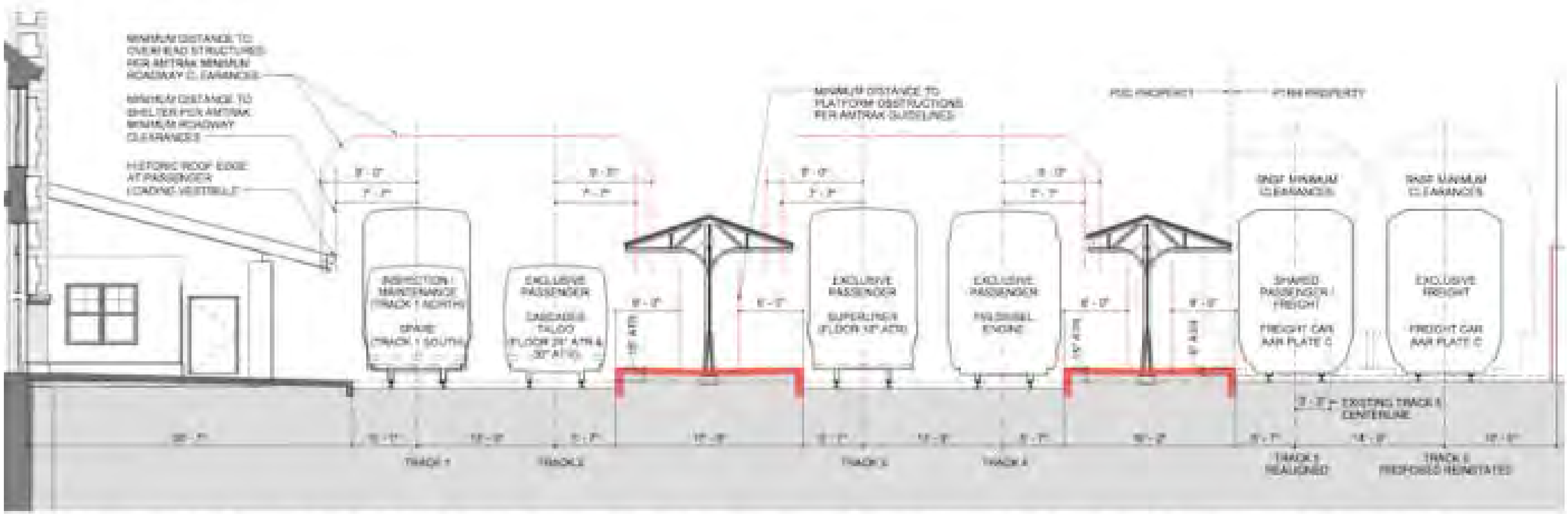


Figure 7.1-6 Insufficient Passenger Weather Protection of Existing Canopies

Figure 7.1-7 Existing Platform Canopies Compared to Rail Clearance Requirements and Potential Impacts of Track 6 Insertion



CONCEPTUAL TRACK UTILIZATION AND LEVEL BOARDING ALTERNATIVE (TRACK 6 CONFIGURATION) CROSS SECTION AT PLATFORMS

7.1.8. Platform Canopy Alternatives

The following alternatives were evaluated:

- The No-Build Alternative would maintain the existing platform canopies as-is, without addressing operational or structural deficiencies.
- The Traditional Umbrella Canopies with High Shed alternative provides new umbrella canopies and a High Shed structure constructed to current rail clearances using traditional styling and materials.
- The Contemporary Umbrella Canopies with High Shed alternative provides new umbrella canopies and a High Shed structure constructed to current rail clearances using contemporary styling and materials.
- The Traditional Train Shed alternative provides a continuous train shed with a contemporary design styling between the Broadway Bridge and the pedestrian bridge. North and south of these bridges, respectively, the canopies would continue as Umbrella Canopies also using a traditional styling
- The Contemporary Train Shed alternative provides a continuous train shed with a contemporary design styling between the Broadway Bridge and the pedestrian bridge. North and south of these bridges, respectively, the canopies would continue as Umbrella Canopies also using a contemporary styling

The results of the evaluation of the four alternatives are summarized in Table 7.1-1.

7.1.8.1 Platform Canopies and High Shed No-Build Alternative

If the Platform Canopies are not improved, the existing structures will continue to pose a significant seismic hazard and will continue to deteriorate over time. The condition of the structure detracts from the function and appearance of Union Station.

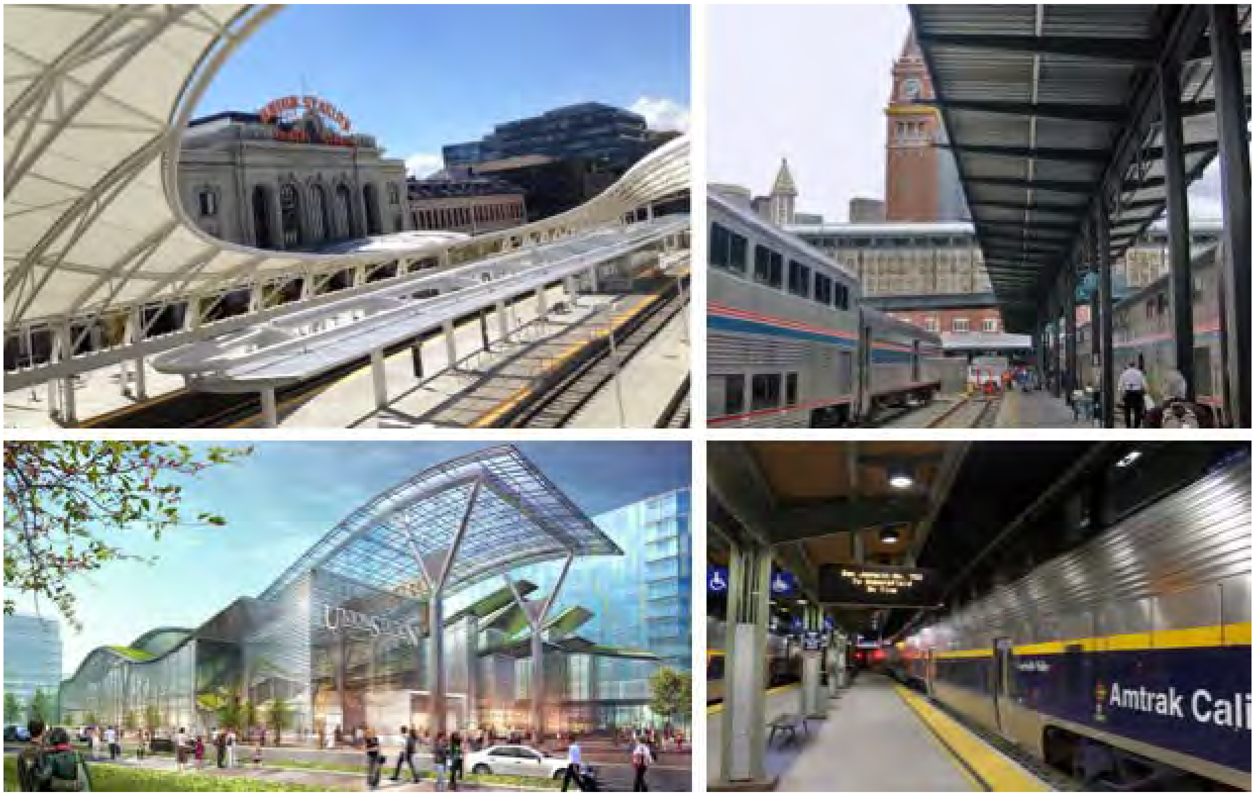
The existing canopies also provide inadequate operating conditions for passengers and train crews. The dripline of the platform canopy edges is over the platform surface, not the rail cars, resulting in precipitation cascading over the canopy edge between passengers and the boarding doors of trains. Insufficient lighting levels and outmoded rail support systems will continue to be a hindrance to the safe and efficient operations of the station.

During the conditions assessment phase, the Platform Canopies were identified to have numerous deficiencies in terms of function, train clearance, structural/seismic condition, drainage, lighting, and wayfinding. The Platform Canopies are also in a state of deterioration including corrosion of structural steel members, corroded and failed drainage pipes, and numerous decommissioned electrical, water, and yard air systems. The Track 4/5 platform has been modified by truncating the triangular roof truss on the track 4 side, to provide for wider clearances for freight trains operating on Track 4.

Vertical and horizontal clearance of the Platform Canopies is also a concern. Rehabilitating the truncated Track 4 edge of the Track 4/5 canopy would violate the horizontal clearance requirements of Amtrak and freight rail standards. Potential realignment of Track 5 due to the introduction of Track 6 could pose a similar constraint on the Track 5 side of this structure, which currently has sufficient clearance.

For these reasons, the No-Build Alternative was eliminated from further consideration as part of the set of feasible alternatives.

Figure 7.1-8 New Platform Canopy Precedents at Historic U.S. Train Stations (Clockwise from Upper Left: Denver, CO; Seattle, WA; Washington DC; Sacramento, CA)



7.1.8.2 Alternative A: Traditional Umbrella Canopies with High Shed

This alternative would consist of new umbrella canopies and a high shed structure constructed to current rail clearances (approximately 22 feet above top of rail) and with an overhang to the centerline of the adjacent boarding tracks (Figures 7.1.9 through 12). The structural steel framing would be fabricated to resemble a traditional truss-like form.

If designed with a peaked roof truss shape, this alternative could most closely resemble the existing platform canopies and high shed at Union Station. However, the width and height of the structures would be significantly increased over the existing dimensions due to the current rail clearance requirements and weather protection objectives. The roofing material could also incorporate glass and/or photovoltaic cells rather than the existing faux terra cotta sheet metal roofing.

Figure 7.1-9 Platform Canopies and High Shed Alternative A - Traditional Umbrella Canopies with High Shed

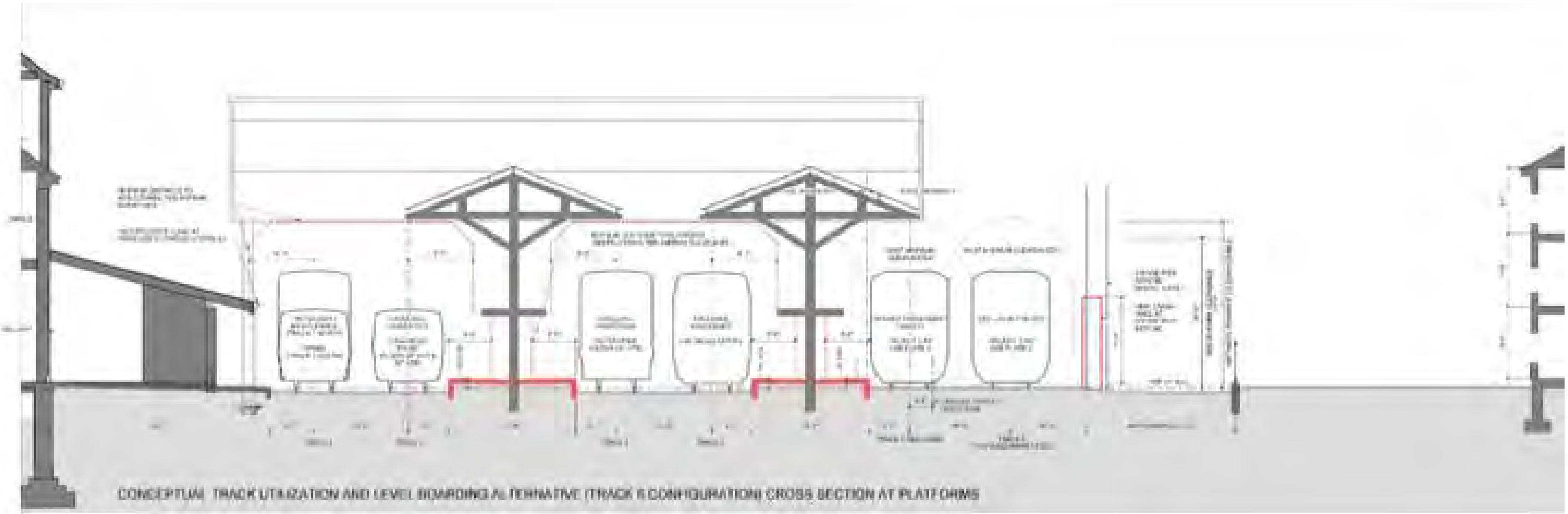


Figure 7.1-10 Platform Canopies and High Shed Alternative A - Traditional Umbrella Canopies with High Shed

Figure 7.1-11 Platform Canopies and High Shed Alternative A - Traditional Umbrella Canopies with High Shed

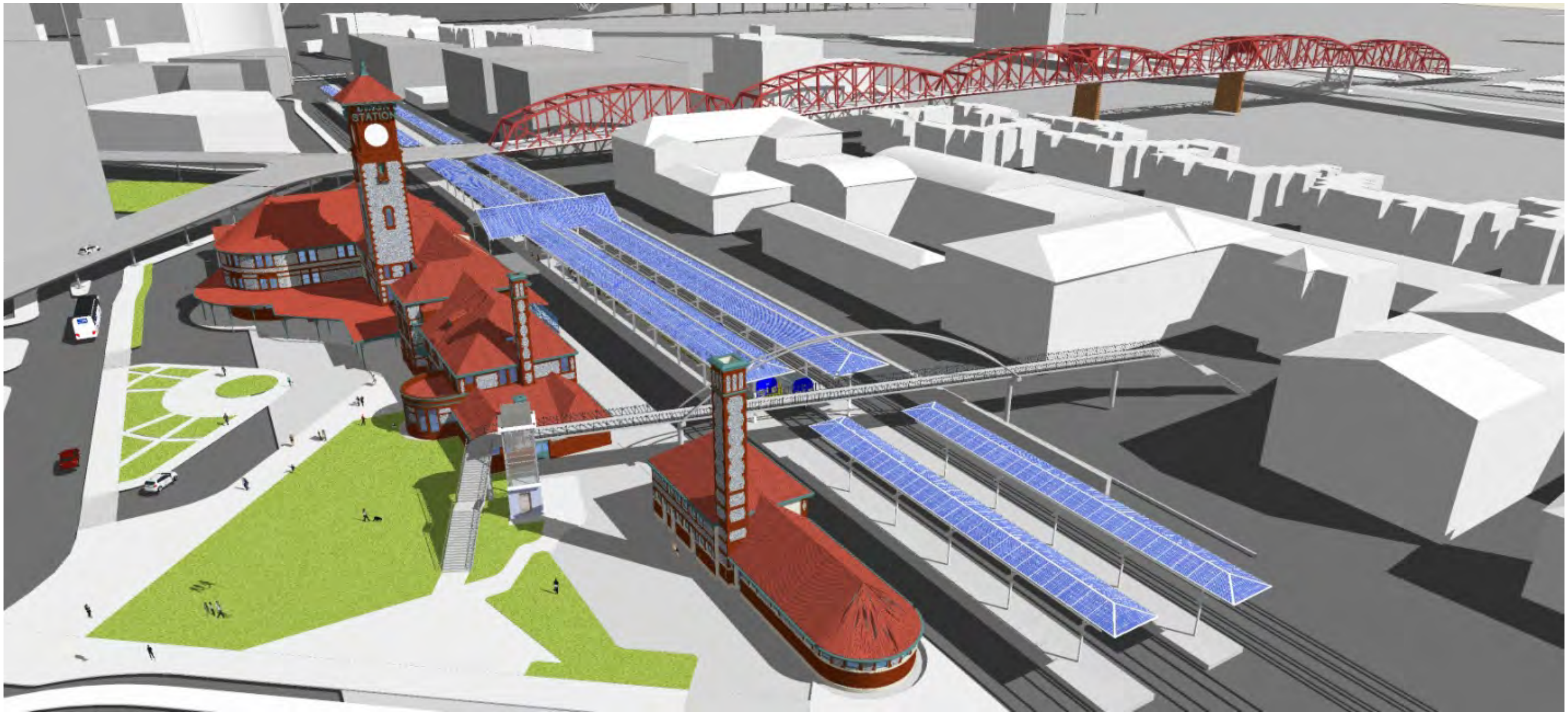


Figure 7.1-12 Platform Canopies and High Shed Alternative A - Traditional Umbrella Canopies with High Shed

7.1.8.3 Alternative B: Contemporary Umbrella Canopies with High Shed

Like Alternative A, this alternative would consist of new umbrella canopies and a high shed structure constructed to current rail clearances (approximately 22 feet above top of rail) and with an overhang to the centerline of the adjacent boarding tracks (Figure 7.1-13 through 7.1-16). However the design would incorporate more contemporary structural forms. This introduces a wide variety of alternatives; the conceptual example illustrated in the figures shows a "gullwing" design as just one of many possibilities.

The design objective is to produce a lighter, more transparent canopy structure that would meet rail operations requirements and complements the historic structure without attempting to replicate the historic structure. Roof materials would likely consist of tempered glass and/or photovoltaic cells.

Figure 7.1-13 Platform Canopies and High Shed Alternative B - Contemporary Umbrella Canopies with High Shed

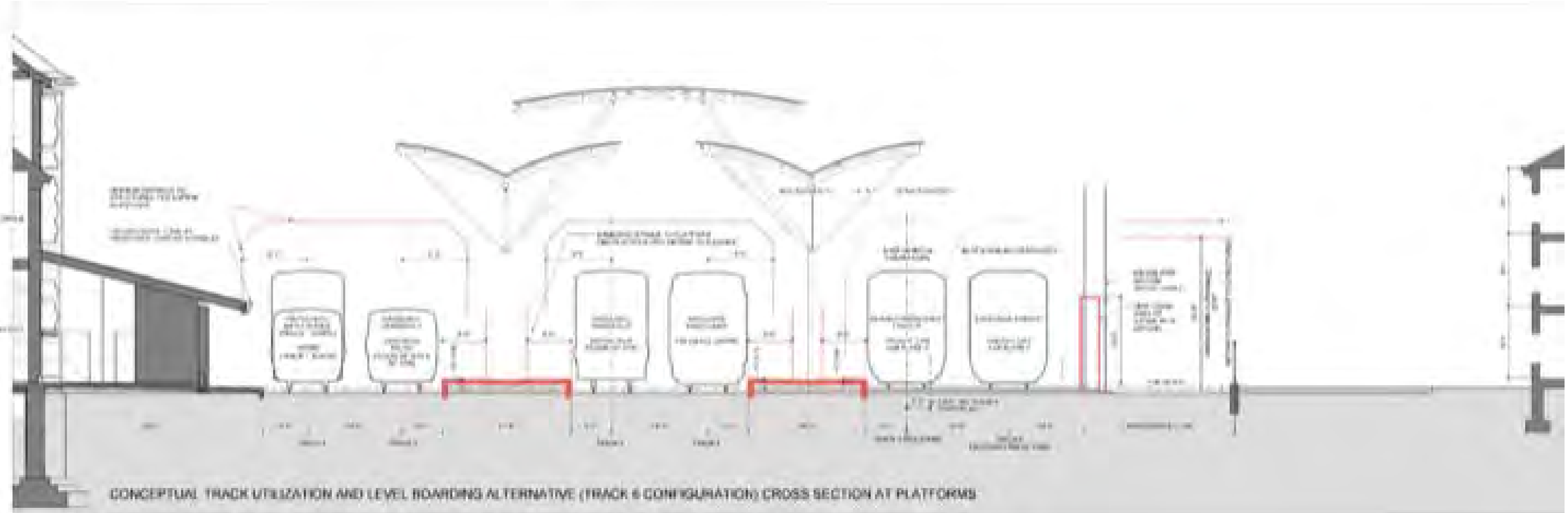


Figure 7.1-14 Platform Canopies and High Shed Alternative B - Contemporary Umbrella Canopies with High Shed

Figure 7.1-15 Platform Canopies and High Shed Alternative B - Contemporary Umbrella Canopies with High Shed

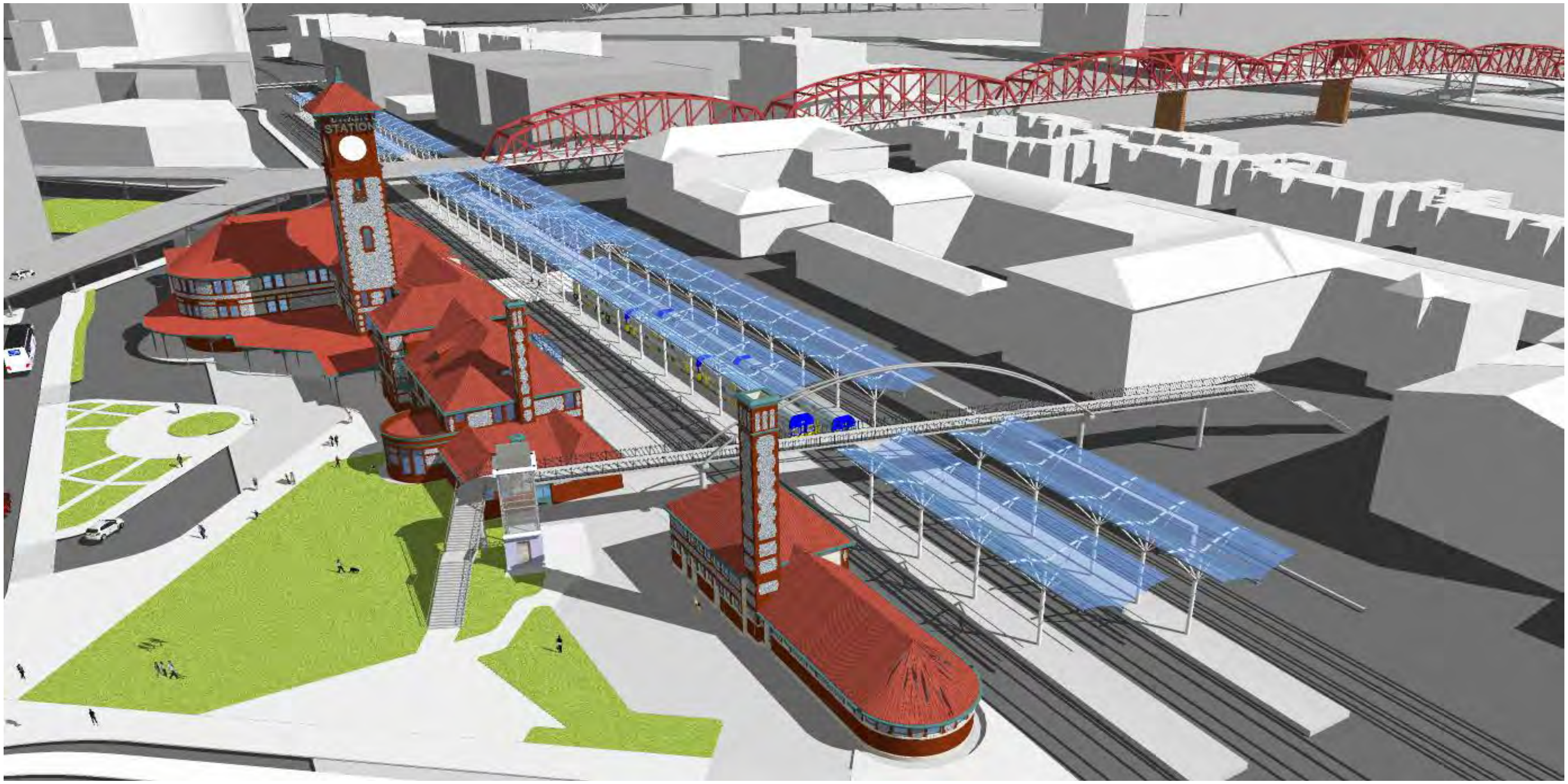
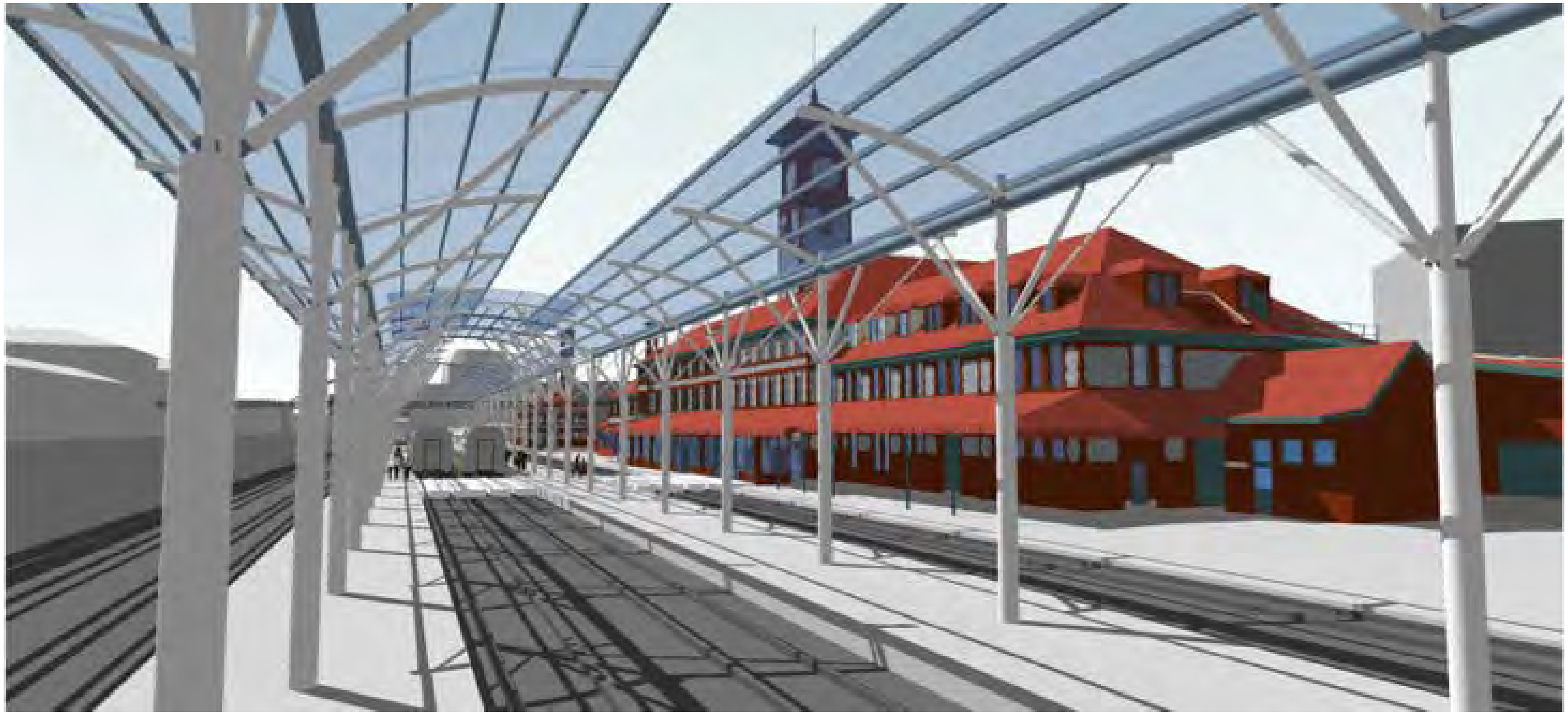


Figure 7.1-16 Platform Canopies and High Shed Alternative B - Contemporary Umbrella Canopies with High Shed



7.1.8.4 Alternative C: Traditional Train Shed Form

Alternative C would provide a continuous train shed with a contemporary design styling between the Broadway Bridge and the pedestrian bridge (Figure 7.1-17 through 20). North and south of these bridges, respectively, the canopies would continue as umbrella canopies also using a traditional styling, similar to Alternative A. The effect would be of a classic European-style train shed, reminiscent of a train shed concept originally proposed for Union Station in the 1890s but never constructed.

Figure 7.1-17 Platform Canopies and High Shed Alternative C- Contemporary Umbrella Canopies with High Shed

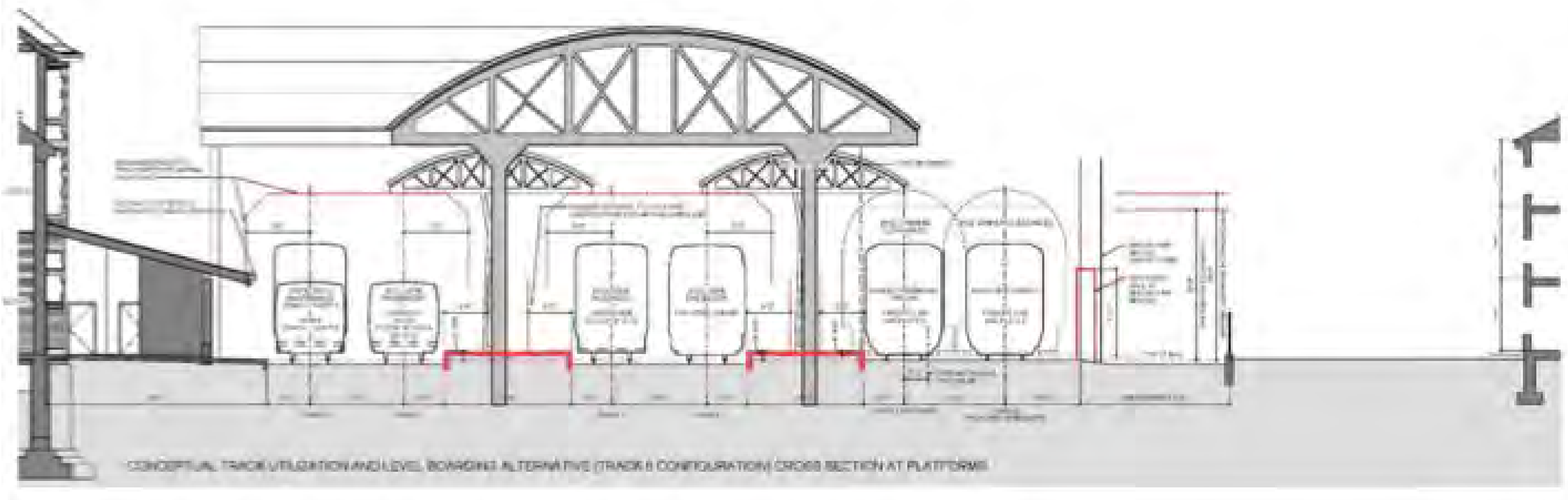


Figure 7.1-18 Platform Canopies and High Shed Alternative C - Contemporary Umbrella Canopies with High Shed

Figure 7.1-19 Platform Canopies and High Shed Alternative C - Traditional Train Shed Form

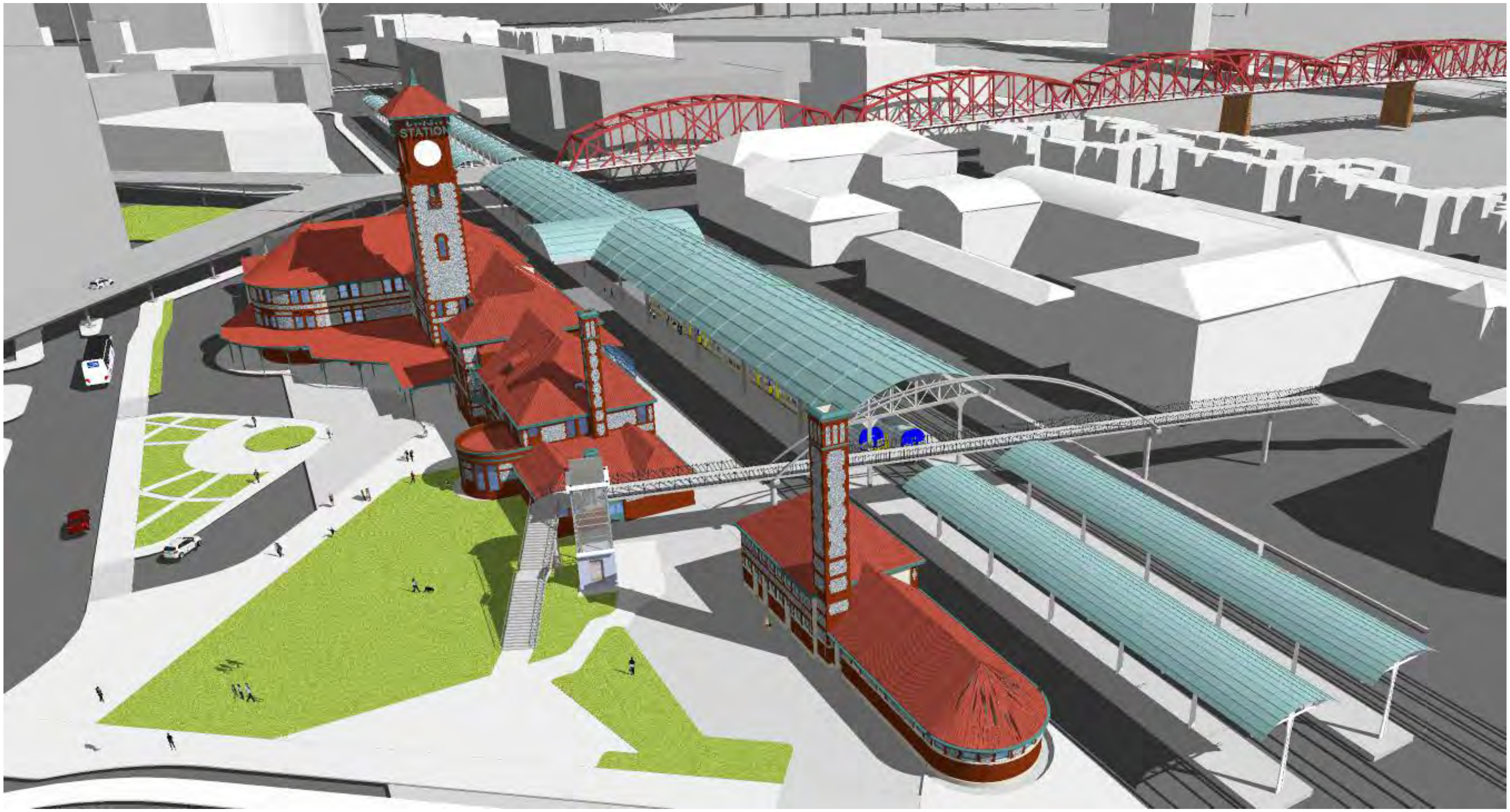
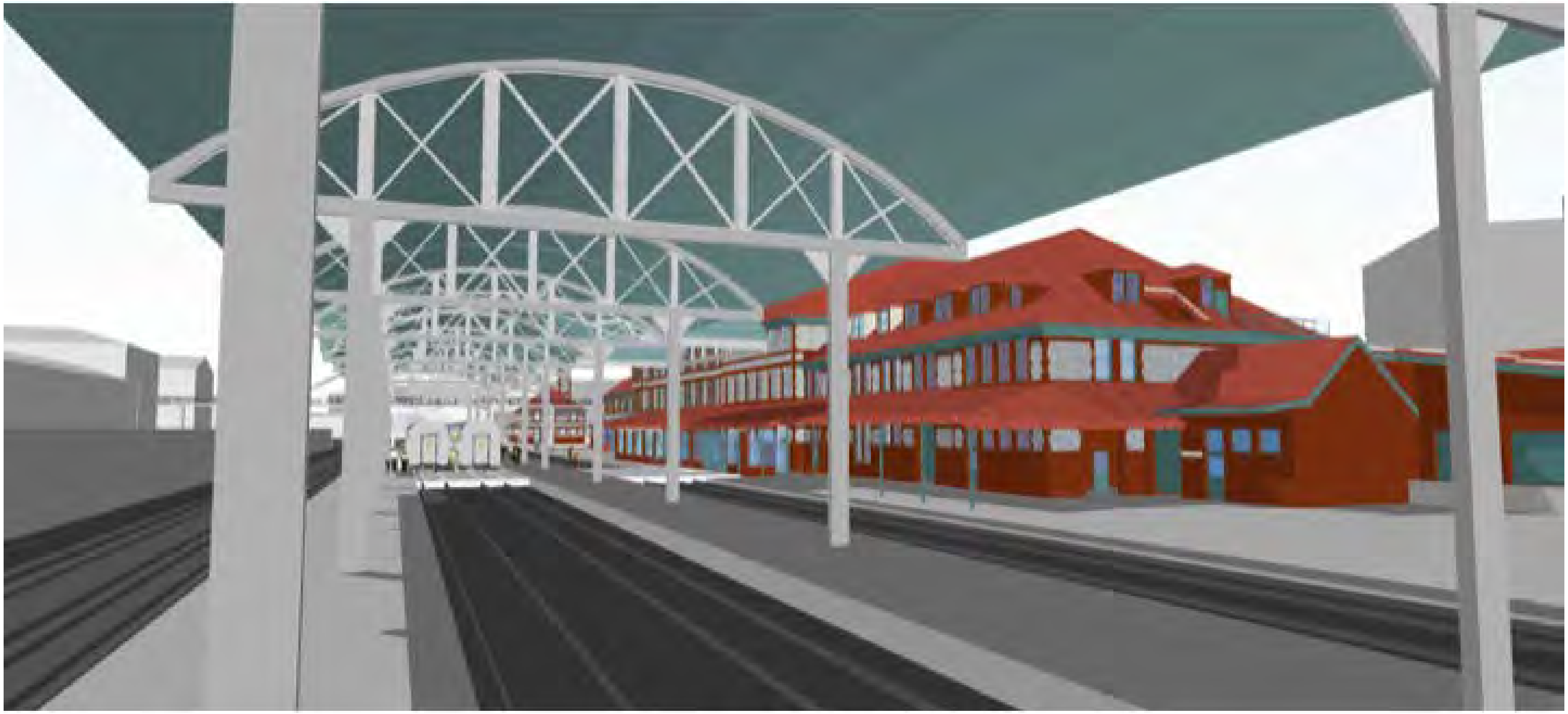


Figure 7.1-20 Platform Canopies and High Shed Alternative C - Contemporary Umbrella Canopies with High Shed



7.1.8.5 Alternative D: Contemporary Train Shed Form

Alternative D would provide a continuous train shed with a contemporary design styling between the Broadway Bridge and the pedestrian bridge (Figure 7.1-21 through 24). North and south of these bridges, respectively, the canopies would continue as umbrella canopies also using a contemporary styling, similar to Alternative B. Like Alternative B, this alternative aims to incorporate more contemporary structural forms and engineering methods to produce a lighter, more transparent train shed that meets rail operations requirements and complements the historic structure without attempting to replicate the historic structure. Also, like Alternative B, there is a wide variety of structural forms and material choice that is made possible by this alternative.

Figure 7.1-21 Platform Canopies and High Shed Alternative D - Contemporary Train Shed Form

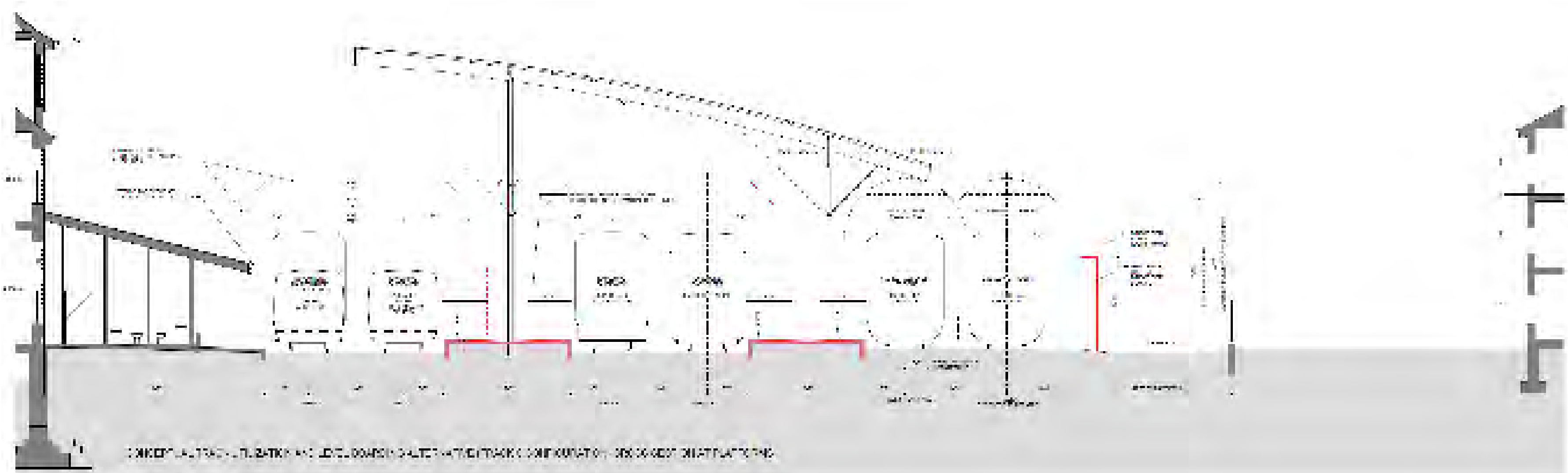


Figure 7.1-22 Platform Canopies and High Shed Alternative D - Contemporary Train Shed Form

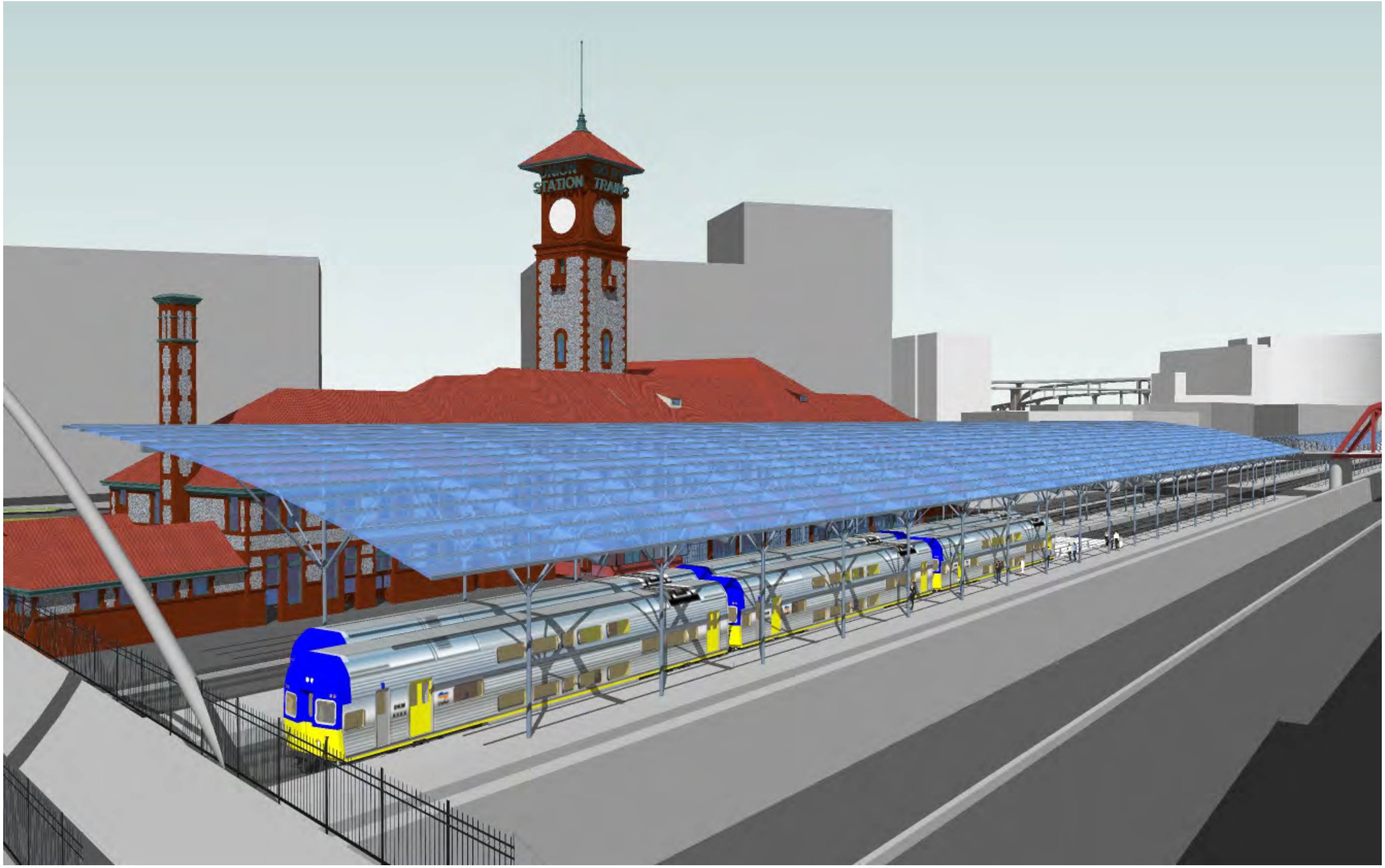


Figure 7.1-23 Platform Canopies and High Shed Alternative D - Contemporary Train Shed Form

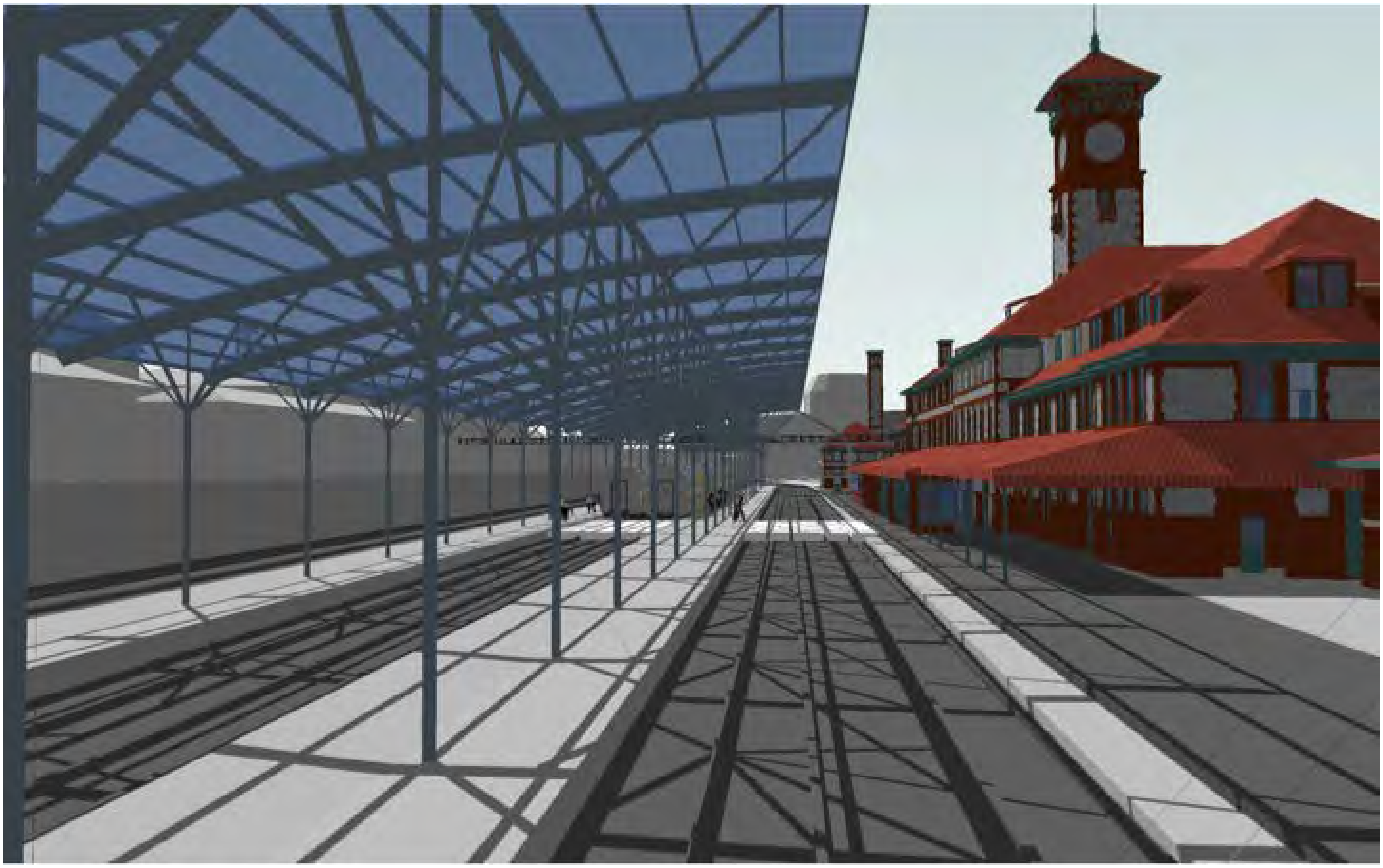
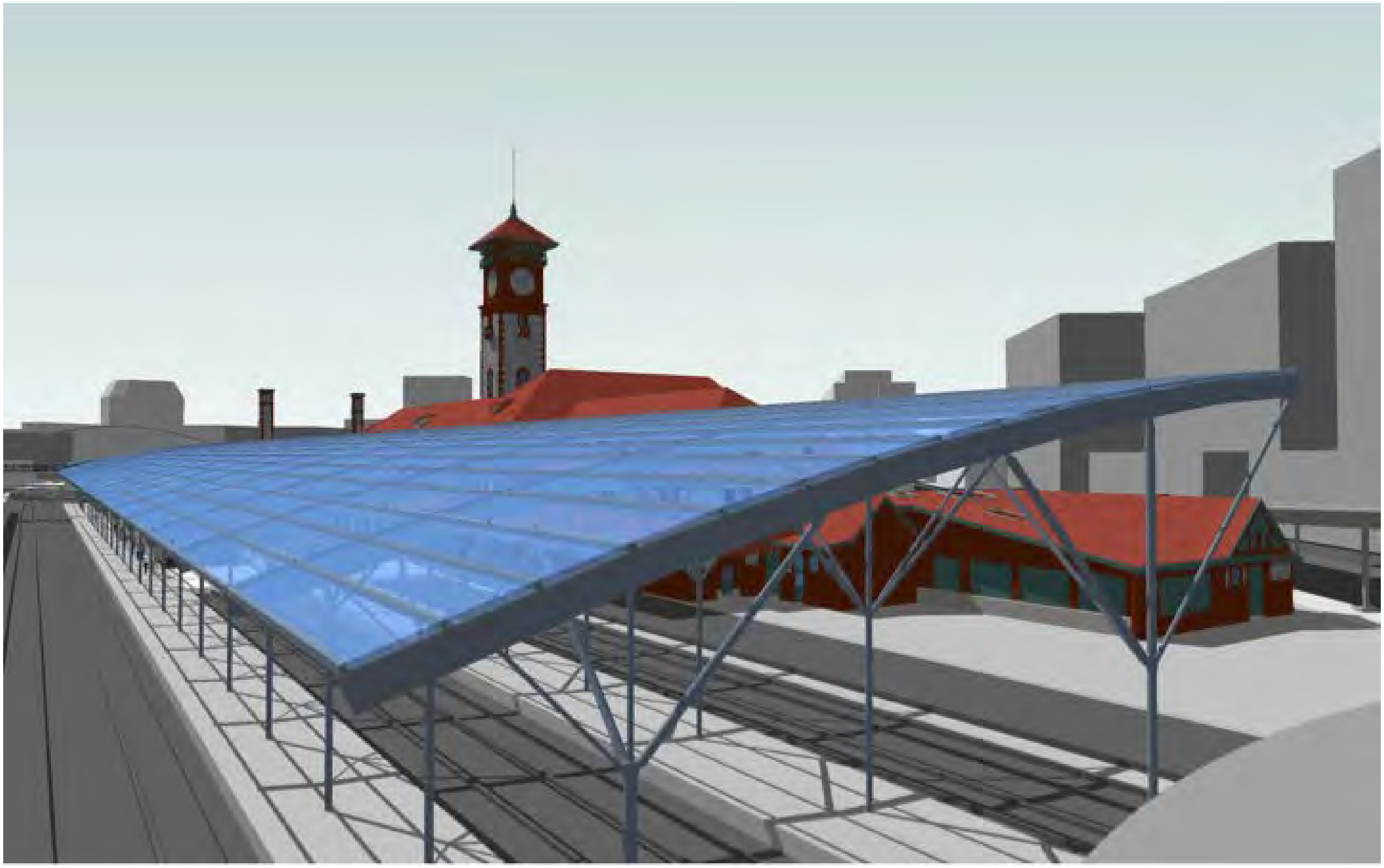


Figure 7.1-24 Platform Canopies and High Shed Alternative D - Contemporary Train Shed Form



7.1.9. Recommendation: Platform Canopies

The project team recommends implementing the contemporary umbrella canopies with high shed (Alternative B). This alternative provides the essential benefits for rail operations (increased clearances and improved weather protection) while preserving the historic form of the existing umbrella canopy/high shed system. The capital cost of this alternative would be lower than Train Shed Alternatives C and D, while still providing sufficient area for a photovoltaic system, if desired.

In terms of constructability and maintenance of rail operations during construction, the umbrella canopy would be simpler to implement as part of a staged track reconstruction that upgrades one platform/platform canopy system at a time. It is anticipated that a contemporary platform canopy/high shed design can be developed to capture the positive benefits of a contemporary design approach while honoring the historic platform canopies and adjacent station.

Table 7.1-1 Evaluation of Platform Canopy Alternatives

Evaluation Criteria		No-Build	A	Traditional Umbrella Canopies with High Shed	B	Contemporary Umbrella Canopies with High Shed	C	Traditional Train Shed Form	D	Traditional Train Shed Form
A: Ability to Meet Project Goals										
A.1. Accommodate Future Capacity and Operational Needs of Passenger and Freight Rail	◆	Significant existing rail and passenger operations deficiencies and seismic hazards will persist	●	Opportunity to address rail operations, passenger experience, accessibility, and life safety issues identified.	●	Opportunity to address rail operations, passenger experience, accessibility, and life safety issues identified.	●	Opportunity to address rail operations, passenger experience, accessibility, and life safety issues identified.	●	Opportunity to address rail operations, passenger experience, accessibility, and life safety issues identified.
A.2. Preserve and Protect the Historic Character of Union Station	◆	Platform canopies and High Shed will continue to deteriorate	●	Most similar to existing, historic canopy form designed to current standards; requires caution to distinguish from truly historic building elements	□	Introduces new design that must be thoughtfully integrated with adjacent historic resources.	□	Introduces new design that must be thoughtfully integrated with adjacent historic resources.	□	Introduces new design that must be thoughtfully integrated with adjacent historic resources.
A.3. Improve Economic and Social Vitality	◆	Old and failing platform canopy structures and systems will result in diminished operating efficiency	●	Replacement structures will improve facility operating efficiency	●	Replacement structures will improve facility operating efficiency	●	Replacement structures will improve facility operating efficiency	●	Replacement structures will improve facility operating efficiency

Evaluation Criteria		No-Build	A	Traditional Umbrella Canopies with High Shed	B	Contemporary Umbrella Canopies with High Shed	C	Traditional Train Shed Form	D	Traditional Train Shed Form
A.4. Improve Environmental Sustainability	◆	Existing inefficient lighting and systems will remain	●	Opportunity to upgrade lighting and systems to increase efficiency. Opportunity to incorporate photovoltaic solar panels into design.	●	Opportunity to upgrade lighting and systems to increase efficiency. Opportunity to incorporate photovoltaic solar panels into design.	●	Opportunity to upgrade lighting and systems to increase efficiency. Opportunity to incorporate photovoltaic solar panels into design.	●	Opportunity to upgrade lighting and systems to increase efficiency. Opportunity to incorporate photovoltaic solar panels into design.
B. Cost and Financing										
B.1. Estimated Capital Cost	□	N/A – No capital improvement project	●	Substantial project line item cost, but lower than shed options	●	Substantial project line item cost, but lower than shed options	◆	Larger shed structure potentially carries increased costs and cost risk.	◆	Larger shed structure potentially carries increased costs and cost risk.
B.2. Lifecycle Cost Impacts	◆	Ongoing maintenance costs will likely increase to preserve obsolete infrastructure	●	Increased operating efficiency of modernized lighting and systems	●	Increased operating efficiency of modernized lighting and systems	□	Increased efficiency benefits, but a shed structure will likely have higher costs for cleaning and maintenance.	□	Increased efficiency benefits, but a shed structure will likely have higher costs for cleaning and maintenance.
B.3. Cost Risk	◆	Costs of platform/canopy replacement will likely increase in the future and/or as a stand-alone project	□	Canopy costs will be influenced by future design development decisions on of form and materials	□	Canopy costs will be influenced by future design development decisions on of form and materials	◆	Larger shed structure potentially carries increased costs and cost risk.	◆	Larger shed structure potentially carries increased costs and cost risk.
B.4. Financial Leverage	◆	Likely more difficult to fund future major repairs or replacement as a stand-alone project	●	Potential to leverage energy/sustainability funding sources with photovoltaic option.	●	Potential to leverage energy/sustainability funding sources with photovoltaic option.	●	Potential to leverage energy/sustainability funding sources with photovoltaic option.	●	Potential to leverage energy/sustainability funding sources with photovoltaic option.

Evaluation Criteria		No-Build	A	Traditional Umbrella Canopies with High Shed	B	Contemporary Umbrella Canopies with High Shed	C	Traditional Train Shed Form	D	Traditional Train Shed Form
C. Implementability and Constructability										
C.1. Technical Complexity and Constructability	☐	N/A – No capital cost	●	Increased flexibility to stage construction of linear umbrella-type canopies while preserving station and freight rail operations, as compared to a shed alternative	●	Increased flexibility to stage construction of linear umbrella-type canopies while preserving station and freight rail operations, as compared to a shed alternative	◆	Increased complexity to stage and construct shed structure spanning active rail lines.	◆	Increased complexity to stage and construct shed structure spanning active rail lines.
C.2. Schedule and Schedule Risk	☐	N/A – No capital improvement project	●	Increased flexibility to stage construction of linear umbrella-type canopies while preserving station and freight rail operations, as compared to a shed alternative	●	Increased flexibility to stage construction of linear umbrella-type canopies while preserving station and freight rail operations, as compared to a shed alternative	◆	Increased complexity to stage and construct shed structure spanning active rail lines.	◆	Increased complexity to stage and construct shed structure spanning active rail lines.
C.3. Construction Impact on Passenger and Freight Rail Operations	◆	Potentially more disruptive if undertaken as a future project not coordinated with other track improvements	●	Increased flexibility to stage construction of linear umbrella-type canopies while preserving station and freight rail operations, as compared to a shed alternative	●	Increased flexibility to stage construction of linear umbrella-type canopies while preserving station and freight rail operations, as compared to a shed alternative	◆	Potentially increased simultaneous impact on rail operations and platform construction when implementing shed-type structure spanning all tracks	◆	Potentially increased simultaneous impact on rail operations and platform construction when implementing shed-type structure spanning all tracks
C.4. Construction Impact on Union Station Tenants	☐	N/A – No capital improvement project	☐	Minimal impact anticipated due to location of work on the trackside	☐	Minimal impact anticipated due to location of work on the trackside	☐	Minimal impact anticipated due to location of work on the trackside	☐	Minimal impact anticipated due to location of work on the trackside

Evaluation Criteria		No-Build	A	Traditional Umbrella Canopies with High Shed	B	Contemporary Umbrella Canopies with High Shed	C	Traditional Train Shed Form	D	Traditional Train Shed Form
C.5. Phasing and Project Segmentation	◆	Potentially more disruptive if undertaken as a future project not coordinated with other track improvements	●	Increased flexibility to stage construction of linear umbrella-type canopies while preserving station and freight rail operations, as compared to a shed alternative	●	Increased flexibility to stage construction of linear umbrella-type canopies while preserving station and freight rail operations, as compared to a shed alternative	◆	Increased complexity to stage and construct shed structure spanning active rail lines.	◆	Increased complexity to stage and construct shed structure spanning active rail lines.
C.6. Risks, Assumptions and Unknowns	◆	Foundation and structural condition unknowns may present unanticipated hazards if not addressed	●	Lower anticipated risk to implement umbrella-type structures with high shed using smaller-scale, prefabricated components as much as possible	●	Lower anticipated risk to implement umbrella-type structures with high shed using smaller-scale, prefabricated components as much as possible	◆	Increased complexity to stage and construct shed structure spanning active rail lines.	◆	Increased complexity to stage and construct shed structure spanning active rail lines.
D. Environmental Impacts and Approvals										
D.1. Environmental Impacts and Project Classification	◆	Temporarily prolongs use historic canopy and high shed structures, but continued deterioration and eventual loss is likely	◆	Canopy removal involves permanent loss of historic canopy and high shed structures	◆	Canopy removal involves permanent loss of historic canopy and high shed structures	◆	Canopy removal involves permanent loss of historic canopy and high shed structures	◆	Canopy removal involves permanent loss of historic canopy and high shed structures

Evaluation Criteria		No-Build	A	Traditional Umbrella Canopies with High Shed	B	Contemporary Umbrella Canopies with High Shed	C	Traditional Train Shed Form	D	Traditional Train Shed Form
D.2. Historic Impacts and Approvals	◆	Temporarily prolongs use historic canopy and high shed structures, but continued deterioration and eventual loss is likely	●	Most similar to existing canopies, though it is key to distinguish new structures from truly historic resources	◆	Preserves historic form/high shed, but introduces new materials and design elements	◆	Most significant change to historic form	◆	Most significant change to historic form
D.3. Decision Making and Approvals	◆	No build alternative may conflict with FRA mandates for ADA Level Boarding and other regulatory requirements	□	Will require discussions and approvals of new design	□	Will require discussions and approvals of new design	◆	More significant changes to historic form will likely require additional consultations	◆	More significant changes to historic form will likely require additional consultations

7.2. Rail and Building Maintenance Area

This improvement reorganizes and rationalizes the rail and building maintenance areas on the north side of Union Station to improve operations, safety, security, and aesthetics. The improvements include replacement of the seismically-deficient and non-historic Butler-type shed in the rail maintenance area.

The following alternatives were evaluated:

- The No-Build Alternative would retain the rail and building operations areas as-is, without improvements. The existing Butler-type shed would remain.
- The Attached Gable Shed Only alternative reinstates the historic gable shed that was removed for the construction of the Butler-type shed in the 1960s.
- The Service Court with Detached Sheds alternative creates an open service court between two smaller shed structures – one adjacent to the station building (potentially, the restored attached gable shed) and another adjacent to the track maintenance area.
- The New Replacement Shed with Attached Gable alternative provides a new shed structure covering the width of the maintenance area between Track 1 and the Main Building.

The results of the evaluation of the four alternatives are summarized in Table 7.2-1.

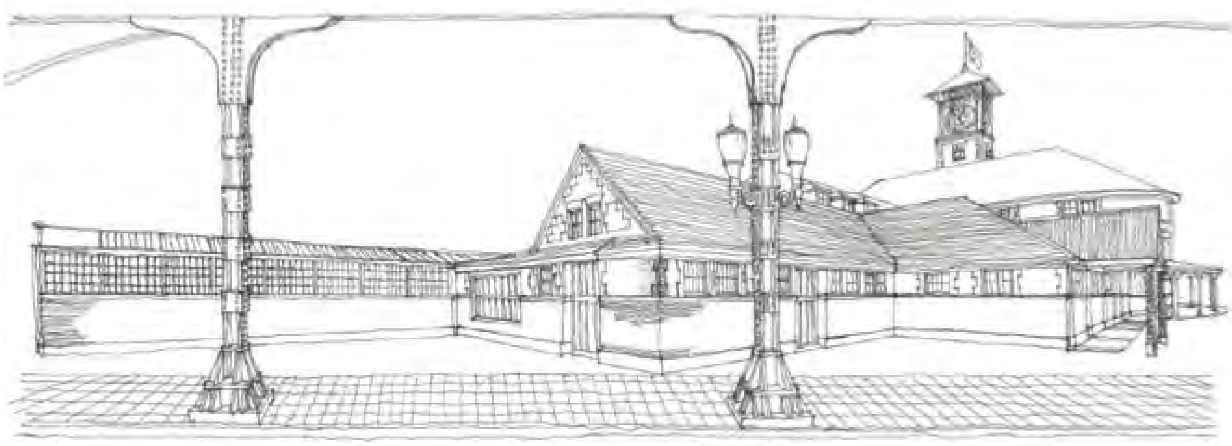
7.2.1. Design Requirements and Objectives

The key design requirements of the rail and building maintenance area identified through the conditions assessment and stakeholder discussions include:

- Replace the structurally and seismically deficient Butler-type shed.
- Rationalize and separate rail and building maintenance functions on the north end of the Main Building.
- Accommodate rail maintenance and inspection activities occurring on the adjacent Track 1 North.
- Provide improved perimeter security and visual screening from NW Station Way.
- Reduce and formalize parking for official Amtrak and building management vehicles only.
- Accommodate future truck-based train fueling operations (under design development).
- Provide for consolidated and secure refuse/recycling storage and appropriate disposal of liquid wastes from train servicing.
- Provide secure and covered storage for rail maintenance and baggage operations equipment (carts, tugs, lavatory servicing, etc.
- Consolidated Main Building mechanical and building support systems at the north end of the building (existing garage).
- Accommodate future exterior equipment for HVAC or other building systems.
- Provide design and adjacencies of interior/exterior rail operations and maintenance facilities to ensure safe and efficient workflow.
- Provide safe and secure storage for hazardous materials and wastes.
- Provide secure storage for spare parts, tools, and other materials.
- Improve the appearance of maintenance facilities from passenger areas, and maintain safe separation of passenger boarding and maintenance activities.
- Improve perimeter security and aesthetics along the Station Way perimeter.

Figure 7.2-1 View of Existing Maintenance Area from NW Station Way

Figure 7.2-2 Maintenance Area Screening/Fencing Concept Viewed from NW Station Way



7.2.2. Train Maintenance Shed Alternatives

There are many aspects of the rail and building maintenance area rehabilitation and many of these are subject to ongoing design discussion with PDC and Amtrak. The discussion in this section is limited to the replacement of the Butler-type shed structure, which was identified as structurally and seismically deficient in the Conditions Assessment Report (DOWA/IBI Group, 2015).

7.2.2.1 Train Maintenance Shed No-Build Alternative
Under the No-Build Alternative, the train maintenance area would remain in its current condition with regular maintenance but with no capital investment. The conditions assessment identified critical structural and seismic deficiencies that require the replacement of the existing Butler-type shed. The structure is also in deteriorated condition with failing roof panels, corrosion, and fading/peeling paint. The large size of the structure tends to block natural light from reaching the maintenance area and the adjacent portion of NW Station Way under the Broadway Bridge viaduct, yet existing artificial lighting is efficient. The structure is also utilitarian in construction and does not complement the adjacent historic structure. Much of the area under the current shed is dedicated to informal parking.

7.2.2.2 Alternative A: Attached Gable Shed Only
This alternative would reconstruct the historic gable shed that was removed for the construction of the Butler-type shed in the 1960s (Figure 7.2-3). This would provide limited outdoor covered space for baggage carts, supplies, etc., but the majority of the rail and building service area and parking would be open to the elements.

7.2.2.3 Alternative B: Service Court with Detached Sheds
This alternative would provide an open "service court" between two smaller shed structures – one adjacent to the station building (potentially, the restored attached gable shed) and another adjacent to the track maintenance area (Figure 7.2-4). The center opening would allow for parking of official vehicles and the fuel truck outside of the covered area. The advantage of this option is reduced size and coverage of the shed structures, which would likely result in a reduced cost. It also would avoid parking a fuel truck under a covered area attached to the Main Building, as is the case today. A drawback of this alternative would be the greater weather exposure of the exterior maintenance area.

7.2.2.4 Alternative C: New Replacement Shed (with Attached Gable)
This alternative would provide a new shed structure covering the width of the maintenance area between Track 1 and the Main Building (Figure 7.2-5). The length of this structure would likely be shorter in length than the existing Butler-type shed, given anticipated Amtrak needs, the reduced parking requirements, and potential fueling operations (not under cover). This may also allow additional natural light to reach the public street on NW Station Way underneath the Broadway Bridge viaduct. The design of the new shed would likely assume the form of the preferred platform canopy design. However, it is also possible to combine the new replacement shed with a reconstructed attached gable, providing the added benefit of reversing the historic damage to the Main Building when the Butler-type shed was built.

7.2.3. Recommendation: Rail and Building Maintenance Area
The project team recommends implementing the new replacement shed with attached gable (Alternative C) (Figure 7.2-5). This alternative would provide the greatest functional benefit and design flexibility to provide coverage that meets the operations needs of Amtrak. It also would provide the historic benefit of the restored attached gable. The specific sizing requirements and organization of the maintenance area and associated shed structure would be further developed through preliminary engineering.

Figure 7.2-3 Train Maintenance Shed Alternative A - Attached Gable Shed Only

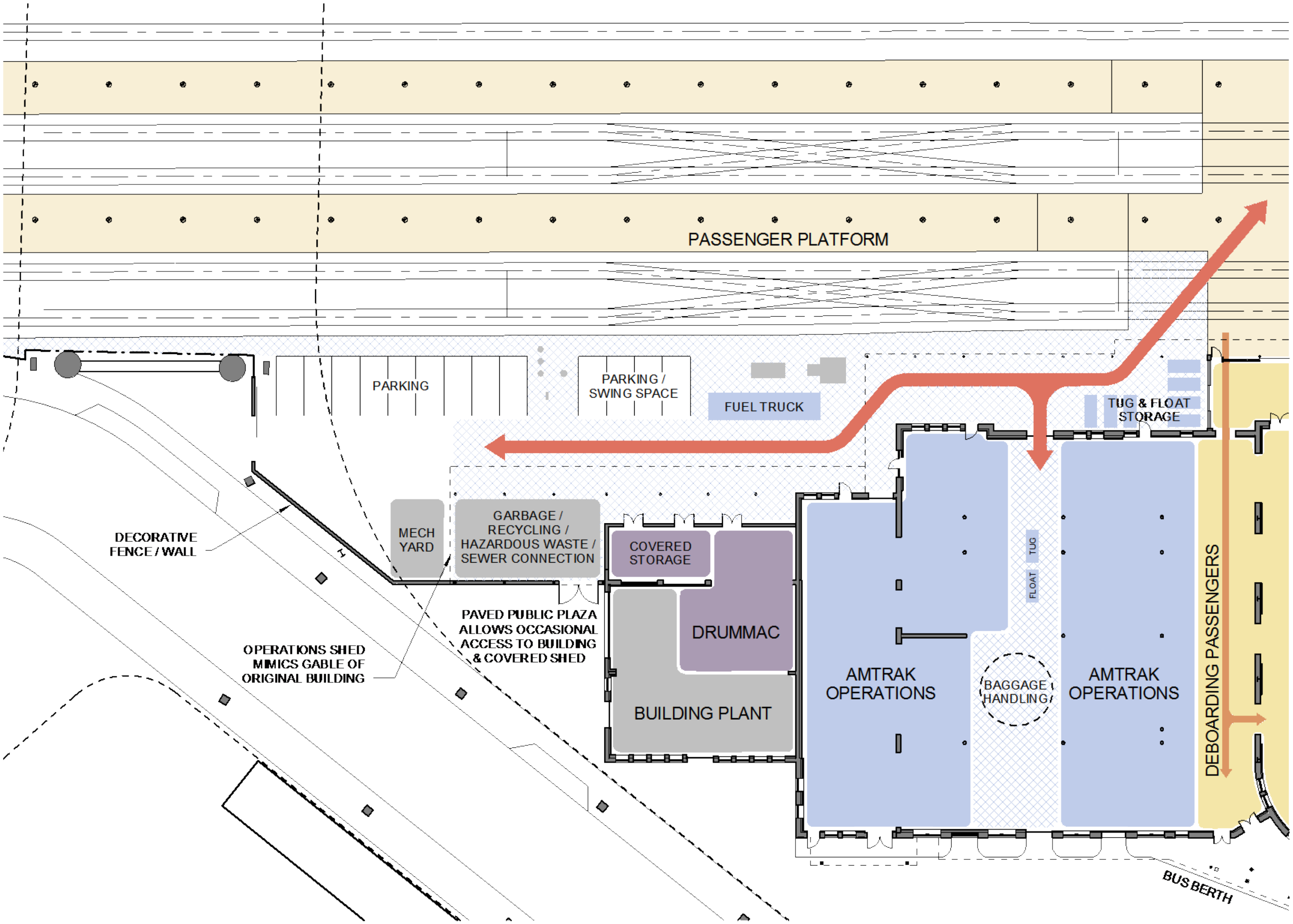


Figure 7.2-4 Train Maintenance Shed Alternative B - Service Court with Detached Sheds

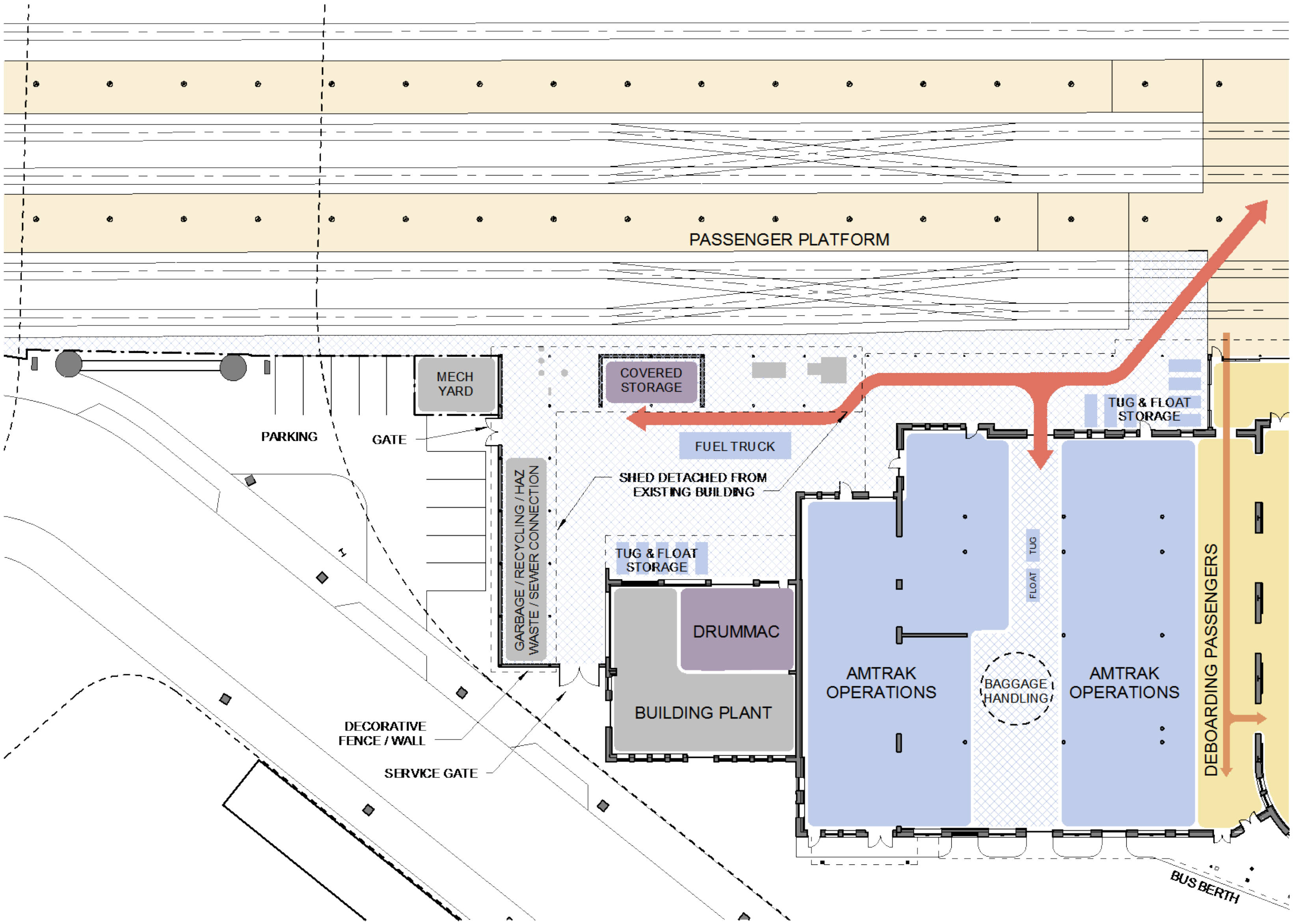


Figure 7.2-5 Train Maintenance Shed Alternative C - New Replacement Shed with Attached Gable

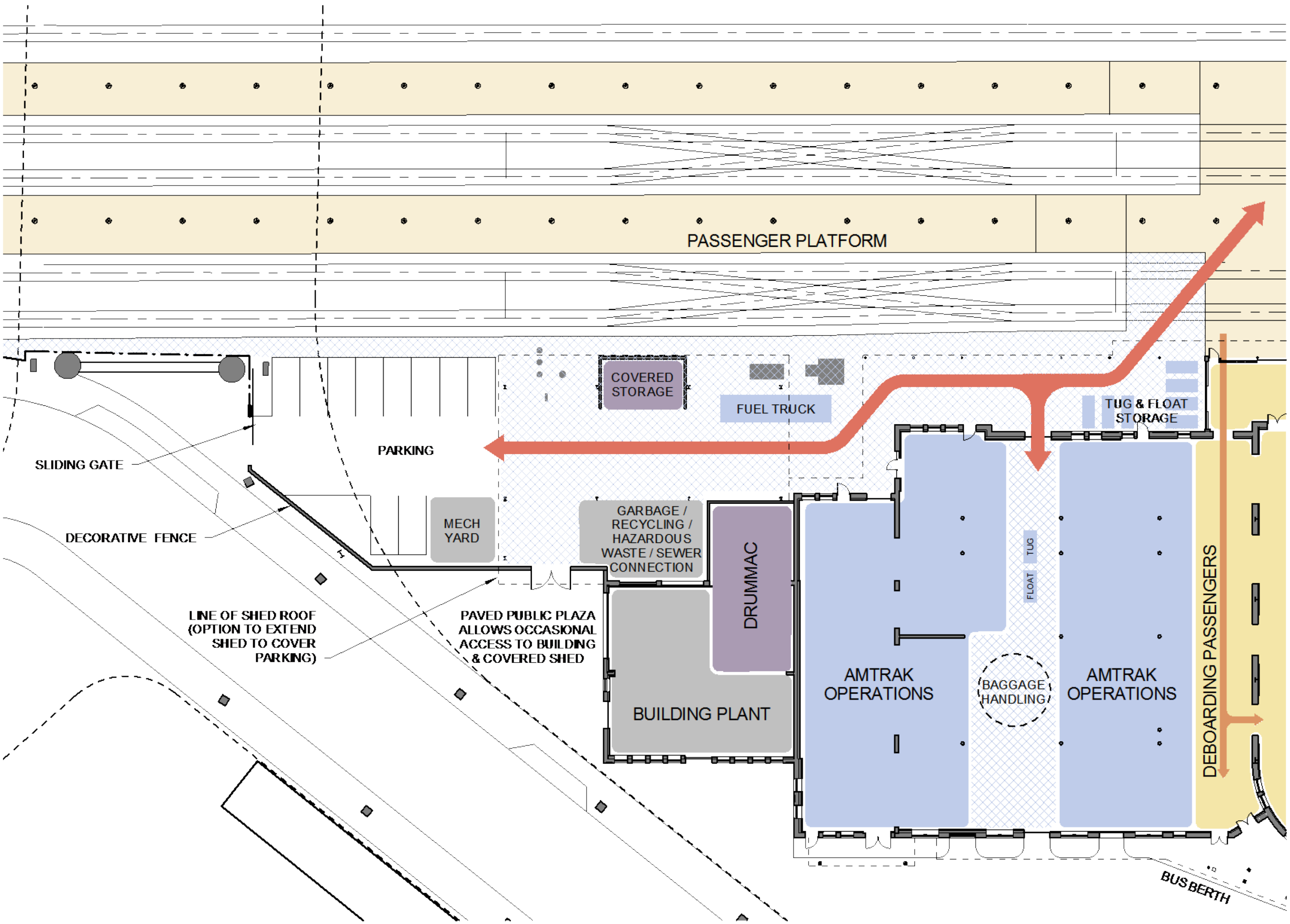


Table 7.2-1 Evaluation of Train Maintenance Shed Alternatives

Evaluation Criteria		No-Build	A	Attached Gable Shed Only	B	Service Court with Detached Sheds	C	New Replacement Shed (with Attached Gable)
A: Ability to Meet Project Goals								
A.1. Accommodate Future Capacity and Operational Needs of Passenger and Freight Rail		Significant existing rail operations deficiencies and seismic hazards will persist		Rationalizes and improves operations, safety, security, and efficiency of rail and building maintenance areas		Rationalizes and improves operations, safety, security, and efficiency of rail and building maintenance areas		Rationalizes and improves operations, safety, security, and efficiency of rail and building maintenance areas
A.2. Preserve and Protect the Historic Character of Union Station		Maintenance shed will continue to deteriorate and detract from the historic character of the station		Eliminates existing shed which detracts from historic character, and restores the compromised historic gable shed that was removed		Eliminates existing shed which detracts from historic character, and restores the compromised historic gable shed that was removed		Eliminates existing shed which detracts from historic character, and restores the compromised historic gable shed that was removed
A.3. Improve Economic and Social Vitality		Missed opportunity to improve appearance, visual screening and access control of the maintenance area from the public right of way		Opportunity to improve appearance, visual screening and access control of the maintenance area from the public right of way		Opportunity to improve appearance, visual screening and access control of the maintenance area from the public right of way		Opportunity to improve appearance, visual screening and access control of the maintenance area from the public right of wa.
A.4. Improve Environmental Sustainability		Existing inefficient lighting and systems will remain		Provides opportunity to implement more energy efficient systems and other sustainability features		Provides opportunity to implement more energy efficient systems and other sustainability features		Provides opportunity to implement more energy efficient systems and other sustainability features

Evaluation Criteria		No-Build	A	Attached Gable Shed Only	B	Service Court with Detached Sheds	C	New Replacement Shed (with Attached Gable)
B. Cost and Financing								
B.1. Estimated Capital Cost	□	N/A – No capital improvement project	●	Likely to be a lower cost alternative (offset by reduced coverage of exterior maintenance area)	□	Likely to be a moderate cost alternative (with moderate coverage of exterior maintenance area)	◆	Likely to be a higher cost alternative (offset by increased coverage of exterior maintenance area)
B.2. Lifecycle Cost Impacts	◆	Ongoing maintenance costs will likely increase to preserve obsolete infrastructure	●	Reduced lifecycle costs for building systems and due to rail maintenance efficiency and security improvements	●	Reduced lifecycle costs for building systems and due to rail maintenance efficiency and security improvements	●	Reduced lifecycle costs for building systems and due to rail maintenance efficiency and security improvements
B.3. Cost Risk	◆	Costs of maintenance area refurbishment and maintenance shed replacement will likely increase in the future; risk of unanticipated failure or major repair needs for existing shed	□	Costs to reconstruct the historic gable shed are uncertain and subject to historic design review	□	Costs to reconstruct the historic gable shed are uncertain and subject to historic design review	□	Costs to reconstruct the historic gable shed are uncertain and subject to historic design review
B.4. Financial Leverage	◆	Likely more difficult to fund future major repairs or replacement as a stand-alone project	●	Increased funding potential as part of a multifaceted renovation project.	●	Increased funding potential as part of a multifaceted renovation project.	●	Increased funding potential as part of a multifaceted renovation project.

Evaluation Criteria		No-Build	A	Attached Gable Shed Only	B	Service Court with Detached Sheds	C	New Replacement Shed (with Attached Gable)
C. Implementability and Constructability								
C.1. Technical Complexity and Constructability	☐	N/A – No capital improvement project	☐	Gable reconstruction will involve historic design coordination and material compatibility with existing structure	☐	Gable reconstruction will involve historic design coordination and material compatibility with existing structure	☐	Gable reconstruction will involve historic design coordination and material compatibility with existing structure
C.2. Schedule and Schedule Risk	☐	N/A – No capital improvement project	☐	Comparable among build alternatives	☐	Comparable among build alternatives	☐	Comparable among build alternatives
C.3. Construction Impact on Passenger and Freight Rail Operations	☐	N/A – No capital improvement project	☐	Rail maintenance functions will have to be temporarily relocated while the area is under construction	☐	Rail maintenance functions will have to be temporarily relocated while the area is under construction	☐	Rail maintenance functions will have to be temporarily relocated while the area is under construction
C.4. Construction Impact on Union Station Tenants	☐	N/A – No capital improvement project	☐	Limited impact on non-rail tenants due to back of house location of maintenance area	☐	Limited impact on non-rail tenants due to back of house location of maintenance area	☐	Limited impact on non-rail tenants due to back of house location of maintenance area
C.5. Phasing and Project Segmentation	☐	N/A – No capital improvement project	☐	Rail maintenance functions will have to be temporarily relocated while the area is under construction	☐	Rail maintenance functions will have to be temporarily relocated while the area is under construction	☐	Rail maintenance functions will have to be temporarily relocated while the area is under construction
C.6. Risks, Assumptions and Unknowns	☐	N/A – No capital improvement project	☐	Restoration of the historic gable canopy requires further design development to fully understand feasibility and risks	☐	Restoration of the historic gable canopy requires further design development to fully understand feasibility and risks	☐	Restoration of the historic gable canopy requires further design development to fully understand feasibility and risks

Evaluation Criteria		No-Build	A	Attached Gable Shed Only	B	Service Court with Detached Sheds	C	New Replacement Shed (with Attached Gable)
D. Environmental Impacts and Approvals								
D.1. Environmental Impacts and Project Classification	◆	Existing maintenance shed continues to detract from historic character of the station. No improvements to existing hazardous/waste materials storage	●	Potential to reconstruct missing historic gable shed. Improvements will upgrade handling and storage of hazardous materials	●	Potential to reconstruct missing historic gable shed. Improvements will upgrade handling and storage of hazardous materials	●	Potential to reconstruct missing historic gable shed. Improvements will upgrade handling and storage of hazardous materials
D.2. Historic Impacts and Approvals	◆	Existing maintenance shed continues to detract from historic character of the station.	●	Restoration of historic gable is a significant benefit	□	Restoration of historic gable is a significant benefit, though introduction of new shed elements needs to be carefully considered to ensure historic compatibility	□	Restoration of historic gable is a significant benefit, though introduction of new shed elements needs to be carefully considered to ensure historic compatibility
D.3. Decision Making and Approvals	□	Requires consensus with Amtrak, FRA, and permitting authorities to retain existing conditions	□	Refinement of maintenance area requirements and design alternatives is a topic of ongoing discussion with Amtrak	□	Refinement of maintenance area requirements and design alternatives is a topic of ongoing discussion with Amtrak	□	Refinement of maintenance area requirements and design alternatives is a topic of ongoing discussion with Amtrak

8. Union Station Annex Alternatives

This section describes the Union Station Annex Improvements evaluated in conceptual design. These alternatives are organized as follows:

- Annex No-Build
- Landscaped Area/Annex Parking Lot
- Annex Floor Plan
- Annex Chimney

8.1. Design Requirements and Objectives

The proposed Annex improvements would address existing deficiencies in the Annex building identified during the conditions assessment, and would address the project goals of improving the activation and re-use of the currently underutilized Annex to increase Union Station vitality and restore productive purpose to the building.

The key design requirements of the Annex identified through the conditions assessment and stakeholder discussions include:

- Repurpose the Annex as productive leasable space as part of overall revitalization vision.
- Relocate existing boiler room mechanical equipment to the Main Building to facilitate re-use.
- Provide structural, seismic, mechanical, life safety, and accessibility upgrades for the Annex, similar to the Main Building.
- Increase the visibility/presence of the Annex from the front of Union Station and adjacent public ways.
- Preserve and seismically retrofit the iconic Annex chimney.
- Repurpose the surplus Amtrak parking in the adjacent parking area.
- Improve perimeter security between the Annex front side and the rail operations/platform areas to the rear of the Annex.
- Consolidate Amtrak office and law enforcement support functions into the Main Building.

8.2. Annex No-Build Alternative

Under the No-Build Alternative, the Annex building would remain in its current condition with regular maintenance but with no capital investment. Numerous deficiencies were identified with the Annex building during the conditions assessment. The structural and seismic condition of the building, including the chimney, is severely deteriorated and poses a hazard to nearby persons and rail infrastructure. Major mechanical systems, electrical, and plumbing are at the end of their useful life, and many aspects of the building to not meet existing code or accessibility requirements. The second floor is accessible only by a single steep stairway, and it lacks elevator service and adequate emergency egress.

The poor condition of the building makes it very difficult to lease at a competitive market rate to a third-party tenant. Amtrak has recently vacated the structure and does not envision needing the Annex space to support future rail operations. Without improvement, the building would continue to deteriorate, would likely experience a high vacancy rate, and would pose a continued safety hazard.

8.3. Landscaped Area/Annex Parking Alternatives

The re-use of the Annex is predicated on improving the visibility and "presence" of the Annex building, and ensuring clearer and more secure separation of the Annex from rail operations and building support functions. A set of alternatives for the area fronting the Annex (landscaped area and Annex parking) has been developed to address this issue.

This improvement addresses existing security concerns in the existing landscaped areas, repurposes the redundant parking lot in front of the Annex, and increases the prominence of the Annex from NW Station Way to help support its re-activation.

The following alternatives were evaluated:

- The No-Build Alternative would retain the existing landscape area and Annex parking lot in its current configuration.
- The Maintain Existing Landscaped Area and Parking alternative retains the existing landscaped area between the Main Building and the Annex, as well as the parking area that currently serves the Annex and the Wilf's kitchen/delivery area.
- The Hardscaped Annex Plaza alternative creates a new, primarily hardscape, "Annex Plaza" in the location of the existing landscaped area and Annex parking lot.

The results of the evaluation of the three alternatives are summarized in Table 8.1-1.

8.3.1. Alternative A: Maintain Existing Landscaped Area and Parking

This alternative would retain the existing landscaped area between the Main Building and the Annex, as well as the parking area that currently serves the Annex and the restaurant kitchen/delivery area (Figure 8.3-1). While Amtrak has indicated that this parking is not needed to support its operations, it could be used to support a future Annex tenant and/or other building visitors. The landscaped area would continue to be a vegetated area.

A drawback of this alternative is that it does not improve the visibility of the Annex from the street, and the existing landscape area has been an ongoing security concern due to the lack of visibility through the landscaping. This would also impact the perceived security of the adjacent pedestrian bridge.

Figure 8.3-1 Annex Alternative A – Existing Landscaped Area

8.3.2. Alternative B: Hardscaped Annex Plaza

This alternative would create a new, primarily hardscape, "Annex Plaza" in the location of the existing landscaped area and Annex parking (Figure 8.3-2). This includes the western landing of the pedestrian bridge over the Union Station tracks and platforms, and therefore is a pedestrian gateway to and from the river corridor along NW Naito Parkway.

An observation about Union Station made in 1903 by the leading landscape architects the Olmstead Brothers, while employed by the City of Portland reads: "A liberal open space is needed in front of every large public building, and a railroad station is no exception to this rule…The present provision of open space southwest of the station is not liberal in effect and will undoubtedly, in time, become quite inadequate."

The introduction of the Annex plaza would improve the visibility of the Annex building, and would create a new public gathering space to increase vitality in this traditionally back-of-house portion of the station complex. Its design would be reminiscent of other urban parks and plazas built in the Portland Central City in recent years, such as Jamison Square and Director Park, and could serve a similar function as a gathering spot for the emerging Broadway Corridor neighborhood. Annex plaza features, while not yet determined at this time, could include seating, fountains, play equipment, landscape planters, public art, event space, rail historic exhibits, food carts, or many other possibilities.

The hardscape surface would also allow for installation of underground sustainability features of the building mechanical systems, such as a rainwater cistern or a ground source bore field for geothermal heating and cooling.

Figure 8.3-2 Annex Alternative B – Hardscaped Plaza

8.3.3. Recommendation: Landscaped Area/Annex Parking

The project team recommends implementing the Annex plaza improvements (Alternative B) (Figure 8.3-2). This transformation would be consistent with the periodic change and re-purposing of this area over the history of Union Station. It would maximize the potential of the Annex while creating a community gathering spot that celebrates Union Station and provides benefits to the broader neighborhood.

Table 8.3-1 Evaluation of Landscaped Area/Annex Parking Alternatives

Evaluation Criteria		No-Build	A	Maintain Existing Landscaped Area and Parking	B	Hardscaped Annex Plaza
A: Ability to Meet Project Goals						
A.1. Accommodate Future Capacity and Operational Needs of Passenger and Freight Rail	◆	Existing lack of perimeter security and other deficiencies will persist. Land next to historic station will continue to be devoted to surplus parking	●	Security/perimeter improvements can be implemented to separate Annex uses from rail operations areas	●	Security/perimeter improvements can be implemented to separate Annex uses from rail operations areas
A.2. Preserve and Protect the Historic Character of Union Station	◆	Annex building will likely to continue to be underutilized if immediate surroundings are not improved	□	Preserves current landscaped area without changes, but Annex building visibility and revitalization is negatively impacted	□	Provides additional prominence and vitality to the historic Annex and south Main Building. Must be implemented in a way that is compatible with adjacent historic resources
A.3. Improve Economic and Social Vitality	◆	Limits visibility, vitality, and reuse options for the historic Annex, as well as opportunities to link the Annex to the Main Building and surrounding neighborhood	◆	Limits visibility, vitality, and reuse options for the historic Annex, as well as opportunities to link the Annex to the Main Building and surrounding neighborhood	●	Increases visibility and revitalization opportunities for the historic Annex as a positive Union Station and neighborhood amenity
A.4. Improve Environmental Sustainability	◆	Limits options to implement sustainability features envisioned under and as part of Plaza	◆	Limits options to implement sustainability features envisioned under and as part of Plaza	●	Provides area for incorporation of sustainability features for building systems; reduces and repurposes on-site parking
B. Cost and Financing						
B.1. Estimated Capital Cost	□	N/A – No capital improvement project	●	Relatively minor changes with lower construction costs	◆	Higher construction costs anticipated to reap more significant benefits
B.2. Lifecycle Cost Impacts	□	Similar to current operating/maintenance costs	□	Similar to current operating/maintenance costs	●	Higher building efficiency with sustainability features incorporated into Plaza area

Evaluation Criteria		No-Build	A	Maintain Existing Landscaped Area and Parking	B	Hardscaped Annex Plaza
B.3. Cost Risk	●	Low cost risk	●	Low cost risk	◆	Capital cost is subject to future design decisions on materials and features, as well as historic design review
B.4. Financial Leverage	◆	Likely more difficult to fund future improvements a stand-alone project	●	Increased funding potential as part of a multifaceted renovation project.	●	Potential to leverage sustainability, arts, urban redevelopment funding sources. Also opportunity for value capture related to higher future Annex lease revenues
C. Implementability and Constructability						
C.1. Technical Complexity and Constructability	□	N/A – No capital improvement project	●	Low complexity	◆	Requires engineering coordination with sustainability features, increasing complexity.
C.2. Schedule and Schedule Risk	□	N/A – No capital improvement project	●	Low schedule risk	◆	Requires additional coordination among work phases and disciplines
C.3. Construction Impact on Passenger and Freight Rail Operations	□	N/A – No capital improvement project	□	Relatively minor construction impacts to modest changes	□	Temporary impacts to construct improvements, but also creates opportunities to use partially-rehabilitated plaza area for construction or rail operations staging
C.4. Construction Impact on Union Station Tenants	□	N/A – No capital improvement project	□	Relatively minor construction impacts to modest changes	□	Temporary impacts to construct improvements, but also creates opportunities to use partially-rehabilitated plaza area for construction or rail operations staging

Evaluation Criteria		No-Build	A	Maintain Existing Landscaped Area and Parking	B	Hardscaped Annex Plaza
C.5. Phasing and Project Segmentation	☐	N/A – No capital improvement project	●	Area can be used to support construction staging. Improvements could be implemented as a later phase following railside and Main Building improvements	●	Area can be used to support construction staging. Improvements could be implemented as a later phase following railside and Main Building improvements
C.6. Risks, Assumptions and Unknowns	☐	N/A – No capital improvement project	●	Low risk alternative	☐	Requires further design development to understand risks of more complex project element
D. Environmental Impacts and Approvals						
D.1. Environmental Impacts and Project Classification	●	No changes preserves existing appearance of area	●	Likely to retain much of the existing appearance of the area	☐	Positive impact of implementing building sustainability infrastructure under Plaza, balanced with potential impact to adjacent historic resources
D.2. Historic Impacts and Approvals	☐	No changes, but opportunity to improve surroundings of historic resources are deferred	☐	Relatively minor changes anticipated to existing conditions	◆	More significant changes to area will likely merit additional historic review
D.3. Decision Making and Approvals	☐	N/A – No capital improvement project	☐	Design subject to historic design review	◆	Likely to be subjected to a more intensive historic design review

8.4. Annex Floor Plan Alternatives

Within the existing Union Station Annex building, three floor levels currently exist, including a two-story office and sunken boiler and storage room spaces. Three floor plan alternatives have been developed utilizing the existing shells and floor levels in different ways.

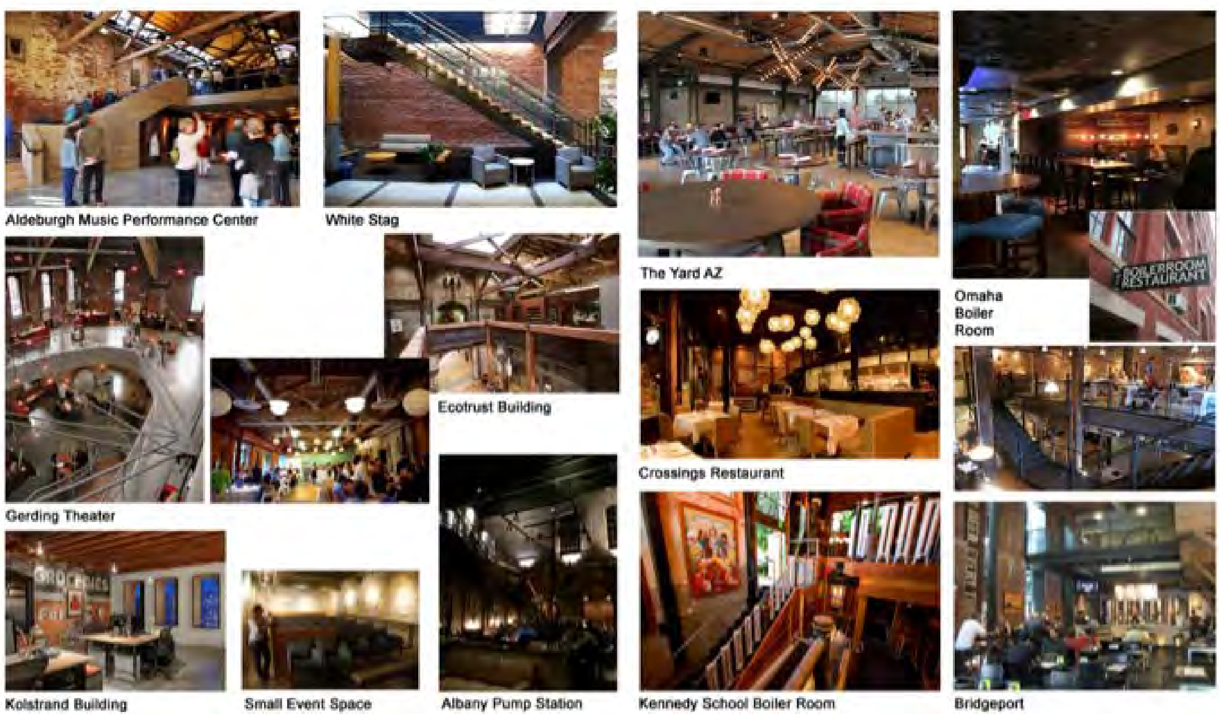
This improvement addresses interior architectural reconfiguration to address the deterioration, code compliance and accessibility issues, and re-use opportunities for the underutilized Annex building.

The following alternatives were evaluated:

- The No-Build Alternative retains the existing floorplan as-is, with the boiler room devoted to mechanical/storage functions and the two-story offices in their existing deteriorated condition.
- The Single-Story Shell alternative remodels the second floor offices in favor of a one floor, high-ceiling interior space throughout the volume of the building.
- The 2+1 Floor alternative retains the two-story office portion as well as the one-story boiler room.
- The Boiler Room Basement alternative retains the second floor office space and lowers the existing boiler and storage room floors to add a second level above those two spaces, creating four levels in the Annex.

The results of the evaluation of the four alternatives are summarized in Table 8.4-1.

Figure 8.4-1 Annex Re-Use Precedents: Industrial/Revealed Masonry Spaces



8.4.1. Alternative A: Single-Story Shell Alternative

Under this alternative, the second floor office would be removed and the lower boiler and storage room floors would be in-filled to bring it up to the main floor level in the office portion (Figure 8.4-2). By removing the second floor office, an additional stair and new elevator would not be needed. Raising the boiler room floor would eliminate changes in floor elevations, therefore not requiring stairs and an elevator to this level. Structural improvements to reinforce the Annex chimney, exterior walls and foundation would be needed, including a braced frame or concrete wall being constructed to reinforce the existing brick walls.

8.4.2. Alternative B: 2+1 Floor Alternative

Under the 2+1 Floor Alternative, the second floor office would be left intact while the boiler and storage room floors would be brought up to the level in the main office (Figure 8.4-3). A new elevator and stairs would be required in this option to access the second floor. Below the existing first floor office, a new lower floor could be partially excavated to create an area for mechanical equipment. Structural improvements to reinforce the chimney, exterior walls and foundation would be needed, including a braced frame or concrete wall being constructed to reinforce the existing brick walls.

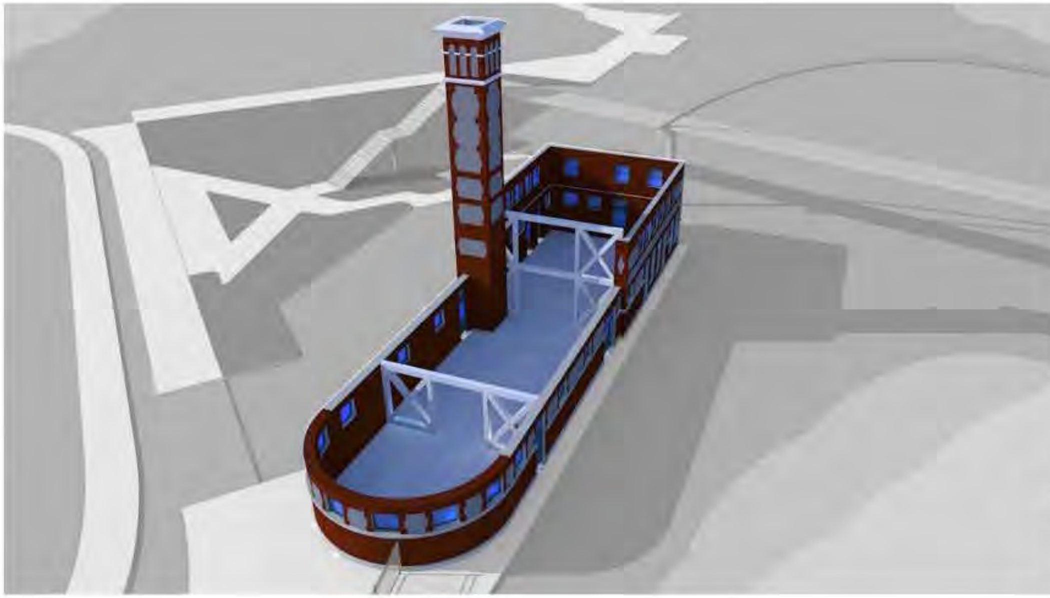
8.4.3. Alternative C: Boiler Room Basement Alternative

Improvements under this Boiler Room Basement alternative would attempt to create as much leaseable area as possible in the structure (Figure 8.4-4). This option would leave the second floor of the office intact and would lower the existing boiler and storage room floors to add a second level above those two spaces, creating four levels in the Annex. This second level in the boiler and storage room area would increase the usable area of the Annex, and the level below can remain as a mechanical room function. A new elevator and stair would be needed to access both the second floor office and the basement level in the boiler/storage room area. Structural improvements to reinforce the chimney, exterior walls and foundation would be needed, including a braced frame or concrete wall being constructed to reinforce the existing brick walls.

8.5. Recommendation: Annex Floor Plan

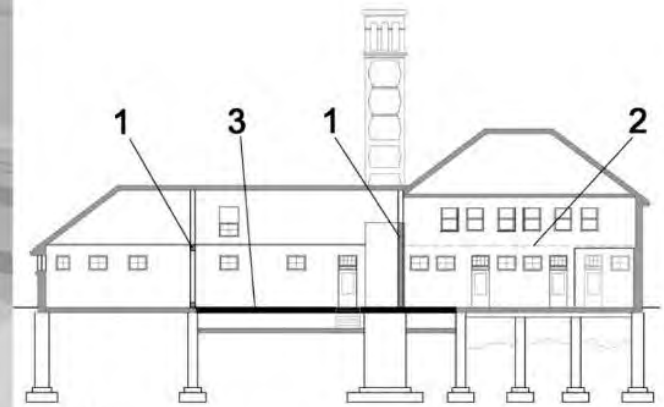
The project team recommends implementing the Single-Story Shell Alternative (Alternative A) for the Annex. This alternative would provide the most flexibility for re-use of the Annex building, once the basic building upgrades have been completed and the Annex is ready for leasing and fit-out based on future market and neighborhood conditions. The additional cost and space consumption of stair and elevator access to a second floor or mezzanine may not be cost effective for many uses; however, the single story shell alternative could be designed in a manner to accommodate the addition of a second floor mezzanine in the future, if warranted by the tenant.

Figure 8.4-2 Annex Floor Plan Alternative A - Single Story Shell

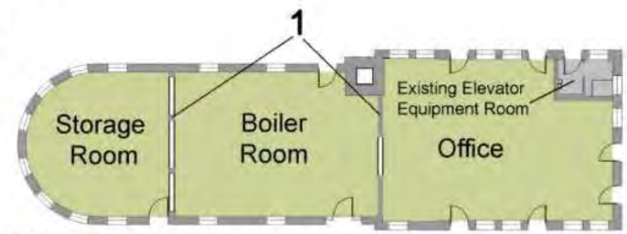


1. New structural systems (braced frame or concrete wall) in lieu of existing interior brick walls
2. Remove existing second floor in office
3. Raise Boiler Room floor to eliminate changes in floor elevations

Structural improvements relating to chimney, exterior walls and foundation.



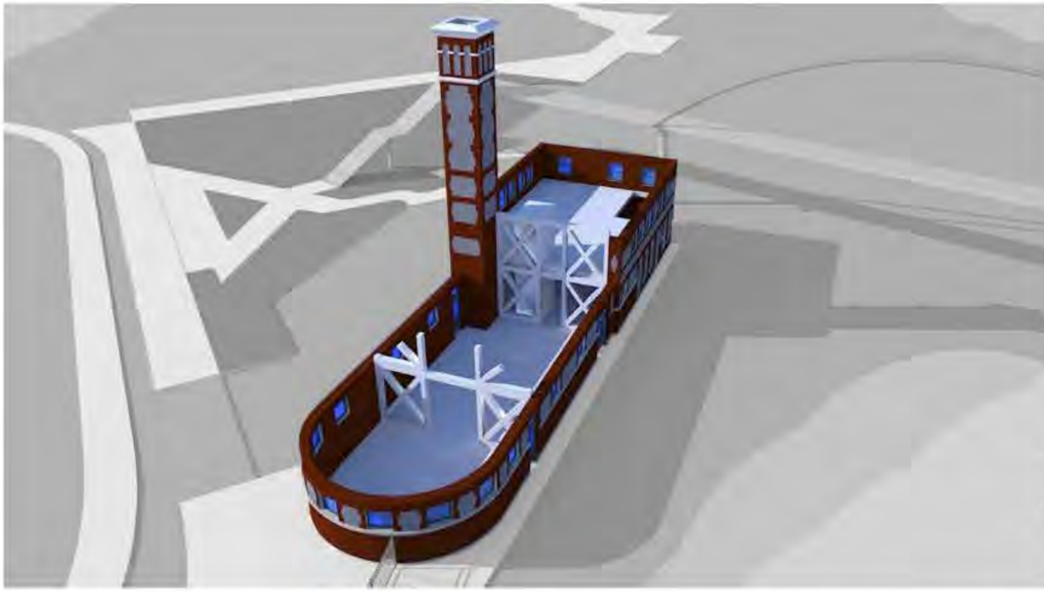
Section
N.T.S
Approximately 3600 square feet

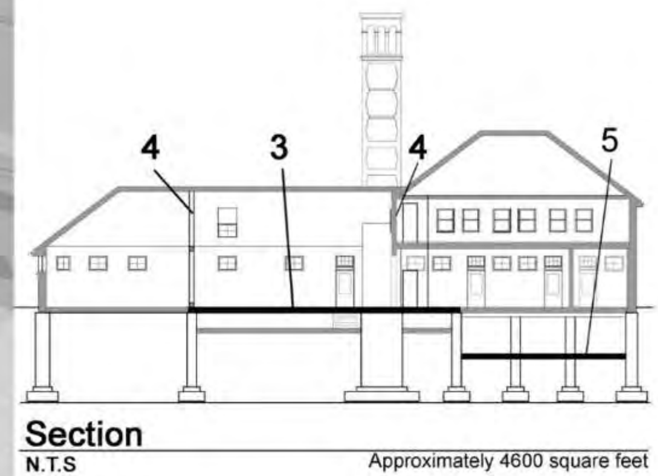


First Floor Plan
N.T.S

leasable space | building utility | vertical circulation

Figure 8.4-3 Annex Floor Plan Alternative B - 2-Story Office + 1-Story Boiler





1. Keep two story office
2. Add elevator and new stairs
3. Raise Boiler Room floor
4. New structural systems (braced frame or concrete wall) in lieu of existing interior brick walls
5. Add floor for mechanical equipment

Structural improvements relating to chimney, exterior walls and foundation.

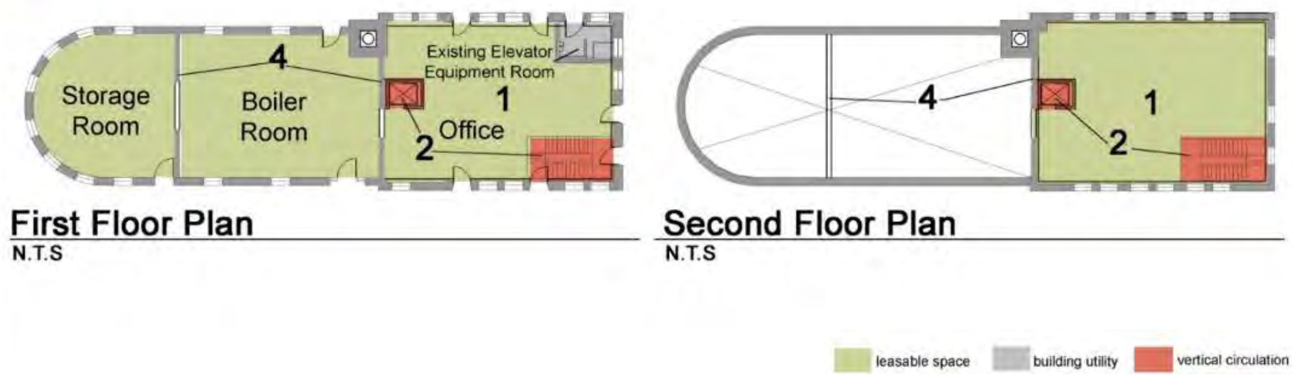
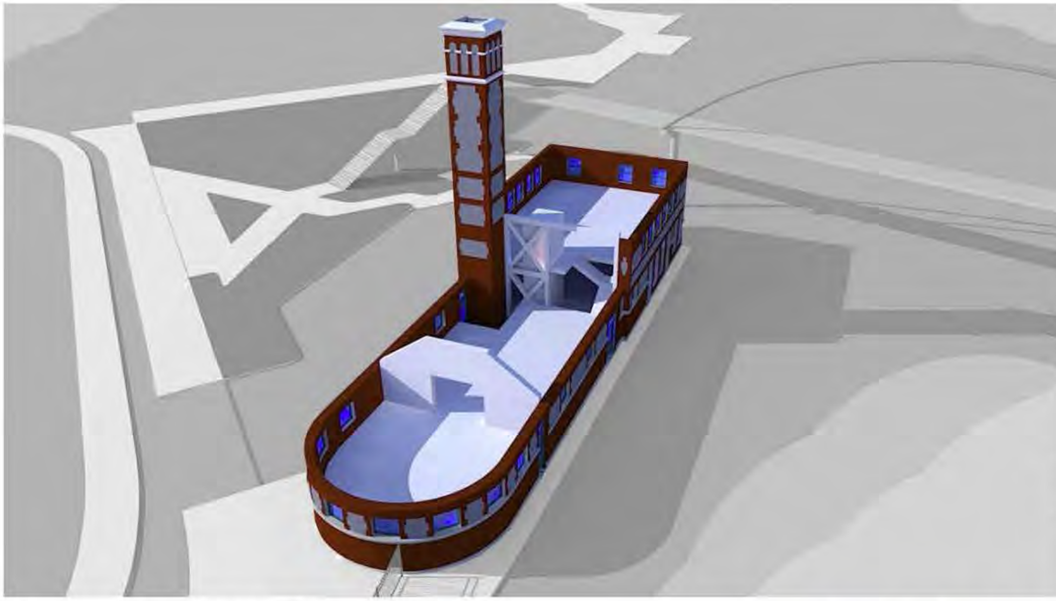
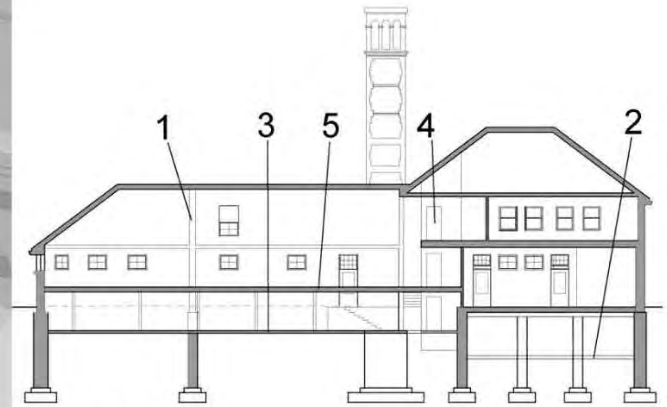


Figure 8.4-4 Annex Floor Plan Alternative C - Boiler Room Basement

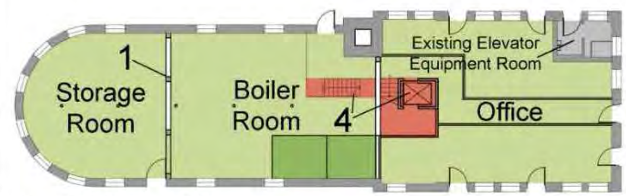




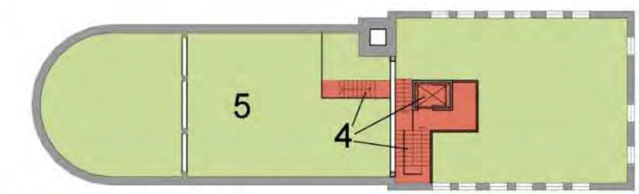
Section
N.T.S
Approximately 6300 square feet

1. New structural frames or in lieu of existing interior brick walls
2. Add mechanical room to basement
3. Lower Boiler Room and Storage Room floors
4. Add elevator and new stairs
5. Add 2nd level in Boiler Room and Storage Room to increase usable area

Structural improvements relating to chimney, exterior walls and foundation.



First Floor Plan
N.T.S



Second Floor Plan
N.T.S

restrooms | leasable space | building utility | vertical circulation

Table 8.4-1 Evaluation of Annex Floor Plan Alternatives

Evaluation Criteria		No-Build	A	Single Story Shell	B	2-Story Office + 1-Story Boiler	C	Boiler Room Basement
A: Ability to Meet Project Goals								
A.1. Accommodate Future Capacity and Operational Needs of Passenger and Freight Rail	☐	Space is not utilized for rail operations	☐	Space is not utilized for rail operations	☐	Space is not utilized for rail operations	☐	Space is not utilized for rail operations
A.2. Preserve and Protect the Historic Character of Union Station	◆	Does not implement necessary improvements to repurpose and revitalize the Annex. Ongoing risk of significant seismic damage/failure into the future	●	Preserves and repurposes Annex, but with architectural/structural modifications to the interior	●	Floor plan most closely resembles the existing historical Annex interior, with upgrades and modifications	●	Preserves and repurposes Annex, but with architectural/structural modifications to the interior
A.3. Improve Economic and Social Vitality	◆	Limits reuse options of the Annex due to seismic hazard	◆	Decreases leasable space	☐	Similar to existing leasable space	●	Adds leasable floor space
A.4. Improve Environmental Sustainability	◆	Does not upgrade to energy inefficient building systems	●	Includes more energy efficient and sustainable building systems upgrades	●	Includes more energy efficient and sustainable building systems upgrades	●	Includes more energy efficient and sustainable building systems upgrades
B. Cost and Financing								
B.1. Estimated Capital Cost	◆	Cost to address deterioration and repair will likely increase in the future	●	Lowest costs for usability upgrades; no elevator, and 1 set of restroom facilities, balanced withe costs to install horizontal trusses where floor is removed.	☐	Moderate costs to provide new elevator and egress to relatively small second floor office area (for small gain in leasable SF). Additional costs to raise floor in central Boiler area.	◆	Highest costs due to multi-stop elevator, additional stairs and additional restrooms. Higher costs to upgrading/building second floor, lowering floor slab in the Boiler area and adding basement slab under the office.

Evaluation Criteria		No-Build	A	Single Story Shell	B	2-Story Office + 1-Story Boiler	C	Boiler Room Basement
B.2. Lifecycle Cost Impacts	◆	Annex retains higher energy and operating costs	☐	Minimal maintenance cost	☐	Minimal maintenance cost	☐	Minimal maintenance cost
B.3. Cost Risk	◆	Less certainty about future costs of construction and repairs if deferred to future. Potential for higher costs of emergency repairs	☐	Moderate cost risk	☐	Moderate cost risk	◆	Increased complexity of structure presents higher cost risk
B.4. Financial Leverage	◆	Likely more difficult to pursue Annex repairs as a future stand-alone project	●	Increased funding potential as part of a multifaceted renovation project	●	Increased funding potential as part of a multifaceted renovation project	●	Increased funding potential as part of a multifaceted renovation project
C. Implementability and Constructability								
C.1. Technical Complexity and Constructability	☐	N/A – No capital improvement project	◆	Highly technical engineering and construction	◆	Highly technical engineering and construction	◆	Highly technical engineering and construction. Adds new framing elements that will require pile supports.
C.2. Schedule and Schedule Risk	☐	N/A – No capital improvement project	☐	Dependent on brick tests and whether existing elements can handle connections required for seismic upgrade	☐	Dependent on brick tests and whether existing elements can handle connections required for seismic upgrade	☐	Dependent on brick tests and whether existing elements can handle connections required for seismic upgrade.

Evaluation Criteria		No-Build	A	Single Story Shell	B	2-Story Office + 1-Story Boiler	C	Boiler Room Basement
C.3. Construction Impact on Passenger and Freight Rail Operations	◆	More difficult to use Annex for temporary rail/passenger/tenant space during the construction phase if not renovated	◆	Annex renovation, particularly core drilling holes in the Boiler east wall, may result in rail disruptions or temporary track closures given close proximity	◆	Annex renovation, particularly core drilling holes in the Boiler east wall, may result in rail disruptions or temporary track closures given close proximity	◆	Annex renovation, particularly core drilling holes in the Boiler east wall, may result in rail disruptions or temporary track closures given close proximity
C.4. Construction Impact on Union Station Tenants	◆	More difficult to use Annex for temporary rail/passenger/tenant space during the construction phase if not renovated	☐	Impact limited to Annex tenants who could potentially be relocated to Main Building; building has a high percentage of vacancies	☐	Impact limited to Annex tenants who could potentially be relocated to Main Building; building has a high percentage of vacancies	☐	Impact limited to Annex tenants who could potentially be relocated to Main Building; building has a high percentage of vacancies
C.5. Phasing and Project Segmentation	◆	More difficult to use Annex for temporary rail/passenger/tenant space during the construction phase if not renovated	●	Potential to use renovated Annex for temporary rail/passenger/tenant space	●	Potential to use renovated Annex for temporary rail/passenger/tenant space	●	Potential to use renovated Annex for temporary rail/passenger/tenant space
C.6. Risks, Assumptions and Unknowns	◆	Likely more difficult to pursue Annex repairs as a future stand-alone project	☐	Dependent on brick tests and whether existing elements can handle connections required for seismic upgrade. Condition of existing wood foundation piles is unknown.	☐	Dependent on brick tests and whether existing elements can handle connections required for seismic upgrade. Condition of existing wood foundation piles is unknown.	☐	Dependent on brick tests and whether existing elements can handle connections required for seismic upgrade. Condition of existing wood foundation piles is unknown.

Evaluation Criteria		No-Build	A	Single Story Shell	B	2-Story Office + 1-Story Boiler	C	Boiler Room Basement
D. Environmental Impacts and Approvals								
D.1. Environmental Impacts and Project Classification	◆	Results in continued degradation, underutilization, and potential future loss of a significant historic resource.	●	Results in preservation and repurposing of a significant historic resource	●	Results in preservation and repurposing of a significant historic resource	●	Results in preservation and repurposing of a significant historic resource
D.2. Historic Impacts and Approvals	◆	Defers opportunity to preserve historic resource to a future time	◆	Changes character of building need to be balanced with reuse potential	◆	Changes character of building need to be balanced with reuse potential	◆	Changes character of building need to be balanced with reuse potential
D.3. Decision Making and Approvals	☐	No issues anticipated	☐	Proposed reconfiguration will require historic design review	☐	Proposed reconfiguration will require historic design review	☐	Proposed reconfiguration will require historic design review

8.6. Annex Chimney Alternatives

The existing Annex chimney is approximately 7 feet 10 inches square and 80 feet high above the concrete base. The current construction consists of approximately 20- to 21-inch thick unreinforced brick walls. The conditions assessment identified the Annex chimney as significantly deteriorated and not seismically sufficient. Reinforcement of the chimney itself and the chimney foundation is be required, or an alternative (shortening) or removal of the chimney) must be considered. The Annex chimney is no longer a functional structure, but is historically important because it is evocative of the building's historic function as a boiler room.

This alternative would address the structural/seismic deficiencies and deterioration of the 80-foot Annex chimney, which is currently inoperable but is a character-defining feature of the Annex.

The following alternatives were evaluated:

- The No-Build Alternative retains the chimney as-is, without improvements. Deterioration would be expected to continue, and life safety risks due to seismic hazard would remain.
- The Full Height Chimney with Reinforcement alternative reconstructs the chimney using original face brick around a seismically upgraded foundation and core.
- The Chimney Height Reduction with Reinforcement alternative similarly reconstructs the chimney using original face brick around a seismically upgraded foundation and core, but with an overall reduced height
- The Ghost Chimney alternative replaces the existing masonry chimney with a new reconstructed form that is evocative of the mass and height of the former chimney.
- The Remove Chimney alternative removes the existing chimney entirely.

The results of the evaluation of the five alternatives are summarized in Table 8.5-1.

8.6.1. Annex Chimney Alternative A: Full Height Chimney with Reinforcement

Alternative A would reconstruct the chimney using original face brick around a seismically upgraded foundation and core (Figure 8.5-1). Maintaining the existing chimney would be ideal in maintaining the complete historic character of the exterior of the Annex. In order to retain the brick chimney as it appears currently, it would be necessary to carefully dismantle the exterior brick, remove the remaining interior brick, and rebuild the chimney as a reinforced concrete structure and reapply the exterior brick as a veneer. Much like the clock tower in the Main Building, the Annex chimney foundation would also need to be reinforced and tied to the chimney. Insertion of micropiles around the perimeter of the pile cap for seismic strengthening would be required. This option introduces a number of technical and constructability risks that would have to be further evaluated in future phases of design; however, the benefit of this alternative would be the preservation of the full height chimney with little to no permanent indication of the retrofit.

Figure 8.5-1 Annex Chimney Alternative A – Full Height Chimney with Reinforcement

8.6.2. Annex Chimney Alternative B: Chimney Height Reduction with Reinforcement

Alternative B would reconstruct the chimney using original face brick around a seismically upgraded foundation and core, but with an overall reduced height (Figure 8.5-2). This alternative is a similar reconstruction of the historic chimney as described in Alternative A; however the height of the chimney would be reduced from its full height of 80 feet to a lower height of approximately 50-60 feet. The cornice brick work at the top of the existing chimney would likely be reconstructed at the top of the reduced-height chimney. This option presents less risk due to breakage of original brick during the removal process, because fewer of the original face brick are required for reconstruction. The alternative may also reduce the extent of structural/seismic improvements such as foundation strengthening. The downside of this alternative is that this option compromises the original form of the full-height chimney.

Figure 8.5-2 Annex Chimney Alternative B – Chimney Height Reduction with Reinforcement

Figure 8.5-3 Annex Chimney Foundation Conceptual Strengthening Scheme

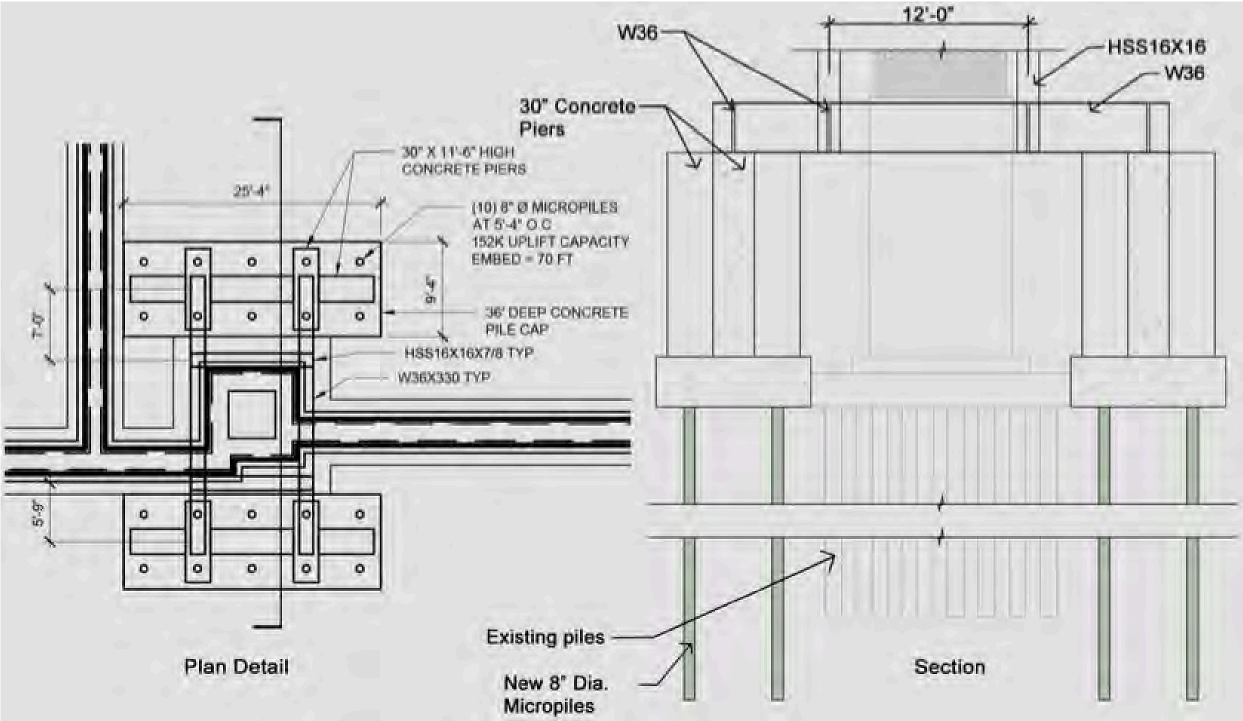
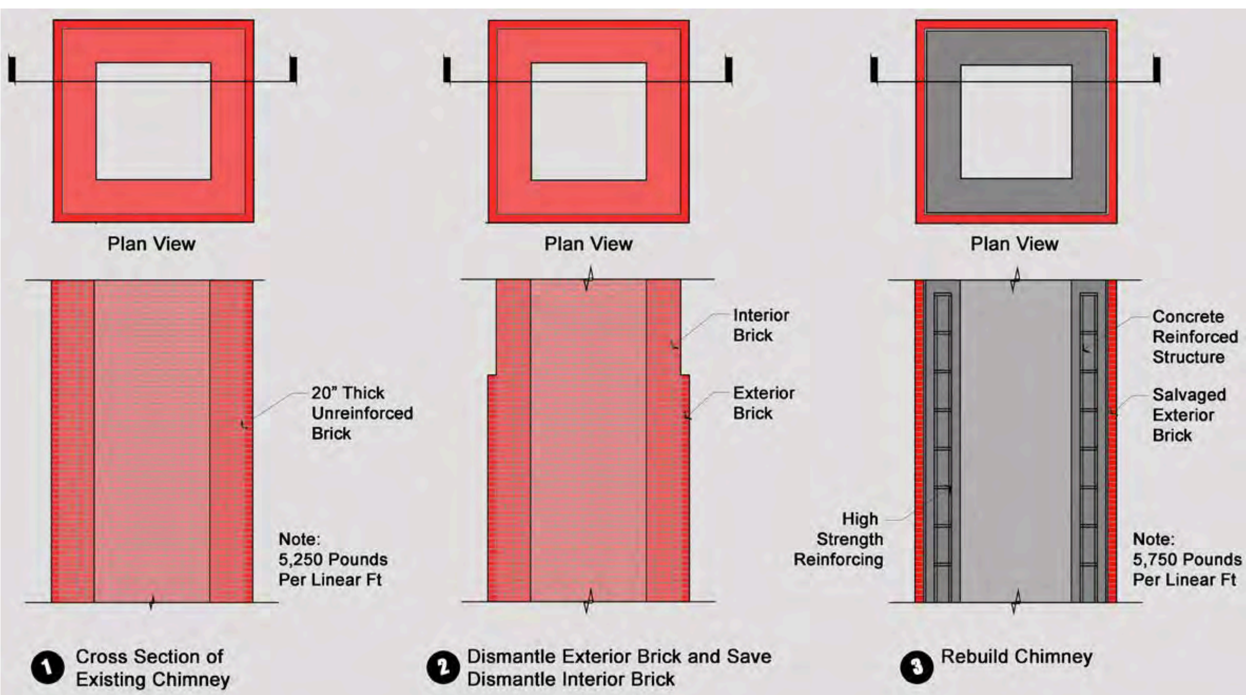


Figure 8.5-4 Annex Chimney: Reconstruction around a Reinforced Core (Alternatives A and B)



8.6.3. Annex Chimney Alternative C: Ghost Chimney

Alternative C would replace the existing masonry chimney with a new reconstructed form that is evocative of the mass and height of the former chimney, called a ghost chimney. This alternative improvement would acknowledge the historic presence of the chimney following tis removal. Several conceptual designs for a ghost chimney have been developed, as described below.

8.6.3.1 Glass Ghost Chimney with Diagonal Supports

One of the ghost chimney options is to create a glass curtain wall structure that emphasizes its transparency yet gives homage to the original chimney (Figure 8.5-5). The spacing of mullions and supports would be broken up evenly along the height of the tower, and diagonal bracing across the inside of the glass tower would be visible through the glass. A glass curtain wall tower would replace the existing 8 feet by 8 feet chimney utilizing a tube steel structure. Tube steel columns at each corner would run the height of the new structure with tube steel beams placed at equal increments. Smaller diagonal tubes would run up each side of the ghost chimney, also at equal increments beginning and ending at each beam. A glass curtain wall roof would cap the top of the new glass tower with tube steel supports spanning the top of the tower. or the foundation, 3 to 4 feet of existing concrete would be removed and replaced with a new 3 feet deep by 13 foot square pile cap, reinforced around the perimeter with closed ties and longitudinal reinforcing. Beam portions may extend out into the building to provide access to vertical and battered piles. The piles would be located beyond the original pile cap, which is 15 feet 6 inches square.

Figure 8.5-5 Annex Chimney Alternative C - Glass Ghost Chimney with Diagonal Supports

8.6.3.2 Glass Ghost Chimney with Metal Banding

Another option similar to the previous ghost chimney is a glass curtain wall structure with metal banding, reminiscent of the brick and stucco pattern of the existing chimney (Figure 8.5-6). The metal banding would correspond to areas of the existing chimney with wider areas of brick between stucco portions; curtain wall mullions would also add to the ghosted pattern of original rhythm of brick, stucco, and decorative trim. A glass curtain wall with metal banding would replace the existing 8 feet by 8 feet chimney utilizing a tube steel structure. Four corner columns of tube steel would be used with tube steel beams hidden behind the metal banding. This metal banding would occur at locations to represent the rhythm of the brick in-between the stucco pattern of the existing chimney. A t the middle of the new glass ghost chimney, the metal banding would be absent to reflect the stucco patterning along this portion of the existing chimney; the structural tubes would also skip up to the next metal band, allowing the middle of the ghost chimney to be as transparent as possible. The top of the new chimney would include a metal reveal, and a metal roof would cap off the tower using tube steel supports across the span. For the foundation, 3 to 4 feet of existing concrete would be removed and replaced with a new 3 feet deep by 13 foot square pile cap, reinforced around the perimeter with closed ties and longitudinal reinforcing. Beam portions may extend out into the building to provide access to vertical and battered piles. The piles would be located beyond the original pile cap, which is 15 feet 6 inches square.

Figure 8.5-6 Annex Chimney Alternative C - Glass Ghost Chimney with Metal Banding

8.6.3.3 Steel Framed Ghost Chimney

A further ghost chimney option is one using all steel components to reflect the pattern of the existing chimney (Figure 8.5-7). The existing 8 feet by 8 feet chimney would be replaced by a steel structure consisting of wide flange columns and beams with steel angle and plate detailing. Wide flange beams would be used as the main structure as well as defining the areas where the brick pattern is located on the existing chimney, while steel angles would describe areas of the stucco patterning. Smaller wide flange beams and steel angles would be used at the top of ghost chimney to reflect the arched design and trim work. For the foundation, 3 to 4 feet of existing concrete would be removed and replaced with a new 3 feet deep by 13 foot square pile cap, reinforced around the perimeter with closed ties and longitudinal reinforcing. Beam portions may extend out into the building to provide access to vertical and battered piles. The piles would be located beyond the original pile cap, which is 15 feet 6 inches square.

Figure 8.5-7 Annex Chimney Alternative C - Steel Framed Ghost Chimney

8.6.4. Annex Chimney Alternative D: Remove Chimney

This alternative would remove the Annex chimney entirely, modifying the roof line to give the appearance that the chimney was never present (Figure 8.5-8). While this is technically the least complicated alternative, it has the significant drawback of severely compromising this character-defining feature of the historic Annex.

Figure 8.5-8 Annex Chimney Alternative D - Remove Chimney

8.6.4.1 Recommendation: Annex Chimney

The project team recommends implementing Alternative A, the Full Height Chimney Reconstruction with Reinforced Core (Figure 8.5-1). The Annex chimney is evocative of the building's historic use as Union Station's boiler room. The historic benefit of preserving the character-defining Annex chimney was the key factor in selecting the chimney preservation alternative. This alternative assumes technical viability of chimney restoration, including but not limited to the ability to salvage existing face brick. Technical feasibility and constructability considerations would continue to be explored in future design phases.

Table 8.5-1 Evaluation of Annex Chimney Alternatives

Evaluation Criteria		No-Build	A	Full Height Chimney with Reinforcement	B	Chimney Height Reduction with Reinforcement	C	Ghost Chimney	D	Remove Chimney
A: Ability to Meet Project Goals										
A.1. Accommodate Future Capacity and Operational Needs of Passenger and Freight Rail	◆	Potential risk of structure/seismic failure of the Annex chimney to impact rail operations/life safety	●	Reduces seismic hazard to tracks and rail operations	●	Reduces seismic hazard to tracks and rail operations	●	Reduces seismic hazard to tracks and rail operations	●	Reduces seismic hazard to tracks and rail operations
A.2. Preserve and Protect the Historic Character of Union Station	◆	Does not address deteriorated state of the chimney; ongoing risk of failure or significant seismic damage in the future	●	Maintains existing character-defining feature of structure	□	Change to form but maintains a modified chimney as character defining feature	□	Changes character of the structure but provides a replacement that speaks the Annex's historic function	◆	Removes a character-defining feature of the Annex
A.3. Improve Economic and Social Vitality	◆	Limits reuse options of the Annex due to seismic hazard	●	Mitigates seismic hazard that could prevent revitalization of the Annex	●	Mitigates seismic hazard that could prevent revitalization of the Annex	●	Mitigates seismic hazard that could prevent revitalization of the Annex	●	Mitigates seismic hazard that could prevent revitalization of the Annex
A.4. Improve Environmental Sustainability	□	Minimal impact anticipated	□	Minimal impact anticipated	□	Minimal impact anticipated	□	Minimal impact anticipated	□	Minimal impact anticipated

Evaluation Criteria	No-Build	A Full Height Chimney with Reinforcement	B Chimney Height Reduction with Reinforcement	C Ghost Chimney	D Remove Chimney
B. Cost and Financing					
B.1. Estimated Capital Cost	◆ Cost to address deterioration and repair will likely increase in the future	◆ Higher cost alternative to stabilize structure, provide seismic reinforcement, and implement foundation improvements.	◆ Higher cost alternative to stabilize structure, provide seismic reinforcement, and implement foundation improvements.	◆ Higher cost alternative to create a visually-appealing replacement structure, provide seismic reinforcement, and implement foundation improvements.	● Lower cost alternative; cost is to remove tower and dispose or reuse brick, additional cost to revise roof framing and add new tile roofing
B.2. Lifecycle Cost Impacts	◆ Future repair/replacement costs will likely increase in the future	□ Normal maintenance of masonry after initial construction cost	□ Normal maintenance of masonry after initial construction cost	□ Minimal maintenance if ghost structure is made from weathering steel and allowed to rust. Periodic cleaning and painting if standard steel is used	□ Normal roof maintenance after initial demolition and roof construction costs
B.3. Cost Risk	◆ Less certainty about future costs of construction and repairs if deferred to future	◆ Cost risk due to reconstruction of the existing chimney using reclaimed, historic face brick and specialty labor.	◆ Cost risk due to reconstruction of the existing chimney using reclaimed, historic face brick and specialty labor.	◆ Cost risk due to future design decisions regarding appearance and materials of the ghost chimney	□ Cost risk due to repairs necessary to repair areas where chimney was removed, in a manner that is acceptable to historic reviewers

Evaluation Criteria		No-Build	A	Full Height Chimney with Reinforcement	B	Chimney Height Reduction with Reinforcement	C	Ghost Chimney	D	Remove Chimney
B.4. Financial Leverage	◆	Likely more difficult to pursue Annex repairs as a future stand-alone project	●	Increased funding potential as part of a multifaceted renovation project.	●	Increased funding potential as part of a multifaceted renovation project.	●	Increased funding potential as part of a multifaceted renovation project.	●	Increased funding potential as part of a multifaceted renovation project.
C. Implementability and Constructability										
C.1. Technical Complexity and Constructability	□	N/A – No capital improvement project	◆	Highly technical engineering and construction. Requires specialized labor to deconstruct and reconstruct the chimney. Risk of material breakage during deconstruction	◆	Highly technical engineering and construction. Requires specialized labor to deconstruct and reconstruct the chimney. Risk of material breakage during deconstruction	◆	Ghost structure will require engineering. It is not a simple piece of artwork. Depending on concept for ghost structure may be more complicated engineering than other options	◆	Roof truss that connects to chimney would need to be lengthened. Restoration must be completed in a way that is complementary to existing structure, including repair of historic materials
C.2. Schedule and Schedule Risk	□	N/A – No capital improvement project	□	Technical complexity may contribute to schedule risk	□	Technical complexity may contribute to schedule risk	□	Design approvals may contribute to schedule risk	□	Design approvals may contribute to schedule risk
C.3. Construction Impact on Passenger and Freight Rail Operations	◆	More difficult to use Annex for temporary rail/passenger/tenant space during the construction phase if not renovated	◆	Possible impact on rail during construction stabilization	◆	Possible impact on rail during construction stabilization	◆	Possible impact on rail during demolition and construction	◆	Possible impact on rail during demolition

Evaluation Criteria		No-Build	A	Full Height Chimney with Reinforcement	B	Chimney Height Reduction with Reinforcement	C	Ghost Chimney	D	Remove Chimney
C.4. Construction Impact on Union Station Tenants	◆	More difficult to use Annex for temporary rail/passenger/tenant space during the construction phase if not renovated	☐	Impact limited to Annex tenants who could potentially be relocated to Main Building; building has a high percentage of vacancies	☐	Impact limited to Annex tenants who could potentially be relocated to Main Building; building has a high percentage of vacancies	☐	Impact limited to Annex tenants who could potentially be relocated to Main Building; building has a high percentage of vacancies	☐	Impact limited to Annex tenants who could potentially be relocated to Main Building; building has a high percentage of vacancies
C.5. Phasing and Project Segmentation	◆	Likely more difficult to pursue Annex repairs as a future stand-alone project	●	Could be completed as a separate or later phase from Main Building and track improvements	●	Could be completed as a separate or later phase from Main Building and track improvements	●	Could be completed as a separate or later phase from Main Building and track improvements	●	Could be completed as a separate or later phase from Main Building and track improvements
C.6. Risks, Assumptions and Unknowns	◆	Increased deterioration will likely increase risk and complexity of repair in the future	☐	Ability to use batter piles will be limited because of proximity to existing vertical wood piles. Anchoring to existing concrete may be difficult and requires testing for verification.	☐	Ability to use batter piles will be limited because of proximity to existing vertical wood piles. Anchoring to existing concrete may be difficult and requires testing for verification.	☐	If ghost structure is as tall as original chimney, the structure will need significant bracing, similar to a radio tower.	☐	Unknowns regarding restoration of Annex façade and roof impacted by chimney replacement

Evaluation Criteria		No-Build	A	Full Height Chimney with Reinforcement	B	Chimney Height Reduction with Reinforcement	C	Ghost Chimney	D	Remove Chimney
D. Environmental Impacts and Approvals										
D.1. Environmental Impacts and Project Classification	◆	Results in continued degradation, underutilization, and potential future loss of a significant historic resource	●	Results in preservation and repurposing of a significant historic resource	●	Results in preservation and repurposing of a significant historic resource	●	Results in preservation and repurposing of a significant historic resource	◆	Results loss of character-defining feature of a significant historic resource
D.2. Historic Impacts and Approvals	◆	Results in continued degradation, underutilization, and potential future loss of a significant historic resource	●	Retains existing character of structure	□	Preserves character/form but in modified stat.	□	Preserves form but with loss of historic material	◆	Results loss of character-defining feature of a significant historic resource
D.3. Decision Making and Approvals	□	No issues anticipated	□	Proposed changes will require historic design review and approval	□	Proposed changes will require historic design review and approval	□	Proposed changes will require historic design review and approval	□	Proposed changes will require historic design review and approval

8.7. Annex Entrance Canopy

Repurposing of the Annex building, along with potential introduction of an Annex Plaza and/or modifications to the Annex Chimney, presents an opportunity to accentuate the new "front door" entrance to the Annex. Currently, the Annex office spaces (first and second floor) are entered from a door on the north side of the building, oriented towards the tracks and away from the street. The main entrance for the Boiler Room is on the western façade. The entrance to the half-round storage room is from the south façade.

Based on the reuse of the Annex structure, it may be desirable to reconfigure one or more of the western entrances as the main entrance to the Annex. These entrances have the advantage of facing the nearest public street, NW Station Way, the pedestrian bridge, and the most direct route from the Main Building via its front sidewalks. In the future, this entrance would also face onto a redesigned parking lot, or the proposed Annex Plaza. Moving the main entrance away from the north side of the Annex also increases flexibility in implementing a new security fence between the tracks/platforms and the public front side of the station, as requested by Amtrak.

A series of canopy designs have been developed to explore the options for accentuating the entrance, including both historical and more contemporary designs (Figures 8.7.1 through 3). A decision on whether to incorporate this type of entrance canopy has not been determined at this time, nor has a preferred design or materials set for this canopy. Therefore entrance canopy alternatives were not formally defined and evaluated.

A sampling of conceptual designs for the Annex entrance canopy concepts is presented here in anticipation of further design development and decision making in future phases of the project.

With any of these canopy options, outdoor seating is proposed a complementary attraction to the building. Cafe seating will be located at the north side of the Annex between the building and the Union Station Main Building. The seating will also spill out around the southwest facade of the Annex, with additional outdoor seating near the boiler room portion of the building. The combination of an entry canopy and outdoor seating will increase the activity and visibility of the Annex building and, if implemented, the adjacent Annex Plaza spaces.

Figure 8.7-1 Annex Entrance Canopy Design Concept

Figure 8.7-2 Annex Entrance Canopy Design Concept

Figure 8.7-3 Annex Entrance Canopy Design Concept

8.8. Annex Mechanical, Electrical, Plumbing, and Lighting

This section discusses preliminary recommendations for Annex Mechanical, Electrical, Plumbing, and Lighting improvements.

8.8.1. Mechanical/HVAC Systems

8.8.1.1 LEED Gold Scenario

Under this scenario, the Annex will be served by a variable refrigerant flow system (VRF) heat pump system consistent with the main Union Station building. The VRF system consists of ground mounted heat pump units, modular refrigerant flow controllers and terminal fan coil units located within the building. The heat pump units are connected to the flow controllers with refrigerant piping. The refrigerant piping is routed from the flow controllers to multiple fan units with refrigerant heating / cooling coils located in or adjacent to the spaces served. Each fan unit can accomplish heating and cooling independently. The fan coil units are available in a wide variety of configurations and may be ductless or ducted. The heat pump units in these systems are capable of producing adequate heating capability at extremely low ambient temperatures without the requirement for supplementary electric resistant heat.

Separate dedicated outdoor air systems (DOAS) will be required to provide ventilation to the building. These would be variable volume, gas fired units delivering forced ventilation air to the individual VRF fan coils in the building. The units and ductwork are typically smaller than standard HVAC systems since only the ventilation air is being conditioned and distributed while the VRF fan coils accomplish the primary heating and cooling.

VRF system controls are typically provided by the specific system manufacturer. Control and monitoring of temperature, scheduling and general operating points is accomplished via a BACnet interface to most common DDC controls manufacturers. Integral control of refrigeration compression and other internal system operating parameters is accomplished by the control system specific to the VRF manufacturer.

The central heat pump equipment will be selected and sized based on the projected space planning options for the Annex.

Refrigerant piping would be routed from the outdoor heat pump units to the refrigerant flow controllers located at strategic points within the building. Terminal refrigerant piping and fan coils could be added later in response to specific space planning requirements. The outside air ductwork would likewise be routed within the building to allow build-out flexibility for proposed tenant plans.

8.8.1.2 LEED Platinum and Net-Zero Scenarios

Under these scenarios, the Annex will be served by a ground source heat pump system as discussed in the Core Building Improvements chapter. The heat pump system will utilize terminal fan / compressor units to heat and air condition the building by extracting or rejecting heat from a central water loop. The central water loop is then pumped through a well system to obtain and reject heat from the loop. The main loop temperature is allowed to fluctuate within the working temperatures of the heat pumps with individual units constantly injecting heat into or taking heat out of the loop. The water loop temperature typically fluctuates between 60 degrees F. and 90 degrees F. allowing the individual heat pump units to extract or reject heat from the loop via a self-contained refrigeration system for use in space conditioning.

The heat pumps have integral compressors with reversing valves allowing either heating or cooling with the central water loop temperature parameters. The individual heat pump units are located within the dwelling units.

Natural ventilation will be utilized as the first stage of cooling and air conditioning energy will not be utilized until occupant environmental temperature limits cannot be maintained. The typical occupant temperature limits are relaxed to allow a wider fluctuation of temperatures within the building before mechanical heating and cooling is engaged.

Separate dedicated outdoor air systems (DOAS) will be required to provide ventilation to the building. These would be variable volume, gas-fired units delivering forced ventilation air to the individual VRF fan coils in the building. The units and ductwork are typically smaller than standard HVAC systems since only the ventilation air is being conditioned and distributed while the VRF fan coils accomplish the primary heating and cooling.

8.8.2. Plumbing

8.8.2.1 LEED Gold Scenario

The common area toilet rooms will contain water efficient fixtures including metered flushometer valves and faucets. Water closets will use 1.28 gallons per flush and urinals will flush with only 0.5 gallons per flush. The lavatories will be limited to a maximum 0.25 gallon per cycle and sinks will be 1.5 gallons per minute. Kitchen faucets will be limited to a maximum 1.5 gallons per minute. The showerheads will be a low flow and will be no more than 1.50 gallons per minute.

Water heating will be accomplished through a High efficiency natural gas or heat pump water heater integrated into the VRF system.

8.8.2.2 LEED Platinum Scenario

LEED platinum plumbing systems will utilize low flow water fixtures and will collect graywater from sinks, lavatories and showers to use in flushing toilets and urinals. The graywater will be sent through a treatment process but will be circulated as non-potable water through the building in a separate water distribution system. Water heating will be accomplished through a High efficiency heat pump water heater integrated into the ground source loop.

8.8.2.3 Net-Zero Scenario

Net Zero building plumbing systems will utilize low flow water fixtures and will collect graywater from sinks, lavatories and showers as well as rainwater to use in flushing toilets and urinals. The rainwater will be collected in a large cistern dedicated to the site. Water heating will be accomplished through a High efficiency heat pump water heater integrated into the ground source loop.

8.8.3. Electrical and Lighting

8.8.3.1 LEED Gold Scenario

This scenario replaces the existing electrical service with a new 600 amp, 208 volt, 3 phase main panel board. This is anticipated to be adequate to serve existing and future electrical needs, and will be confirmed as part of future design. It would also retain the existing electrical service to the pedestrian bridge and elevator, located in the Annex. Emergency power will be provided by a battery inverter system. As an alternative, emergency power (to egress lighting only) may be supplied by individual emergency battery backup ballasts. Power and data receptacles would be installed throughout the building based upon anticipated tenant needs. This could be deferred until a T.I. build-out. The main telephone termination, currently in an upstairs closet, would be relocated to a central utility location, perhaps near the electrical service. Provide infrastructure to adequately server the anticipated needs of a tenant build-out.

For lighting, this scenario would install new light fixtures throughout the building based upon the build-out design. New lighting will be LED or a combination of LED and fluorescent fixtures. The style fixtures will be contingent upon the design of the interior spaces. Existing exterior light fixtures would be replaced with LED fixtures. The fixture styles should be consistent with historic building architecture.

8.8.3.2 LEED Platinum and Net-Zero Scenarios

This scenario replaces the existing electrical service with a new 600 amp, 208 volt, 3 phase main panel board. This is anticipated to adequate to serve existing and future electrical needs, and will be confirmed as part of future design. The existing electrical service to the pedestrian bridge and elevator would be retained. Emergency power will be provided by a battery inverter system. As an alternative, emergency power (to egress lighting only) may be supplied by individual emergency battery backup ballasts. Power and data receptacles would be installed throughout the building based upon anticipated tenant needs.

The main telephone termination, currently in an upstairs closet, would be relocated to a central utility location, perhaps near the electrical service.

New light fixtures would be installed throughout the building based upon the buildout design. New lighting will be dimmable LED fixtures. The style fixtures will be contingent upon the design of the interior spaces. Existing exterior light fixtures would be replaced with LED fixtures. The fixture styles should be consistent with historic building architecture.

9. Summary of Preliminary Preferred Alternatives

This section presents a summary of preliminary preferred alternatives as discussed in the preceding chapters. The preliminary preferred alternatives form the basis of NEPA/Section 106 review and public/stakeholder outreach that will occur as a next step for the project.

Table 9.0-1 Preliminary Preferred Alternative: Building and Site Improvements

Improvement	Project Team Recommendation
Vertical Circulation and Access	The project team recommends implementing Alternative B with the two-elevator configuration with an enclosed stair to the second and third floors. The two-elevator approach avoids the potential historic impact of the mezzanine connector bridge on the main concourse. The stairway and elevator configuration would be the most compatible with proposed main floor and upper floor improvements in Amtrak and other leasable spaces.
Amtrak Operations and Passenger Concourse	The project team recommends implementing Alternative B, the North Foyer Hallway – Configuration 1. Creation of a new north foyer hallway would increase train boarding gate capacity for growth in future passenger rail service, and would minimize circulation and quieting conflicts between arriving and departing passenger flows and queues within the main concourse. The configuration of ticketing, baggage, and restrooms in this alternative would meet Amtrak operational and business objectives, and the orientation of passenger services would be the most conducive for arriving and departing passengers. Consolidation of ticketing / baggage functions would increase Amtrak operational efficiency and passenger convenience and would create opportunities to implement accessibility improvements to the customer service counter.
Ticketing Area	The project team recommends preserving the existing, historic walnut ticketing counter to incorporate it as a feature into a new retail concession such as a café. A café alternative would provide a new passenger amenity and creates a high-quality amenity in a prominent main concourse location. Preservation of the existing walnut ticket counter and other features would honor the historic use of this area and would add interest and character to the space.
South Concourse	The project team recommends implementing Alternative A, which would expand retail concessions and have shared use seating. This alternative would improve and enhance the south concourse as an amenity for rail passengers, building tenants, and visitors alike. This alternative envisions flexible seating that can be used both by concession patrons and waiting rail passengers, providing flexible capacity during peak periods. Introduction of new retail concessions activates this area is compatible with providing exhibit space as part of the final space configuration.
First Class Lounge	Amtrak has requested that the First Class Passenger Lounge be retained because of its value to its premium customer base such as sleeper car passengers and business class passengers; therefore, the project team recommends implementing Alterative A. Should Amtrak direction change, the space could be repurposed to accommodate a tenant or amenity as described in Alternative B.

Improvement	Project Team Recommendation
South Main Floor Leasable Spaces	The project team recommends implementing the core and shell only option (Alternative A).The decision about the highest and best use of this space will depend on future market conditions closer to the completion of construction, which is anticipated to be up to five or more years into the future. During this time, market conditions are expected to evolve significantly in the Broadway Corridor, particularly with the potential redevelopment of the nearby U.S. Post Office site and other parcels in the immediate vicinity. The core and shell improvement (Alternative A) would accommodate any of the three re-use scenarios presented in Alternatives B through D. Restaurant and/or retail is the preferred re-use option, consistent with the historic uses of the south end of the building as a restaurant and dining hall, and the historical presence of other public services along the south hallway (e.g. barber shop). The refurbishments of this area of the building would require replacement of the floor structure, potential modifications to the ceiling structure, and seismic retrofits of the interior and exterior walls. Code and accessibility requirements would likely result in modification to the existing configuration of interior spaces. The re-designed south floor leasable spaces would incorporate elements of the historic corridor to the extent practical.
Upper Floor Leasable Spaces	The preferred alternative is to reconfigure leasable spaces to create larger floorplates (Alternative B). With this alternative, PDC will preserve the existing character, footprint, and materials of the existing historic corridors, while creating larger footprint leasable spaces that are more financially viable. In the near term, it is expected that leasable spaces will be rehabilitated to a core and shell level following major structural, systems, and vertical circulation improvements. This will maintain flexibility for tenant fit-out in the future. On a case-by-case basis, historic materials and features of leasable areas (e.g. casework, finishes) will be preserved and/or relocated.
Nursery	The project team recommends removing the nursery building (Alternative B). The nursery building is in poor physical and seismic condition, is currently unused, and cannot be occupied in its current state. Damage due to water and mold has compromised the structure, which risks damaging the main structure. The trackside location behind the Amtrak security control line limits the re-use options and potential future public access to any rehabilitated or reconstructed space. In order to preserve the legacy of the WWII era nursery, an interpretive display of the history of Union Station during WWII in a more public area of Union Station could be considered.
Main Building Seismic Strengthening	The project team recommends implementing reinforced concrete shear walls (Alternative A) because, overall, it would be the most efficient option for strengthening the existing station. Reinforced concrete shear walls would provide the most flexibility in layout and would be the easiest to enclose in architectural features so as to avoid a significant impact on the overall appearance of the station. Reinforced concrete walls also provide the greatest amount of stiffness and would limit the amount of work to brace architectural features. There are some locations in the interior of the building near new stair/elevator cores where the recommended option between a braced frame and a concrete shear wall would be determined during the design process. This decision would consider cost, constructability and space planning based on the final stair/elevator core locations.

Improvement	Project Team Recommendation
Diaphragm Alternatives	The project team recommends adding plywood sheathing above or below the existing floor diaphragm (Alternative A). A horizontal truss would reduce the amount of shear walls to be added to the structure, but would be have a significant impact on the ceiling of the station. The horizontal truss would have to be located below the existing floor diaphragm and is not an option in areas where the ceiling is to be preserved. Additionally, reducing the number of shear walls would increase the load to each shear wall and as a result could require a large amount of foundation work.
Out of Plane Strengthening Alternatives	The project team recommends implementing the reinforced concrete shear walls (Alternative A). Reinforced concrete shear walls would be relatively simple to attach to the existing URM brick walls. As part of the lateral system for the structure and as such, concrete shear walls can be used for both in-plane and out-of-plane strengthening. Where historic finishes and materials exist (such as the walls of the main concourse), the concrete shear wall reinforcement can be implemented behind the historic material by temporarily removing the marble panels, replacing existing hollow clay tile with a shotcrete shear wall, and replacing the marble panels. This process may result in minor changes to finish room dimensions due to the slight increase in wall thickness, but the restored structural reinforcement will be hidden from view behind the restored marble panels with relatively small permanent dimensional changes anticipated. In less historic locations, such as the baggage room or leasable tenant spaces, the introduction of concrete shear walls on the inside of the existing URM wall would result in an increase in the overall wall thickness. However unlike braced framing, there is no risk of steel structural members blocking existing historic windows. The use of concrete shear walls would also create opportunities to introduce new building insulation, acoustic window treatments, and mechanical/electrical conduit within new the wall system. These opportunities would be explored in preliminary design. In certain locations, the steel tube strongback system may be considered as an alternative base. Exceptions to the use of concrete shear walls would be further explored in preliminary design based on overall architectural and structural design considerations.
Tower Unreinforced Masonry (URM) Strengthening	The project team recommends implementing a combination of reinforced concrete shear walls in the lower levels and steel braced frames in the upper levels (Alternative A). The light weight of the braces in the upper levels would provide lateral resistance without adding a significant amount of mass. Reinforced concrete shear walls would anchor the braces from above and at the same time can be used to provide lateral support to the main station structure.
Tower Overturning Resistance	The project team recommends implementing the addition of piles to the existing pile cap (Alternative A). Drilled pile foundations can be challenging to construct, but the work would be concentrated to a small area. Additionally, by adding the piles below the tower, the lateral elements of the tower can be used to support the main station. Without the addition of these piles, the loads from the tower would have to be redistributed to the rest of the station.
Main Building Chimney	The project team recommends adding a pipe column inside the chimneys (Alternative A). This would have no permanent impact on the exterior appearance of the chimney structures. The chimneys are non-functional, and therefore the primary objective for a structural/seismic retrofit is to preserve their historic appearance and character.

Improvement	Project Team Recommendation
Platform Canopies	The project team recommends implementing the contemporary umbrella canopies with high shed (Alternative B) (Figure 5.10-2). This alternative provides the essential benefits for rail operations (increased clearances and improved weather protection) while preserving the historic form of the existing umbrella canopy/high shed system. The capital cost of this alternative would be lower than Train Shed Alternatives C and D, while still providing sufficient area for a photovoltaic system, if desired. In terms of constructability and maintenance of rail operations during construction, the umbrella canopy would be simpler to implement as part of a staged track reconstruction that upgrades one platform/platform canopy system at a time. It is anticipated that a contemporary platform canopy/high shed design can be developed to capture the positive benefits of a contemporary design approach while honoring the historic platform canopies and adjacent station.
Rail / Building Maintenance and Operations Areas	The project team recommends implementing the new replacement shed with attached gable (Alternative C). This alternative would provide the greatest functional benefit and design flexibility to provide coverage that meets the operations needs of Amtrak. It also would provide the historic benefit of the restored attached gable. The specific sizing requirements and organization of the maintenance area and associated shed structure would be further developed through preliminary engineering.
Annex Plaza	The project team recommends implementing the Annex plaza improvements (Alternative B). This transformation would be consistent with the periodic change and re-purposing of this area over the history of Union Station. It would maximize the potential of the Annex while creating a community gathering spot that celebrates Union Station and provides benefits to the broader neighborhood.
Annex Floor Plan	The project team recommends implementing the Single-Story Shell Alternative (Alternative A) for the Annex. This alternative would provide the most flexibility for re-use of the Annex building, once the basic building upgrades have been completed and the Annex is ready for leasing and fit-out based on future market and neighborhood conditions. The additional cost and space consumption of stair and elevator access to a second floor or mezzanine may not be cost effective for many uses; however, the single story shell alternative could be designed in a manner to accommodate the addition of a second floor mezzanine in the future, if warranted by the tenant.
Annex Chimney	The project team recommends implementing Alternative A, the Full Height Chimney Reconstruction with Reinforced Core. The Annex chimney is evocative of the building's historic use as Union Station's boiler room. The historic benefit of preserving the character-defining Annex chimney was the key factor in selecting the chimney preservation alternative. This alternative assumes technical viability of chimney restoration, including but not limited to the ability to salvage existing face brick. Technical feasibility and constructability considerations would continue to be explored in future design phases.

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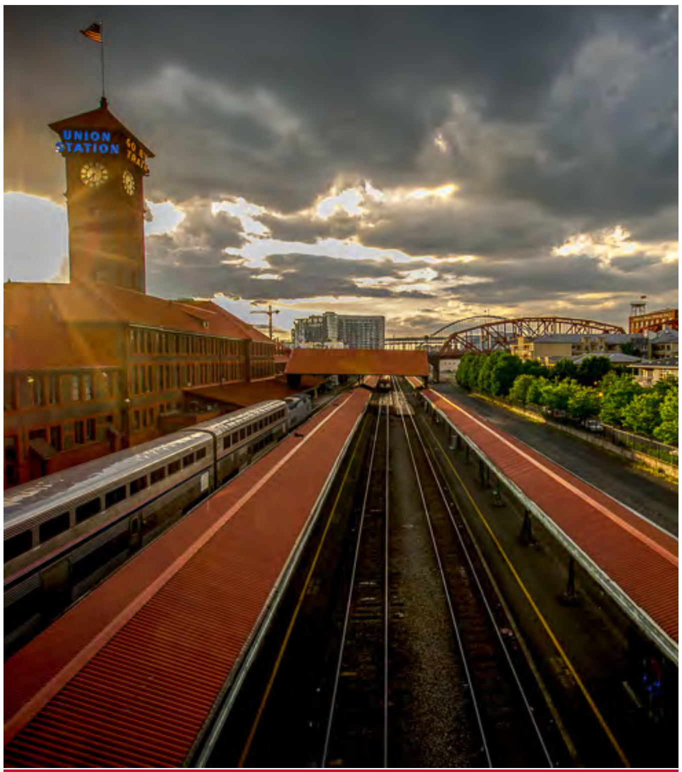
Appendix E: Portland Union Station Rail Conceptual Design Report



Conceptual Design Report

Portland Development Commission

Union Station

Portland, Oregon

June 14, 2016

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Executive Summary

Portland Development Commission (PDC) is currently investigating infrastructure and operating improvement options for Portland's Union Station. This includes reviewing options to upgrade and renovate the existing building, as well as to improve and increase the amount of passenger rail trains served daily at the station, both in the near term (2017) and the long term (2035).

As part of this process, HDR presented recommendations for improvements in the Existing Rail Infrastructure and Operations Report, dated September 14, 2015, and the Site Utilities Report, dated June 19, 2015. This Trackwork Conceptual Engineering Report builds upon the recommendations presented in those reports, as well as on the subsequent meetings and discussions held between the design team and project stakeholders. In most cases, the concepts explored are as laid out in the earlier reports; however, there are a few cases (such as on-site yard control and the improvements to fueling) that differ from the report based on more recent direction.

The main focus of this report has been to develop a conceptual level cost estimate for the potential improvements; the conceptual designs included here are to be considered to approximately the 5% level of design. Each improvement considered includes a description, a concept-level design sketch, an evaluation matrix (the instructions for which are included in Appendix A), and a cost estimate. To facilitate estimating different scenarios, each improvement has been developed as if it were a stand-alone consideration. For example: the cost estimate for installing Track #6 includes all trackwork necessary for that improvement. However, in reality, the installation of Track #6 would probably require signalizing and powering up all switches, which is estimated as its own stand-alone cost. Different cost scenarios can be developed as requested based on further stakeholder input.

This report covers only those improvements put forth in the reports listed above and focuses only on trackwork, utilities within the yard, or other improvements related to the yard and/or Amtrak operations outside of the main terminal building and annex. Improvements to these structures, and/or the operations within them, are included in separate reports. Also, funding sources are not discussed within the individual matrices associated with each potential improvement.

Previous Assumptions and Findings

Several of these concepts are predicated on assumptions put forth in the Existing Rail Infrastructure and Operations Report, as well as on several meetings with Amtrak, Federal Railroad Administration (FRA), Oregon Department of Transportation (ODOT), and Portland Development Commission:

- System-wide, the available length within Union Station will be a controlling factor in passenger train volumes. The current station configuration, which limits train berthing locations due to the passenger walkway, results in managing options between train lengths and train frequency. This report assumes train length will be limited to allow for train frequency.
- Train lengths for Amtrak *Cascades* service will be standardized for all trains to allow for correct placement of fueling, water, and power facilities, as well as to determine final berthing locations.
- Train network modeling (RTC) is not included in the cost to design any improvements, and is not required.
- Initial Terminal and Road Air Brake Test will be performed overnight only on Track #1 by Amtrak switching crews.
- Track #1 will be reserved for overnight inspection.
- A 25-foot buffer length from the train signal to the fouling point is acceptable.
- Freight rail use of Track #4 will be eliminated pending the reinstatement of Track #6
- Amtrak will provide staffing for on-site yardmaster and train switching crews
- This report does not include cost estimates for operations or maintenance.

Summary of Capital Costs

A summary of the capital costs estimated for each potential improvement is listed below; a further breakdown of each cost is also included in each section of the report. These capital cost estimates include:

- An Allocated Contingency (also known as a Line-Item Contingency) that is built into each item according to category; for example, items in the Utilities category include a 35% contingency (to account for the unknowns of underground work), while items in the Track category include a 25% contingency. See Table 1 below.
- To account for the nature of Conceptual Engineering, in which designs are only to a +/- 5% level, an Overall Contingency of 30% is included in order to develop a range of possible costs
- Year of Expenditure (YOE) of 2016 is assumed for planning purposes. Also included is a forecast to YOE 2035; this forecast assumed an annual interest rate going forward of 2.75% and finance charges of 21.31%
- These estimates do not include increases in Operating or Maintenance costs, though consideration of these is noted in each Matrix where appropriate

Table 1 Allocated Contingency

Cost Category	Description	Cost Sort	Contingency per Category
ROW	Right-of-Way / Real Estate	1	10%
UTL	Utilities	2	35%
CIV	Civil Construction	3	25%
GRD	Grade Crossings	4	30%
PLA	Platform	6	25%
SPT	Special Trackwork	8	25%
TRK	Trackwork	9	25%
SPC	Special Conditions	10	30%
STW	Storm Water	11	25%
FUE	Fueling	12	30%
SIG	Rail Signaling	13	30%
TRA	Traffic Signaling	14	25%

Table 2 Potential Improvements

Potential Improvement	Recommended?	$ 2016 (in Thousands of Dollars)	$ 2035 (in Thousands of Dollars)
Improvements to Existing Trackwork	Yes	2,930 – 3,810	5,880 – 7,730
Signalize and Remotely Control All Tracks	Yes	6,310 – 8,210	12,690 – 16,680
Fuel Delivery System	Yes	1,060 – 1,380	2,130 – 2,800
Relocate and Reduce the Width of the Passenger Crossing	Yes	36 – 48	75 – 97
Install Powered Scissor Crossovers	No	1,940 – 2,520	3,940 – 5,130
Shorten Existing Platform	Yes	55 – 72	113 – 147
Construct Track #6	Yes	5,850 – 7,610	11,890 – 15,460
Raise Platform Heights	Yes	2,550 – 3,310	5,180 – 6,730
Raise Track #5	Yes	748 – 973	1,520 – 1,970
Construct On-Site Yard Control	Yes	76 – 99	150 – 200
Reconfigure Drip Pans	Yes	1,570 – 2,040	3,190 – 4,150
Provide 480V Locomotive Power	Yes	270 – 350	550 – 720
Stormwater and Sewer Improvements	Yes	1,020 – 1,330	2,080 – 2,700
Water System Improvements	Yes	1,460 – 1,900	2,970 – 3,870
Electrical System Improvements	Yes	38 – 50	78 – 101
Telephone and Data System Improvements	Yes	36 – 47	74 – 96
Compressed Air System Improvements	Yes	400 – 530	830 – 1,080

Improvements to Existing Trackwork

This category involves replacing existing, old, or broken equipment in the yard with new equipment, installing some equipment, and developing an improved maintenance program for tie replacement.

The evaluation matrix considers two options: the build option would implement improvements to existing trackwork as a whole (not piecemeal); and the no-build option would not make any track improvements.

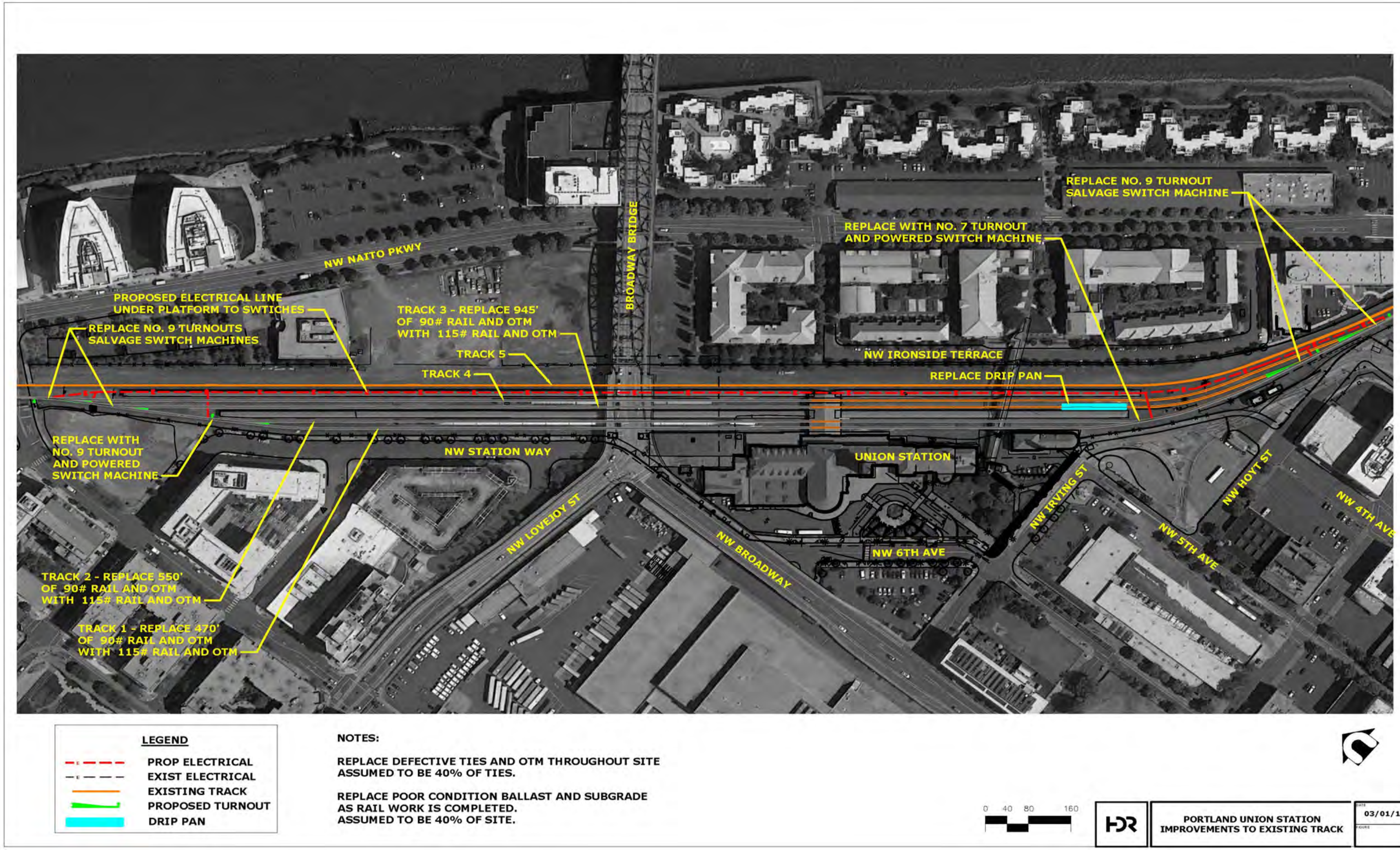
Conceptual Scope

- Replace 90# rail and Other Trackside Materials (OTM) with heavier, industry standard 115# rail.
- Weld the existing rail joints
- Replace existing defective ties within Tracks #1 - Tracks #4 with new wood ties and formalize an ongoing tie replacement program
- Replace the drip pan on the south end of Track #3 with a new, HDPE pan
- Replace the No. 7 turnout at the south end of the yard (between Tracks 1 and 2) with a No. 9 turnout *if the geometry will allow this without extensive rework*. The decision to replace the No. 7 with a No. 9 would need to be determined in Preliminary Engineering
- Replace existing turnouts in kind
- Replace the existing switch machines on the south end of tracks 1-4
- Install switch machines at the two turnouts leading to Track #1 south
- Install correct voltage power to all switch machines

Recommendation

Implement track improvements to accommodate the anticipated 2035 passenger volumes. Reduced maintenance and down-time would provide a substantial return–on-investment for this alternative; a focused study on existing and future operating and maintenance costs could be undertaken in Preliminary Engineering.

Figure 1 Improvements to Existing Trackwork



Matrix 1 Improvements to Existing Trackwork

IMPROVEMENTS TO EXISTING TRACKWORK - DRAFT EVALUATION MATRIX

Evaluation Ratings: ● Positive Imapct □ Neutral Impact ◆ Negative Impact

Evaluation Criteria			Improvements to Existing Trackwork					
			A	Implement Trackwork Improvements	B	No Trackwork Improvements	C	
A: Ability to Meet Project Goals	A.1.	Accommodate Future Capacity and Operational Needs of Passenger and Freight Rail	●	No impact to future capacity; New track materials will help avoid unplanned track outtages due to track failure, improving Amtrak operational needs; no impact to freight, no impact to seismic or security	◆	Continued use of existing track materials could lead to continued, unplanned track outages		
	A.2.	Preserve and Protect the Historic Character of Union Station	□	No impact to historic features or finishes	□	No Change		
	A.3.	Improve Economic and Social Vitality	□	Little to no impact to economic vitality of neighborhood; no impact on building efficiency	□	No Change		
	A.4.	Improve Environmental Sustainability	●	No impact to LEED rating; No impact on energy or materials consumption; Stormwater benefit from replacing drip pan on the south end of Track #3	□	No Change		
B. Cost and Financing	B.1.	Estimated Capital Cost	●	Medium level of cost compared to other track alternatives	□	No Change		
	B.2.	Lifecycle Cost Impacts	●	New track materials will reduce future track maintenance and avoid unplanned track outtages due to track failure. Ongoing maintenance will be more cost effective in the long run, as many elements have reached the end of their useful life	◆	Continued use of existing track materials could lead to unplanned track outages and increased maintenance needs; some existing materials are nearing the end of their useful life; presence of jointed track increases maintenance needs		
	B.3.	Cost Risk	□	Little to no cost risk due to uncertainties	□	No significant risk associated.		
	B.4.	Financial Leverage						
C. Implementability and Constructability	C.1.	Technical Complexity and Constructability	●	Currently considering only standard methods and materials; Low to medium construction timeframe compared to other track alternatives	□	No Change		
	C.2.	Schedule and Schedule Risk	◆	Low to medium risk of schedule delay due to turnout procurement time; little to no risk due to need for design approvals - assuming standard methods and materials	□	No Change		
	C.3.	Impact on Passenger and Freight Rail Operations	●	Medium to high potential for disruptions to passenger trains - detailed staging plans will be required; Medium level of passenger inconvenience expected due to potential for limited track closure; no freight impacts	□	No Change		
	C.4.	Impact on Union Station Tenants	●	Low level of construction noise expected from work in yard; Little to no impact to tenants	□	No Change		
	C.5.	Phasing and Project Segmentation	●	High potential to stage work to spread costs; High potential for implementing independent of other track alternatives; High probability for efficiencies by combining with other track alternatives	□	No Change		
	C.6.	Risks, Assumptions and Unknowns	●	Assuming little excavation in existing ground, there is little to no risk associated with improvements to track materials; no risk to historic features; High possibility to mitigate risks	□	No Change		
D. Environmental Impacts and Approvals	D.1	Environmental Impacts and Project Classification	●	Little to no risk associated with track maintenance; High likelihood of categorical exclusion; No schedule risk due to NEPA	□	No Change		
	D.2	Historic Impacts and Approvals	●	No issues of concern for historic review agencies	□	No Change		
	D.3	Decision Making and Approvals	●	No key decisions or approvals required; No permitting requirements	□	No Change		

Estimate 1 Improvements to Existing Trackwork

Improvements to Existing Trackwork	
Right-of-Way / Real Estate	$ -
Utilities	$143,100
Civil Construction	$ -
Grade Crossings	$ -
Platform	$ -
Special Trackwork	$540,000
Trackwork	$1,088,940
Special Conditions	$ -
Storm Water	$ -
Fueling	$ -
Rail Signaling	$ -
Traffic Signaling	$ -
Subtotal	$1,772,040
Insurance (1.75% of Subtotal w/Allocated Contingencies Only)	$31,011
Allocated Contingency (by category)	$457,320
Eng. & Admin. (Calculated Including Allocated Contingencies Only)	$668,808
Total, 2016 $, No Overall Contingency	**$2,929,179**
Overall Contingency for Conceptual Level Design (30%)	$878,754
Total, 2016 $, with Contingency	**$3,807,932**
Total, 2035 $, No Overall Contingency	**$5,886,974**
Total, 2035 $, with Contingency	**$7,734,955**

Signalize and Remotely Control All Tracks

Signalize the tracks using Centralized Traffic Control. This will require installing communications conduit from a central control point to the north and south switches, as well as installing switch point indicators and other infrastructure needed for a fully signalized system.

The evaluation matrix considers two options: the build option would install an entire signalized system; and the no-build option would leave the yard as it currently exists with no communications system or Centralized Traffic Control.

Conceptual Scope

- Install signal conduit
- Install signal houses
- Detail wiring diagrams
- Develop and coordinate an operating plan with all parties

Recommendation

Implement the Centralized Traffic Control. Though higher in capital cost than other track alternatives, signalization will be necessary for implementing the 2035 passenger train volumes and has been characterized as necessary by the FRA.

Figure 2 Signalize and Remotely Control All Tracks

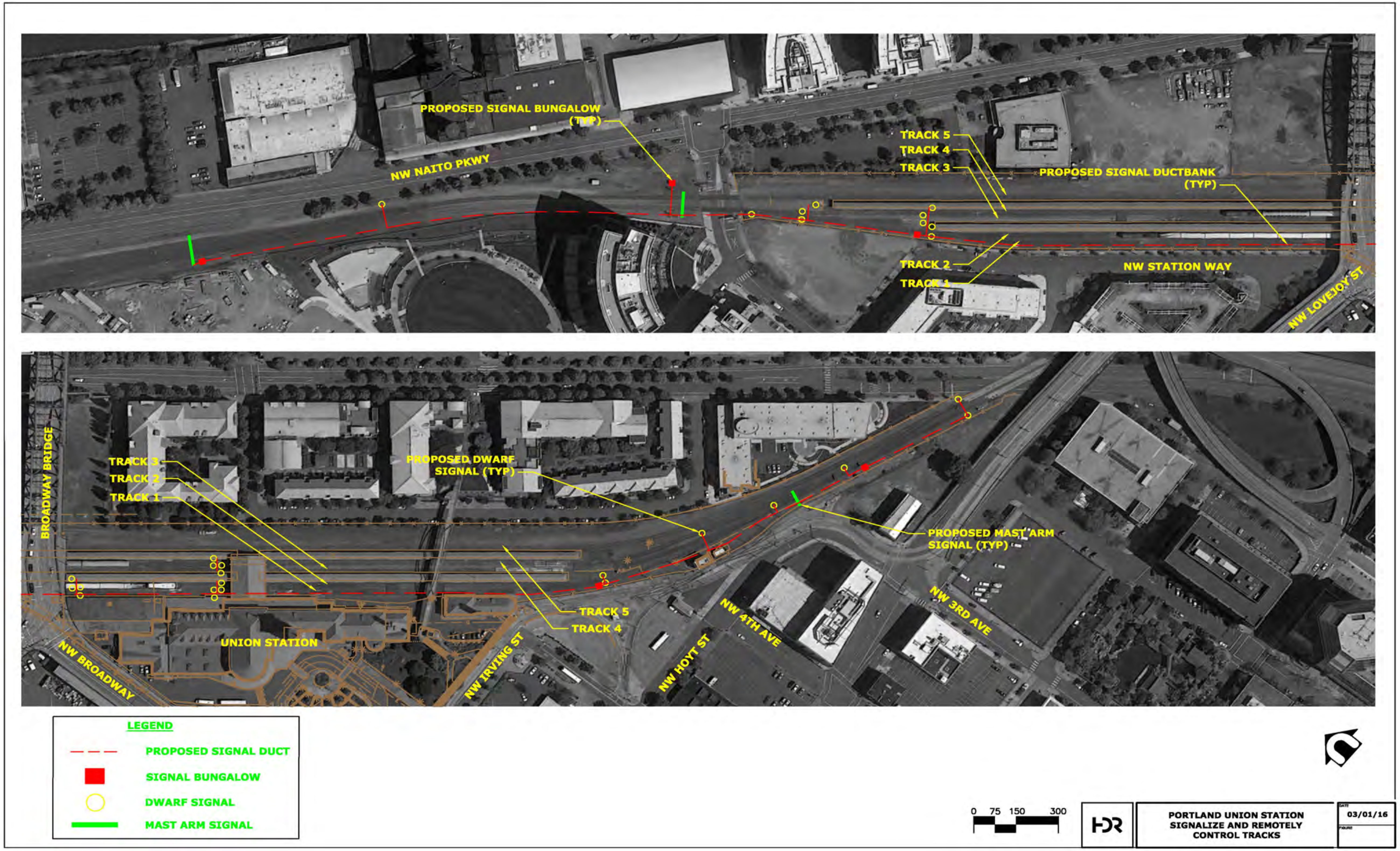
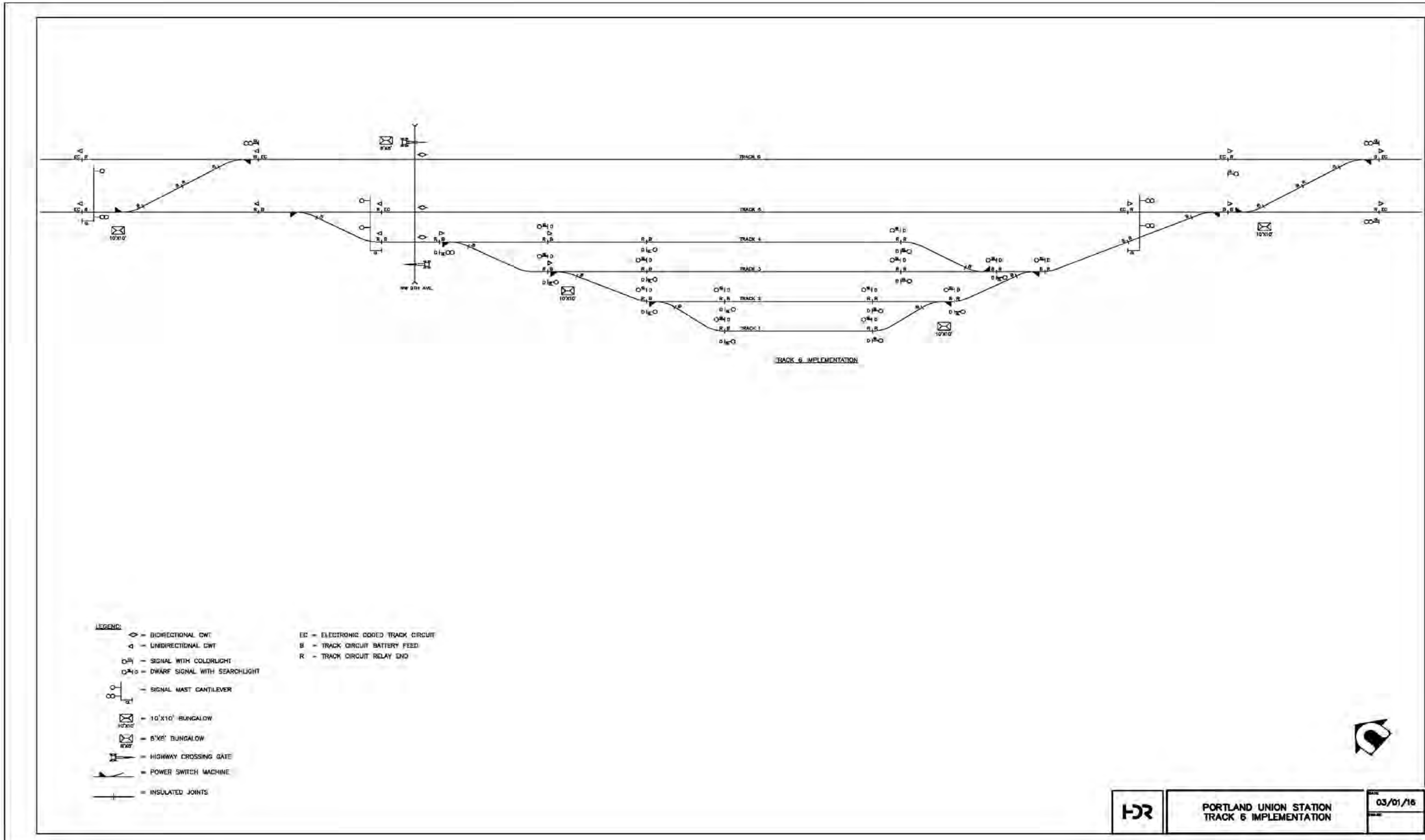


Figure 3 Signalization Line Diagram



Matrix 2 Signalize and Remotely Control All Tracks

SIGNALIZE AND REMOTELY CONTROL ALL TRACKS- DRAFT EVALUATION MATRIX

Evaluation Ratings: ● Positive Imapct □ Neutral Impact ◆ Negative Impact

Evaluation Criteria			Signalize and Remotely Control All Tracks					
			A	Signalize and Remotely Control All Tracks	B	No Signalization or remote control	C	
A: Ability to Meet Project Goals	A.1.	Accommodate Future Capacity and Operational Needs of Passenger and Freight Rail	●	Operations will be much more efficient with a signalized system, allowing for greater flexibility, easier coordination with the local railroad network, and switching movements that do not require the conductor to exit the train or ground personnel to walk to a switch (saving considerable time); Implementation will enable better freight movement through area; no impact to seismic or safety	◆	Inefficient operations may make it very difficult to achieve 2035 passenger train volumes		
	A.2.	Preserve and Protect the Historic Character of Union Station	●	No impact to historic features or finishes	□	No change		
	A.3.	Improve Economic and Social Vitality	●	Signalizing and remotely controlling the switches is considered necessary to accommodate the 2035 train volumes; higher capacity means more passengers accommodated, improving economic and social vitality; no impact to leased space marketability	□	No change		
	A.4.	Improve Environmental Sustainability	●	Powered and signalized switches will allow for the desired 2035 passenger train volumes and improve the ability of freight to move through the area - both will increase the mode share of passenger rail on the I-5 corridor, reducing emissions	□	No change		
B. Cost and Financing	B.1.	Estimated Capital Cost	◆	Requires purchasing turnouts, signals, and installing communications conduit between switches and the signal houses; Considered a medium to high potential cost with respect to other track improvements	□	No change		
	B.2.	Lifecycle Cost Impacts	●	Operations will be much more efficient with a signalized system, removing the requirement for an operator to walk to and physically throw a track switch, a considerable reduction in labor	◆	No immediate change, but as passenger volumes increase traffic through the station will be difficult to manage operationally and could cause delays		
	B.3.	Cost Risk	◆	Minimal risk associated with turnout procurement or installation. Signal equipment could be off the shelf. Risk associated with hazardous soils if encountered while excavating for conduit placement	□	No change		
	B.4.	Financial Leverage						
C. Implementability and Constructability	C.1.	Technical Complexity and Constructability	◆	Signaling design is typically very complex; Typical design parameters regarding buffer length between train berthing location and signal location can not be met, resulting in the potential that the future length of *Cascades* trains for use at Union Station may be limited. This would limit Amtrak's flexibility on the system, which could require policy changes from Amtrak. Medium construction duration relative to other track alternatives	□	No change		
	C.2.	Schedule and Schedule Risk	◆	High probability of schedule risk due to complex design, required approvals from FRA, Amtrak, and railroads	□	No change		
	C.3.	Impact on Passenger and Freight Rail Operations	◆	Medium to high degree of disruption to rail operations; No direct impact to passengers; Medium to high potential for temporary reduction in trackside capacity; High potential for impacts to freight	□	No change		
	C.4.	Impact on Union Station Tenants	□	Little impact to tenants due to construction noise in yard	□	No change		
	C.5.	Phasing and Project Segmentation	◆	Little to no ability to phase work; Little to no ability to accomplish independent of other work: other options dependent on signalizing and remotely controlling tracks include installing scissor crossovers, constructing Track 6, installing new switch machines, constructing a yardmaster control room in the station, and probably the installation of new platforms and canopies (due to the installation of conduits within the platform).	□	No change		
	C.6.	Risks, Assumptions and Unknowns	●	Low risk due to unforseen conditions in underground work; No risk of damage to historic features; Low ability to minimize risk of unforseen conditions underground	□	No change		
D. Environmental Impacts and Approvals	D.1	Environmental Impacts and Project Classification	●	No significant environmental impacts; High probability of categorical exclusion; Little to no risk due to NEPA	◆	Desired 2035 passenger train volumes will be difficult to achieve, reducing the environmental efficacy of the overall project		
	D.2	Historic Impacts and Approvals	●	No issues for historic review	□	No change		
	D.3	Decision Making and Approvals	◆	Medium to High risk of schedule delay due to Class 1 railroads, Amtrak, and FRA needing to approve change in track control system, both from an infrastructure as well as operational perspective	◆	Medium to High risk of schedule delay due to Class 1 railroads, Amtrak, and FRA needing to approve change in track control system, both from an infrastructure as well as operational perspective		

Estimate 2 Signalize and Remotely Control All Tracks

Signalize and Remotely Control All Tracks	
Right-of-Way / Real Estate	$ -
Utilities	$ -
Civil Construction	$ -
Grade Crossings	$ -
Platform	$ -
Special Trackwork	$ -
Trackwork	$ -
Special Conditions	$ -
Storm Water	$ -
Fueling	$ -
Rail Signaling	$3,952,941
Traffic Signaling	$ -
Subtotal	$3,952,941
Insurance (1.75% of Subtotal w/Allocated Contingencies Only)	$69,176
Allocated Contingency (by category)	$1,185,882
Eng. & Admin. (Calculated Including Allocated Contingencies Only)	$1,109,449
Total, 2016 $, No Overall Contingency	**$6,317,448**
Overall Contingency for Conceptual Level Design (30%)	$1,895,234
Total, 2016 $, with Contingency	**$8,212,682**
Total, 2035 $, No Overall Contingency	**$12,691,954**
Total, 2035 $, with Contingency	**$16,682,211**

Fuel Delivery System

Construct a new fueling system to replace the existing method of stretching hoses across the tracks from the Portland and Western Railroad (PWRR) access road. Fueling would occur entirely within the PDC-owned site. The system would be designed to be expanded to the south in the future if desired; the expansion south would mirror the north installation in terms of equipment and layout. The system would also accommodate the Diesel Emissions Fluid (DEF) additive required for newer locomotives.

Since the writing of the Existing Rail Infrastructure Report, Amtrak has provided the following direction on the conceptual design of this system:

1. no on-site fuel storage allowed
2. provide underground piping system with leak detection, and
3. fueling will be performed from a truck parked under the existing Butler Shed north of the station building

The evaluation matrix considers two options: the build option would construct the fuel pumping, piping and hose infrastructure needed to fuel from the north platforms, while the no-build option would not address fueling at Union Station now or in the future.

The estimate is separated out between above grade elements (such as pumps and fueling hoses) and below grade elements such as piping.

Conceptual Scope

- Construction of fueling and DEF equipment under the Butler Shed
- Underground piping with leak detection
- Piping underneath the existing platforms to hose reel cabinets on-platform

Recommendation

Implement the option, as the existing system is unsustainable from an operations and maintenance standpoint.

Figure 4 Fuel Delivery System

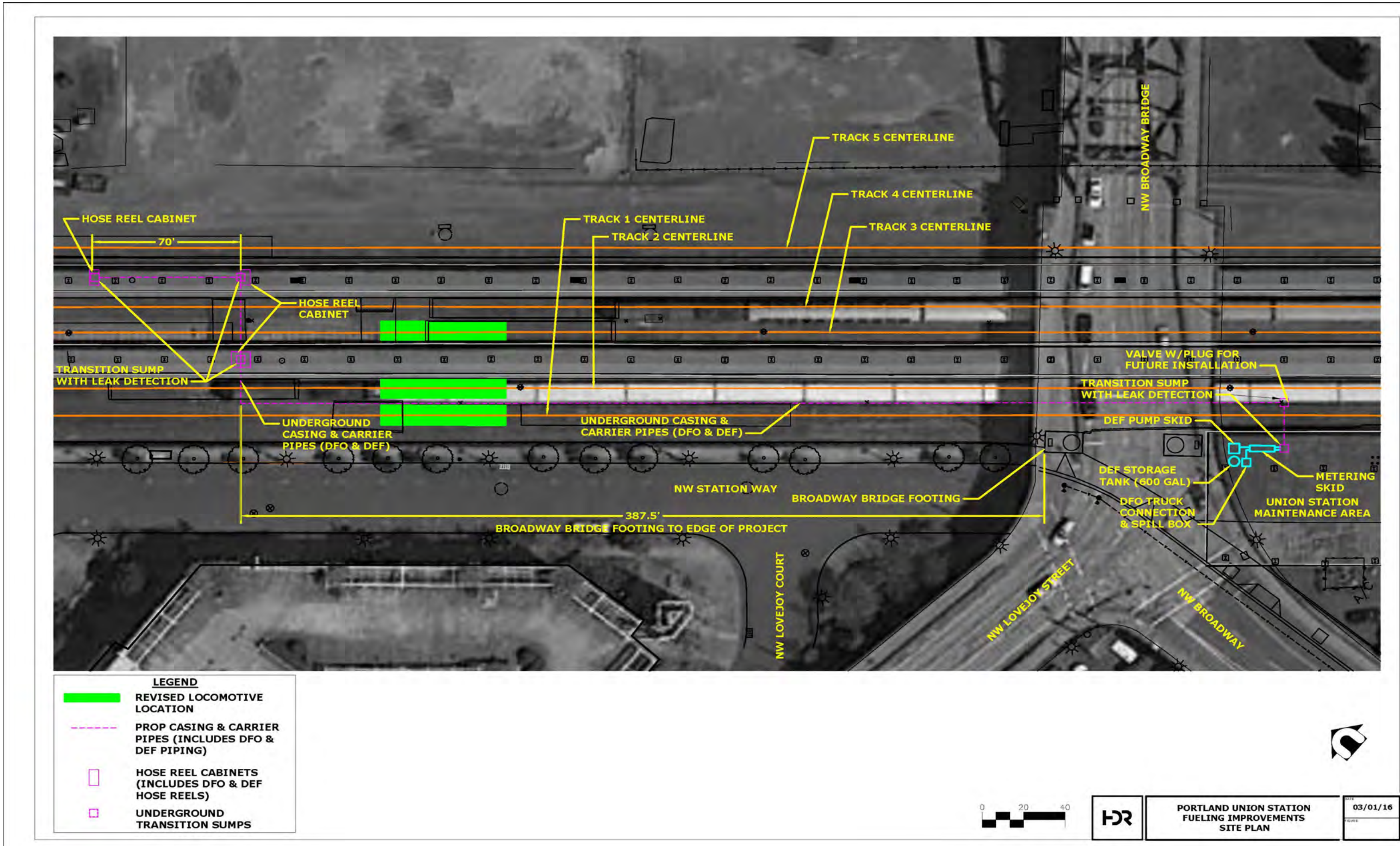
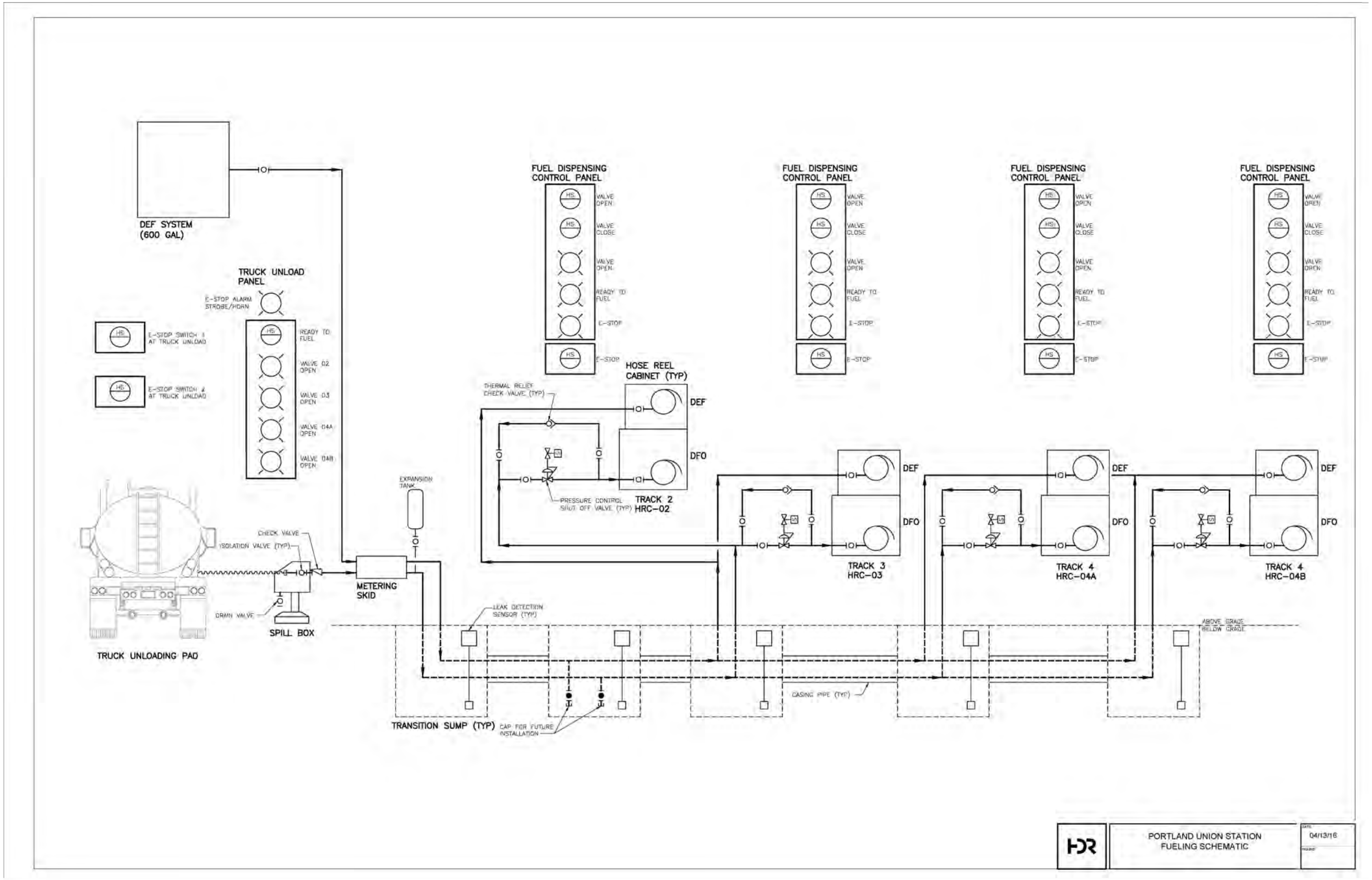


Figure 5 Fuel Delivery System Schematic



Matrix 3 Fuel Delivery System

FUEL DELIVERY SYSTEM - DRAFT EVALUATION MATRIX

Evaluation Ratings: ● Positive Imapct □ Neutral Impact ◆ Negative Impact

Evaluation Criteria			A	Fueling System at North End	B	Fueling System at both North and South Ends	C	No change
			FUEL DELIVERY SYSTEM					
A: Ability to Meet Project Goals	A.1.	Accommodate Future Capacity and Operational Needs of Passenger and Freight Rail	●	Decreased fueling time will enable meeting future capacity; Improved fueling will result in quicker turn-around, improving passenger experience; Fueling infrastructure will meet Amtrak operational needs and design standards; no freight impact; no ADA impact; no impact to site security	●	Fueling ability at both north and south ends of station will allow for even quicker train turn-around time and servicing time, further enabling future increased capacity; fueling infrastructure would meet Amtrak operational needs and design standards; no ADA impact; no freight impact; no impact to site security	◆	Future capacity increases can not be met if pulling fueling hoses over tracks is required; Does not improve the experience of passengers as delays can be expected due to fueling via dragged hose; Status quo does not meet Amtrak operating needs or design standards; Assuming status quo remains, freight is not impacted; no change to ADA accessibility; no change to site security
	A.2.	Preserve and Protect the Historic Character of Union Station	□	No impact to historic features or character; no impact to finishes or materials; improvements would be minimal, mostly underground, and approximately 700' north of building, reducing historic impact	□	No impact to historic features or character; no impact to finishes or materials; north improvements would be minimal, mostly underground, and approximately 700' north of building, reducing historic impact; south fueling improvements would be located near Annex, would need a parking space for the fueling truck, and would mostly be underground - minimal to no impact historically	□	No change
	A.3.	Improve Economic and Social Vitality	●	Improved fueling will enable the desired increase in passenger trains to the station, improving the economic vitality of the neighborhood; increasing passenger train volume will improve marketability of leased tenant spaces; no impact to building management or efficiency	●	Maximizing fueling efficiency would further enable the desired increase in passenger trains to the station, improving the economic vitality of the neighborhood; increasing passenger train volume will improve marketability of leased tenant spaces; no impact to building management or efficiency	◆	Future capacity increases can not be met if pulling fueling hoses over tracks is required, limiting passenger train volumes and thereby limiting the economic vitality of the neighborhood and marketability of tenant spaces; no change to building management or efficiency
	A.4.	Improve Environmental Sustainability	●	Implementation will provide regimented fueling procedures, will eliminate the potential for spills from dragged hoses, and will localize the fueling procedure to known, distinct areas	●	Implementation will provide regimented fueling procedures, will eliminate the potential for spills from dragged hoses, and will localize the fueling procedure to known, distinct areas	◆	Current method of stretching hose over active track causes the need to quickly remove the hose in the event a train is entering the station - this has caused minor fuel spills in the past
B. Cost and Financing	B.1.	Estimated Capital Cost	●	Low capital cost relative to other track alternatives	◆	Low to medium capital cost relative to other track alternatives	□	No change
	B.2.	Lifecycle Cost Impacts	●	Low to no change in operating cost to Amtrak for fueling; Low increase in operating cost due to monitoring of underground pipes	●	Low to no change in operating cost to Amtrak for fueling; Could see a lower operating cost from installing only north equipment due to reduction in train moves to position fueling for locomotive; Low increase in operating cost due to monitoring of underground pipes	□	No change
	B.3.	Cost Risk	□	Low to medium cost risk due to underground work - estimates assume contaminated soils	□	Low to medium cost risk due to underground work - estimates assume contaminated soils	◆	Continued risk of cost due to greater potential for fuel spill
	B.4.	Financial Leverage						
C. Implementability and Constructability	C.1.	Technical Complexity and Constructability	◆	May require stormwater system that can be shut off from city storm system in case of leakage. 13' track centers and limited platform space may impede adding overhead fueling cranes; leak monitoring system may be complex to design and implement; north-only construction duration would be shorter than north and south design	◆	May require stormwater system that can be shut off from city storm system in case of leakage. 13' track centers and limited platform space may impede adding overhead fueling cranes; leak monitoring system may be complex to design and implement; north-only construction duration would be shorter than north and south design	□	No change
	C.2.	Schedule and Schedule Risk	◆	Low schedule risk for design; High level of schedule risk due to permitting fuel lines and street impacts with state and local agencies; Medium level of risk due to unknown conditions underground	◆	Low schedule risk for design; High level of schedule risk due to permitting fuel lines and street impacts with state and local agencies; Medium level of risk due to unknown conditions underground	□	No change
	C.3.	Impact on Passenger and Freight Rail Operations	●	Relatively short duration of construction impacts to passengers and passenger trains; no impact to freight	●	Relatively short duration of construction impacts to passengers and passenger trains; no impact to freight	□	No change
	C.4.	Impact on Union Station Tenants	◆	Relatively short duration of construction impacts to passengers and passenger trains; low level of impact to tenants due to noise	◆	Relatively short duration of construction impacts to passengers and passenger trains; low level of impact to tenants due to noise	□	No change
	C.5.	Phasing and Project Segmentation	●	High ability to phase work to spread costs; High ability to accomplish independent of other work; High cost efficiencies to be gained by coordinating with platform and canopy replacement	●	High ability to phase work to spread costs; High ability to accomplish independent of other work; High cost efficiencies to be gained by coordinating with platform and canopy replacement	□	No change
	C.6.	Risks, Assumptions and Unknowns	□	13' track centers and limited platform space may impede adding overhead cranes; high likelihood of contaminated soils	◆	Amtrak maintenance and operations regarding future passenger train volumes have not yet been determined to benefit from addition of south fueling infrastructure; 13' track centers and limited platform space may impede adding overhead cranes; high likelihood of contaminated soils	◆	Status quo procedures for fueling expose owner and operator to high potential for spills; no risk of damage to historic features; establishment of operating procedures as only mitigation leaves open potential for future mistakes by fueling personnel
D. Environmental Impacts and Approvals	D.1	Environmental Impacts and Project Classification	●	Low risk of spills to be mitigated by training, procedures, containment, and shutoff that disconnects from city stormwater system; high likelihood of categorical exclusion; low risk of schedule delay due to NEPA	●	Low risk of spills to be mitigated by training, procedures, containment, and shutoff that disconnects from city stormwater system; high likelihood of categorical exclusion; low risk of schedule delay due to NEPA	◆	Status quo procedures for fueling expose owner and operator to high potential for spills; no risk of damage to historic features; establishment of operating procedures as only mitigation leaves open potential for future mistakes by fueling personnel
	D.2	Historic Impacts and Approvals	●	No impacts due to historic review and approval	●	No impacts due to historic review and approval	□	No change
	D.3	Decision Making and Approvals	□	Low to no risk of delay due to approval from Amtrak, freight or FRA; High level of scheduling risk due to local and state permitting needs; Rigorous local and state permitting requirements	◆	High level of schedule risk due to need for Amtrak to determine whether future schedule and operations will benefit from south infrastructure; Low to no risk of delay due to approval from freight or FRA; High level of scheduling risk due to local and state permitting needs; Rigorous local and state permitting requirements	●	No change

Estimate 3 Fuel Delivery System

Fuel Delivery System	Above Grade	Below Grade
Right-of-Way / Real Estate	$ -	$ -
Utilities	$ -	$84,775
Civil Construction	$45,000	$ -
Grade Crossings	$ -	$ -
Platform	$ -	$ -
Special Trackwork	$ -	$ -
Trackwork	$ -	$ -
Special Conditions	$ -	$ -
Storm Water	$400	$ -
Fueling	$182,000	$305,875
Rail Signaling	$ -	$ -
Traffic Signaling	$ -	$ -
Subtotal	$227,400	$390,650
Insurance (1.75% of Subtotal w/Allocated Contingencies Only)	$3,980	$6,836
Allocated Contingency (by category)	$68,200	$121,434
Eng. & Admin. (Calculated Including Allocated Contingencies Only)	$88,680	$153,625
Total, 2016 $, No Overall Contingency	**$388,260**	**$672,545**
Overall Contingency for Conceptual Level Design (30%)	$116,478	$201,764
Total, 2016 $, with Contingency	**$504,737**	**$874,309**
Total, 2035 $, No Overall Contingency	**$780,578**	**$1,352,237**
Total, 2035 $, with Contingency	**$1,025,260**	**$1,775,961**

Relocate and Reduce the Width of the Passenger Crossing

Relocate and reduce the width and location of the passenger crossing in order to maximize the available space for trains south of the passenger crossing. Reducing the passenger crossing will allow for the loading of passengers on the *Cascades* routes south of the crossing, increasing overall station capacity.

The evaluation matrix considers two options: the build option would relocate the passenger crossing location and reduce the overall width of the passenger crossing; and the no-build option would leave the passenger crossing in place with no modification.

Conceptual Scope

- Demolition of existing passenger crossing
- Reconstruction of the existing passenger crossing in new location farther north

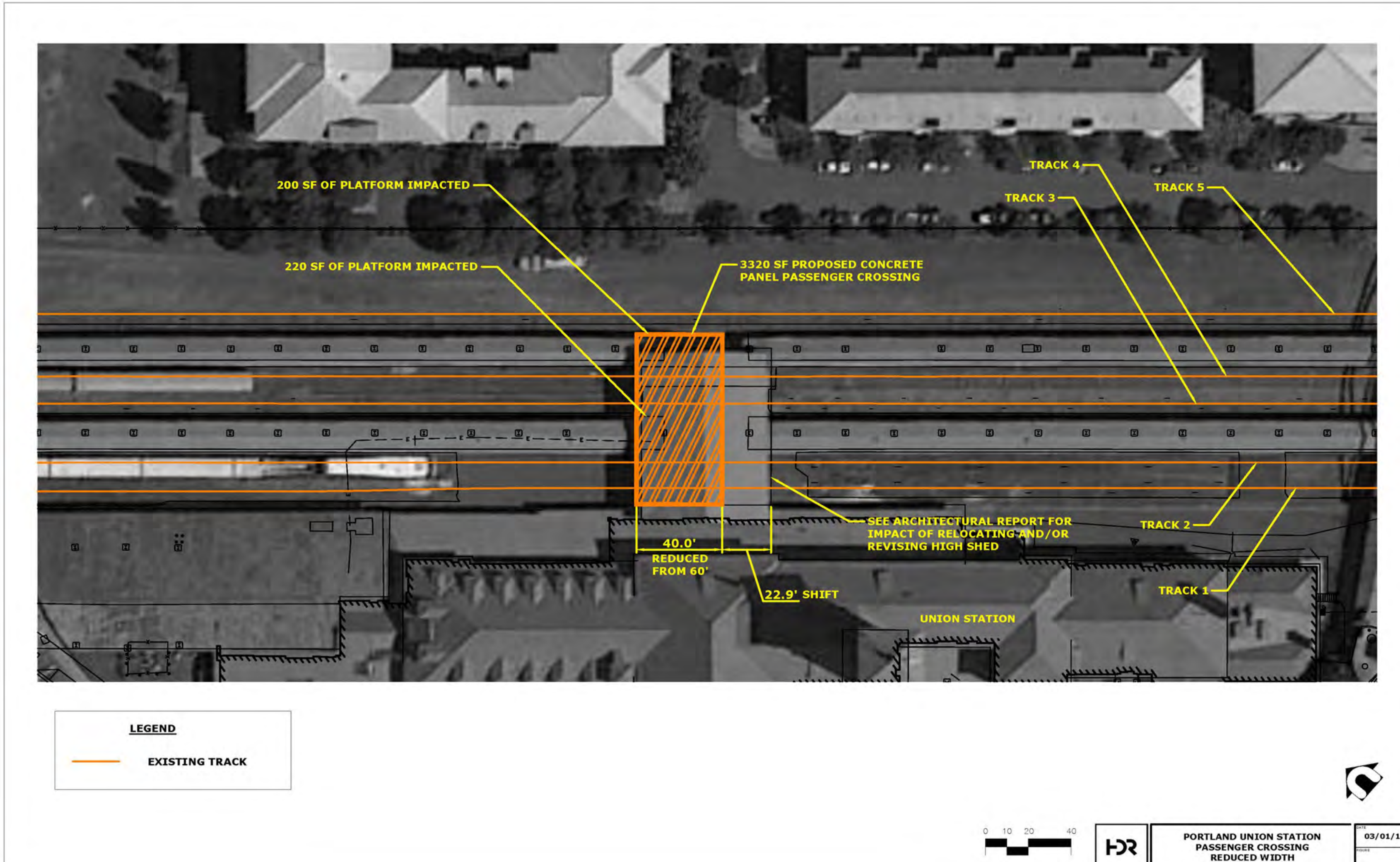
Recommendation

Implement the relocation and reduction of the passenger crossing. Passenger loading south of the passenger crossing must be available in order to achieve the anticipated 2035 train volumes.

Several key assumptions regarding train length are driving specifics of this recommendation. We recommend the adoption of a system-wide, defined and accepted design train length that all parties can agree upon, a detailed 2035 train schedule showing berthing locations at Union Station, and an accepted operating plan that limits boarding south of the crossing to the northern end of the trains where the tracks are tangent.

The cost presented below does not include the cost for reconstructing the overhead “high shed” canopy.

Figure 6 Relocate and Reduce the Width of the Passenger Crossing



Matrix 4 Relocate and Reduce the Width of the Passenger Crossing

RELOCATE PASSENGER CROSSING AND REDUCE WIDTH - DRAFT EVALUATION MATRIX

Evaluation Ratings: ● Positive Impact □ Neutral Impact ◆ Negative Impact

Evaluation Criteria			SCISSOR CROSSOVER					
			A	Modify Passenger Crossing	B	Do not modify passenger crossing	C	
A: Ability to Meet Project Goals	A.1.	Accommodate Future Capacity and Operational Needs of Passenger and Freight Rail	●	Modification will allow berthing of Cascades trains south of the crossing, which will help accommodate future capacity. No impact to freight, security, or seismic issues.	◆	No immediate impact, but it may prove impossible to reach the desired 2035 passenger train volumes without being able to load passengers onto Cascades trains south of the crossing		
	A.2.	Preserve and Protect the Historic Character of Union Station	□	Relocating the passenger crossing requires reconstructin of the high shed. The high shed covering the passenger crossing has been changed in the past, so altering the location and/or width is likely not considered a significant impact. Location and width must accommodate future passenger flow into and out of building. Design could accommodate historic finishes and character	◆	Preserves the existing passenger crossing - Existing high shed is structurally and seismically deficient and would likely need to be rebuilt to meet current codes		
	A.3.	Improve Economic and Social Vitality	●	Implementation will help accommodate future capacity. This would contribute to the economic vitality of both the neighborhood and the buiding by improving passenger rail travel through the corridor. Increased passenger flow will increase quality and marketability of the station. No impact to building managment or efficiency	◆	No immediate change, but as passenger volumes increase not being able to berth the cascades consists on the south side will negatively impact operations and could cause delays.		
	A.4.	Improve Environmental Sustainability	●	Reconfiguring the passenger crossing will allow for future increased volumes of train traffic, improving mode share of passenger rail along the I-5 corridor and reducing emissions; no impact to stormwater or hazardous materials; no effect on LEED status	□	No change		
B. Cost and Financing	B.1.	Estimated Capital Cost	◆	The relocation of the crossing itself is considered low capital cost, but this will require the reconfiguration of the high shed over the crossing, which would be considered a medium-high cost	□	No change		
	B.2.	Lifecycle Cost Impacts	□	Assuming that there are no ongoing maintenance costs associated with the existing high shed, no changes to operational or maintenance costs	□	No change		
	B.3.	Cost Risk	◆	Requires reconfiguring high shed, which would probably require reconfiguring the adjacent platforms and canopies, which would be a high cost effort	□	No change		
	B.4.	Financial Leverage	□	Unknown	□	No change		
C. Implementability and Constructability	C.1.	Technical Complexity and Constructability	◆	Relocation requires reconfiguring high shed, which will require a significant architectural effort to obtain agreement from all parties. Selection of materials and form for high shed would need to consider constructibility and cost. Construction timeframe would be increased due to need to serve passengers throughout construction.	□	No change		
	C.2.	Schedule and Schedule Risk	◆	Should be considered a longer time-frame for design due to the visual impact from reconstructing the high shed; obtaining buy-in from all parties will take longer during early stages of design. Unforseen conditions will exist due to need to construct footings for high shed	□	No change		
	C.3.	Impact on Passenger and Freight Rail Operations	◆	High degree of impact to passenger travel during construction. Construction staging will need to allow for continued passenger travel; this could increase construction time. Could realize reduction in station capacity during construction. No impact to freight operations	□	No change		
	C.4.	Impact on Union Station Tenants	◆	Tenant most impacted will be Amtrak operations. High degree of potential for construction noise outside of station building	□	No change		
	C.5.	Phasing and Project Segmentation	◆	Low potential to phase relative to other improvements, as relocating the passenger crossing requires reconstruction of the adjacent platforms, canopies, and high shed. Potential for efficiencies if similar materials are used on platform canopies as on high shed	□	No change		
	C.6.	Risks, Assumptions and Unknowns	◆	High level of risk that the final width and location of the passenger crossing will depend on an agreed-upon design train length for the future as well as a detailed 2035 schedule showing berthing locations at Union Station - obtaining this agreement from Amtrak, ODOT, and WSDOT may delay schedule significantly. It may be that operational changes that allow for boarding only certain cars at Union Station may also be required (since the platforms are curved at the south end), requiring approval from Amtrak, ODOT and WSDOT	□	No change		
D. Environmental Impacts and Approvals	D.1	Environmental Impacts and Project Classification	●	Low potential impact to historical nature since high shed has been altered several times in the past. High likelihood of eligibility for categorical exclusion. Low risk to NEPA process and approvals	◆	No immediate change, but as passenger volumes increase not being able to berth the cascades consists on the south side will negatively impact operations and could cause delays, reducing the effectiveness of the station to serve more trains.		
	D.2	Historic Impacts and Approvals	●	Team has concluded that there is low potential impact to historical nature since high shed has been altered several times in the past. SHPO recognizes the transporation need of revising the passenger crossing and high shed. Could see increased design time to obtain buy-in from community regarding redesign of shed materials.	□	No change		
	D.3	Decision Making and Approvals	◆	Reconfiguring high shed may require public approval process on new look and feel of shed and canopies. Approvals process could increase schedule. Similar permitting requirements as the rest of the project.	□	No change		

Estimate 4 Relocate and Reduce the Width of the Passenger Crossing

Relocate and Reduce the Width of the Passenger Crossing	
Right-of-Way / Real Estate	$ -
Utilities	$ -
Civil Construction	$22,496
Grade Crossings	$ -
Platform	$ -
Special Trackwork	$ -
Trackwork	$ -
Special Conditions	$ -
Storm Water	$ -
Fueling	$ -
Rail Signaling	$ -
Traffic Signaling	$ -
Subtotal	$22,496
Insurance (1.75% of Subtotal w/Allocated Contingencies Only)	$396
Allocated Contingency (by category)	$5,624
Eng. & Admin. (Calculated Including Allocated Contingencies Only)	$8,436
Total, 2016 $, No Overall Contingency	**$36,950**
Overall Contingency for Conceptual Level Design (30%)	$11,085
Total, 2016 $, with Contingency	**$48,035**
Total, 2035 $, No Overall Contingency	**$75,056**
Total, 2035 $, with Contingency	**$97,573**

Install Powered Scissor Crossovers

Install powered scissor crossovers within the station limits in order to provide the flexibility to move trains from track to track and from north of the passenger crossing to south of the passenger crossing, without fouling the main lines, and allowing for multiple trains on site throughout the day.

The evaluation matrix considers five options:

- Construct a set of crossovers for Tracks #1 and #2
- Construct a set of crossovers for Tracks #3 and #4
- Construct both sets of scissor crossovers
- Construct only platform modifications and utility infrastructure to accommodate scissors at a later date
- The no-build option would leave the existing track configuration in place.

Conceptual Scope

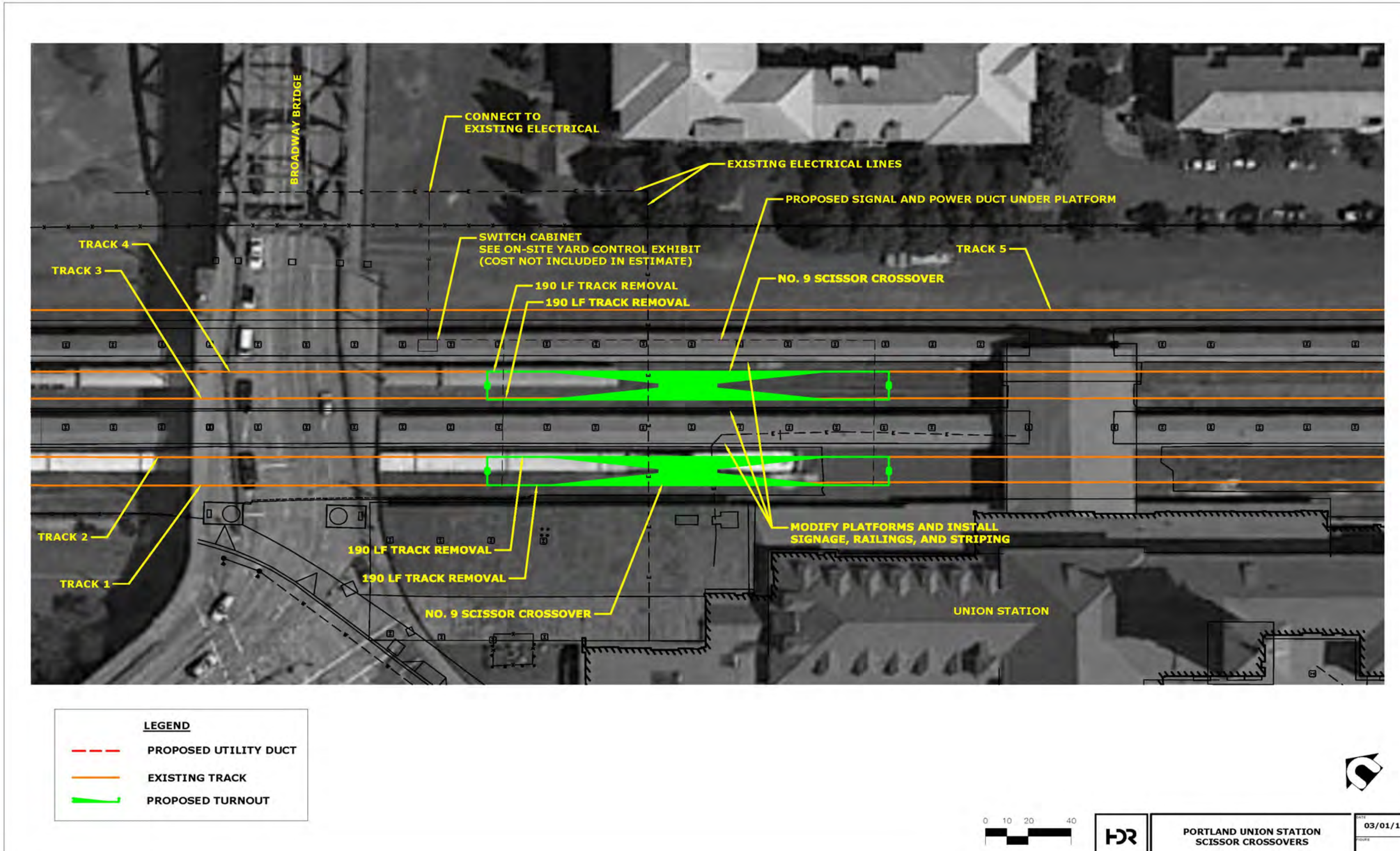
- Install crossovers
- Install power to crossovers

Recommendation

Do not install either crossover at this time. Concerns regarding the safety of installing crossovers within the station limits, the limited space available for signal buffers, as well as the reliance on train schedule assumptions and no modeling for the station make the installation prohibitive.

It is recommended that a detailed, system-wide 2035 schedule be developed and adopted by Amtrak and PDC, including defined train berthing locations within Union Station. An additional recommendation includes acceptance of the use of Track 1 north for maintenance prior to proceeding with future crossover construction.

Figure 7 Install Powered Scissor Crossovers



Matrix 5 Install Powered Scissor Crossovers

INSTALL POWERED SCISSOR CROSSOVERS - DRAFT EVALUATION MATRIX

Evaluation Ratings: ● Positive Impact □ Neutral Impact ◆ Negative Impact

Evaluation Criteria		SCISSOR CROSSOVERS									
		A	Scissors between TK 1 & 2	B	Scissors between TK 3 & 4	C	Both Scissors Installed	D	Construct Plaform and Utility Modifications Only	E	No Scissors
A: Ability to Meet Project Goals	A.1. Accommodate Future Capacity and Operational Needs of Passenger and Freight Rail	●	Postively impacts future station station capacity by providing greater flexibility within the station. Allows for option of performing overnight maintenance on Track 1 north, which is required for level boarding. Provides less flexibility and capacity than scissors in both locations	□	Postively impacts station capacity by providing greater flexibility, but does not help with performing overnight maintenance on Track 1 north, which is required for level boarding. Provides less flexibility and capacity than scissors on both tracks.	●	Maximized the impact on capacity by providing the most flexibility for future operations; Allows for the option of performing overnight maintenance on Track 1 north, required for level boarding	□	Design does not provide flexibility for increased capacity but does allow for easier installation of scissors in the future	◆	Does not provide flexibility required to operate at desired 2035 passenger train volumes; Does not provide added flexibility for maintenance only on Track 1 north.
	A.2. Preserve and Protect the Historic Character of Union Station	□	No impact to historic features or finishes	□	No impact to historic features or finishes	□	No impact to historic features or finishes	□	No impact to historic features or finishes	□	No change
	A.3. Improve Economic and Social Vitality	□	One scissor crossover will increase train capacity through the station, improving economic vitality of neighborhood; no impact to marketability of leased spaces	□	One scissor crossover will increase train capacity through the station, improving economic vitality of neighborhood; no impact to marketability of leased spaces	●	Two crossovers wil maximize train capacity through the station and provide most flexibility, maximizing the positive effect on neighborhood vitality; no impact to marketability of leased spaces	□	No change	□	No change
	A.4. Improve Environmental Sustainability	●	No impact to LEED rating; implementation could increase train capacity through the station, improving the mode share of passenger rail in the corridor and reducing emissions; no impact to stormwater	●	No impact to LEED rating; Implementation could increase train capacity through the station, improving the mode share of passenger rail in the corridor and reducing emissions; no impact to stormwater	●	No impact to LEED rating; Maximizes train capacity through the station and provides most flexibility, presumably maximizing the increase in mode share for passenger rail within the corridor and helping reduce emissions; no impact to stormwater	□	No change	□	No change
B. Cost and Financing	B.1. Estimated Capital Cost	◆	Similar cost for installing on Tracks 3 & 4. Cost of four turnouts and their installation. Design would also require modifications to platform geometry and safety and security measures on one platform for an additional cost	◆	Similar cost for installing on Tracks 1 & 2. Cost of four turnouts and their installation. Design would require modifications to platform geometry and safety and security measures on one platform for an additional cost	◆	Most expensive alternative. Cost of eight turnouts and their installation. Design would require modifications to platform geometry and safety and security measures of two platforms for an additional cost.	●	Low cost for platform reconfiguration and utility stub ups for future use	□	No change
	B.2. Lifecycle Cost Impacts	◆	Similar cost for installing on Tracks 3 & 4. Would require new Amtrak staff position to be trained and empowered to operate switches within the station	◆	Similar cost for installing on Tracks 1 & 2. Would require new Amtrak staff position to be trained and empowered to operate switches within the station	◆	Most expensive alternative - higher life cycle cost due to more turnouts installed. Would require Amtrak staff position to be trained and empowered to operate switches within the station	□	No change	□	No change
	B.3. Cost Risk	◆	High design cost uncertainty due to need to gain approval from Amtrak, FRA, and Class 1 railroads	◆	High design cost uncertainty due to need to gain approval from Amtrak, FRA, and Class 1 railroads for scissors. Medium to high cost risk due to need to get design approval for platform modifications from Amtrak, FRA	◆	High design cost uncertainty due to need to gain approval from Amtrak, FRA, and Class 1 railroads for scissors. Medium to high cost risk due to need to get design approval for platform modifications from Amtrak, FRA	□	Medium to high cost risk due to need to get design approval for platform modifications from Amtrak, FRA	□	No change
	B.4. Financial Leverage										
C. Implementability and Constructability	C.1. Technical Complexity and Constructability	◆	Safety measures requested by stakeholders will require extensive design and coordination efforts; Medium level of construction time relative to other track alternatives	◆	Safety measures and platform modifications requested by stakeholders will require extensive design and coordination effort; Medium level of construction time relative to other track alternatives	◆	Safety measures and platform modifications requested by stakeholders will require extensive design and coordination efforts; Medium level of construction time relative to other track alternatives. High level of complexity for design modifications to platform	◆	Safety measures and platform modifications requested by stakeholders will require extensive design and coordination effort	□	No change
	C.2. Schedule and Schedule Risk	◆	Approvals from stakeholders (Amtrak, FRA, ODOT) considered a significant design schedule risk	◆	Approvals from stakeholders (Amtrak, FRA, ODOT) considered a significant design schedule risk	◆	Approvals from stakeholders (Amtrak, FRA, ODOT) considered a significant design schedule risk	◆	Approvals from stakeholders (Amtrak, FRA, ODOT) considered a significant design schedule risk	□	No change
	C.3. Impact on Passenger and Freight Rail Operations	◆	High degree of impact to passenger train operations during implementation - detailed staging plans will be required; High degree of impacts to passengers; High degree of temporary reduction in trackside capacity; no freight rail impacts	◆	High degree of impact to passenger train operations during implementation - detailed staging plans will be required; High degree of impacts to passengers; High degree of temporary reduction in trackside capacity; no freight rail impacts	◆	High degree of impact to passenger train operations during implementation - detailed staging plans will be required; High degree of impacts to passengers; High degree of temporary reduction in trackside capacity; no freight rail impacts	◆	High degree of impact to passenger train operations during implementation - detailed staging plans will be required; High degree of impacts to passengers; High degree of temporary reduction in trackside capacity; no freight rail impacts	□	No change
	C.4. Impact on Union Station Tenants	●	Little to no impacts to tenants	●	Little to no impacts to tenants	●	Little to no impacts to tenants	●	Little to no impacts to tenants	□	No change
	C.5. Phasing and Project Segmentation	◆	Low ability to phase work to spread costs; Implementation would require the need to power up and signalized all switches, to employ a yardmaster at the station, and construct a switch control facility at the station; High ability to gain cost efficiencies through combination with other track alternatives	◆	Low ability to phase work to spread costs; Implementation would require the need to power up and signalized all switches, to employ a yardmaster at the station, and construct a switch control facility at the station; High ability to gain cost efficiencies through combination with other track alternatives. Platform modification would require reconstruction of canopy	◆	Low ability to phase work to spread costs; Implementation would require the need to power up and signalized all switches, to employ a yardmaster at the station, and construct a switch control facility at the station; High ability to gain cost efficiencies through combination with other track alternatives. Platform modification would require reconstruction of canopy	◆	Low ability to phase work to spread costs; Low ability to accomplish work independent of other track alternatives - Platform modification would require reconstruction of canopy; high potential for efficiencies if combined with other utility work	□	No change
	C.6. Risks, Assumptions and Unknowns	◆	The minimal scheduling and routing within the station performed so far has led to conservative assumptions regarding the need for the scissor crossings - it could be that further modeling and/or detailed scheduling will prove scissors are not needed; High ability to minimize risk through further analysis	◆	The minimal scheduling and routing within the station performed so far has led to conservative assumptions regarding the need for the scissor crossings - it could be that further modeling and/or detailed scheduling will prove scissors are not needed; High ability to minimize risk through further analysis	◆	The minimal scheduling and routing within the station performed so far has led to conservative assumptions regarding the need for the scissor crossings - it could be that further modeling and/or detailed scheduling will prove scissors are not needed; High ability to minimize risk through further analysis	◆	The minimal scheduling and routing within the station performed so far has led to conservative assumptions regarding the need for the scissor crossings - it could be that further modeling and/or detailed scheduling will prove scissors are not needed; High ability to minimize risk through further analysis	◆	Without modeling the station and surrounding rail network beyond the minimal amount of work to date, it is difficult to draw conclusions regarding whether or not the station and surrounding network could operate at the desired 2035 volumes. The minimal scheduling and routing within the station performed so far has led to conservative assumptions regarding the need for the scissor crossings
D. Environmental Impacts and Approvals	D.1 Environmental Impacts and Project Classification	□	No adverse effects; High likelihood of categorical exclusions as this would fill a need for operations; No risk of delay due to NEPA	●	No adverse effects; High likelihood of categorical exclusions as this would fill a need for operations; No risk of delay due to NEPA	●	No adverse effects; High likelihood of categorical exclusions as this would fill a need for operations; No risk of delay due to NEPA	●	No adverse effects; High likelihood of categorical exclusions as this would fill a need for operations; No risk of delay due to NEPA	□	No changes
	D.2 Historic Impacts and Approvals	□	No issues of concern for historic review	□	No issues of concern for historic review	□	No issues of concern for historic review	□	No issues of concern for historic review	□	No changes
	D.3 Decision Making and Approvals	◆	FRA and Amtrak continue to express reluctance to accept scissors within a station area, though designs are only conceptual. It may be that, despite further design revisions to accommodate stakeholder concerns, approval may prove unachievable	◆	FRA and Amtrak continue to express reluctance to accept scissors within a station area, though designs are only conceptual. It may be that, despite further design revisions to accommodate stakeholder concerns, approval may prove unachievable. FRA and Amtrak have expressed concern over dynamic envelope of train through scissor and the impact this would have on the platforms - impacts to platform widths and geometry could be extensive. Platform design would also impact canopy design	◆	FRA and Amtrak continue to express reluctance to accept scissors within a station area, though designs are only conceptual. It may be that, despite further design revisions to accommodate stakeholder concerns, approval may prove unachievable. FRA and Amtrak have expressed concern over dynamic envelope of train through scissor and the impact this would have on the platforms - impacts to platform widths and geometry could be extensive. Platform design would also impact canopy design	◆	FRA and Amtrak have expressed concern over dynamic envelope of train through scissor and the impact this would have on the platforms - impacts to platform widths and geometry could be extensive. Platform design would also impact canopy design	□	No changes

Estimate 5 Install Powered Scissor Crossovers

Install Powered Scissor Crossovers	
Right-of-Way / Real Estate	$ -
Utilities	$32,790
Civil Construction	$ -
Grade Crossings	$ -
Platform	$ -
Special Trackwork	$920,000
Trackwork	$19,760
Special Conditions	$200,000
Storm Water	$ -
Fueling	$ -
Rail Signaling	$ -
Traffic Signaling	$ -
Subtotal	$1,172,550
Insurance (1.75% of Subtotal w/Allocated Contingencies Only)	$20,520
Allocated Contingency (by category)	$360,417
Eng. & Admin. (Calculated Including Allocated Contingencies Only)	$443,690
Total, 2016 $, No Overall Contingency	**$1,943,176**
Overall Contingency for Conceptual Level Design (30%)	$582,953
Total, 2016 $, with Contingency	**$2,526,129**
Total, 2035 $, No Overall Contingency	**$3,947,124**
Total, 2035 $, with Contingency	**$5,131,261**

Shorten the Existing Platforms

The Existing Rail Infrastructure and Operations Report presented the option of extending the existing platforms to the south in order to extend the length of the platform available for *Cascades* service boarding and alighting. However, the track geometry is such that extending the platforms south will result in boarding cars along a curved platform, which isn't recommended because the gap between the car and the platform then varies. The build option then becomes *shortening* the platform to coincide with the limits of straight track. The option also includes paving a section of track to allow for a baggage cart path to the station.

The evaluation matrix considers two options: the build option shortens both platforms and constructs a baggage cart path; the no-build option leaves the existing configuration in place.

Conceptual Scope

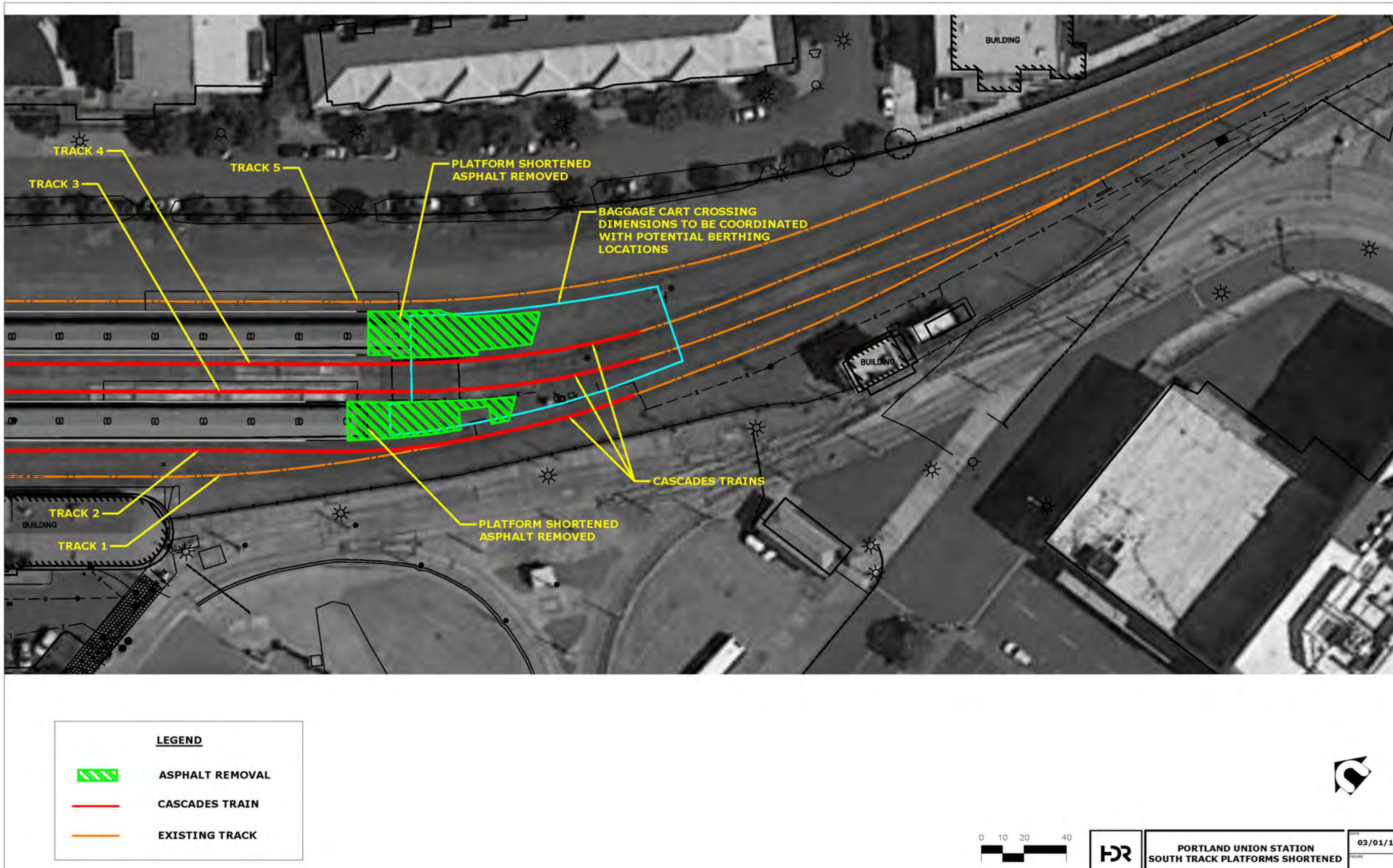
- Shorten existing platforms
- Construct baggage cart path

Recommendation

Shorten both platforms and construct baggage cart path.

We also recommend a design train length be determined and agreed to by all parties. This option also would require an operating plan by Amtrak that does not allow for boarding in Portland in the southern-most cars; this would need to be endorsed by Amtrak.

Figure 8 Shorten the Existing Platforms



Matrix 6 Shorten the Existing Platforms

SHORTEN EXISTING PLATFORMS - DRAFT EVALUATION MATRIX

Evaluation Ratings: ● Positive Imapct □ Neutral Impact ◆ Negative Impact

Evaluation Criteria			Extend Existing Platforms South			
			A	Shorten the Existing Platforms / Construct Baggage Cart Path	B	Do not shorten platforms
A: Ability to Meet Project Goals	A.1.	Accommodate Future Capacity and Operational Needs of Passenger and Freight Rail	●	Postively impacts station capacity by accommodating the berthing of trains south of the passenger crossing; Meets the operating needs and design standards of Amtrak by shortening platforms to adjacent to tangent track only; No freight impacts; Improves ADA accessibility due to removal of curved platform; No impact to safety or security; improves Amtrak operations by adding baggage cart path	◆	No change to passenger train capacity; Does not meet the operating needs or design standards of Amtrak due to curved platforms adjacent to passenger and baggage cars; No freight impacts; Reduces ADA accessibility due to potential for curved platforms adjacent to passenger cars; No impact to safety or security
	A.2.	Preserve and Protect the Historic Character of Union Station	□	No change	□	No change
	A.3.	Improve Economic and Social Vitality	□	No change	□	No change
	A.4.	Improve Environmental Sustainability	□	No change	□	No change
B. Cost and Financing	B.1.	Estimated Capital Cost	●	Low cost magnitude relative to other track alternatives	□	No change
	B.2.	Lifecycle Cost Impacts	●	Low to no lifecycle cost increases	□	No change
	B.3.	Cost Risk	●	Low cost uncertainty due to unknowns with potential underground construction	□	No change
	B.4.	Financial Leverage				
C. Implementability and Constructability	C.1.	Technical Complexity and Constructability	●	Low level of technical complexity - standard methods and materials assumed; relatively short timeframe when compared to other track alternatives	□	No change
	C.2.	Schedule and Schedule Risk	◆	High degree of schedule risk due to required approvals and operational changes required from Amtrak; Low risk of delays and low schedule risk once approvals and operational changes from Amtrak are received	□	No change
	C.3.	Impact on Passenger and Freight Rail Operations	◆	High degree of impact on passenger operations during construction - these disruptions would need to be mitigated through concerted effort during construction staging; High potential to reduce station capacity during construction; No freight impacts	□	No change
	C.4.	Impact on Union Station Tenants	●	Low level of technical complexity - standard methods and materials assumed; relatively short timeframe when compared to other track alternatives	□	No change
	C.5.	Phasing and Project Segmentation	◆	Low ability to phase work to spread costs; Low ability to implement independent of other alternatives - can be independent, but there is a high ability for schedule and cost efficiencies when paired with replacement of platform canopies and/or constructing 15" high platforms. However, platform alterations tied directly to train lengths, track 6 implementation, passenger crossing location, and scissor crossover installation	□	No change
	C.6.	Risks, Assumptions and Unknowns	◆	Low potential for unknown ground conditions below existing platform; High risk due to reliance on assumption that operational changes from Amtrak can be obtained to shorten platforms - no boarding will be available south of tangent track - decision coincides with need to determine future train length and berthing locations; low risk to historic features - platforms have changed multiple times over the years; High ability to mitigate risk due to assumptions before implementation through agreement on operational changes from Amtrak	□	No change
D. Environmental Impacts and Approvals	D.1	Environmental Impacts and Project Classification	●	Low potential for environmental impacts or adverse effects; High likelihood of categorical exclusion; No schedule risk due to NEPA	□	No change
	D.2	Historic Impacts and Approvals	●	No impacts due to historic features; Low risk associated with historic reviews & approvals since this would be considered a transportation change and the platforms have been altered throughout the years; no schedule risk associated with historic reviews process	□	No change
	D.3	Decision Making and Approvals	●	No key stakeholder or regulatory approvals associated with alternative; No permitting or regulatory requirements risk	□	No change

Estimate 6 Shorten the Existing Platforms

Shorten Existing Platforms	
Right-of-Way / Real Estate	$ -
Utilities	$ -
Civil Construction	$34,052
Grade Crossings	$ -
Platform	$ -
Special Trackwork	$ -
Trackwork	$ -
Special Conditions	$ -
Storm Water	$ -
Fueling	$ -
Rail Signaling	$ -
Traffic Signaling	$ -
Subtotal	$34,052
Insurance (1.75% of Subtotal w/Allocated Contingencies Only)	$596
Allocated Contingency (by category)	$8,513
Eng. & Admin. (Calculated Including Allocated Contingencies Only)	$12,770
Total, 2016 $, No Overall Contingency	**$55,931**
Overall Contingency for Conceptual Level Design (30%)	$16,779
Total, 2016 $, with Contingency	**$72,710**
Total, 2035 $, No Overall Contingency	**$113,611**
Total, 2035 $, with Contingency	**$147,695**

Construct Track #6

Rebuilding Track #6, which was removed in the mid - 1990s, allows for a second freight main adjacent to the station yard. Freight trains would use Tracks #5 and #6 exclusively, and would not need to enter the yard on Track #4, allowing for the increased flexibility needed for increased passenger train volumes.

The evaluation matrix considers three options: construct Track #6 to the west of the Broadway Bridge pier, alter the platform between Tracks 4 & 5, and shift Track #5 to accommodate freight trains; construct Track #6 to the east of the Broadway Bridge pier and purchase Right-of-Way (ROW) to accommodate; and the no-build option would leave the existing system of five tracks in place.

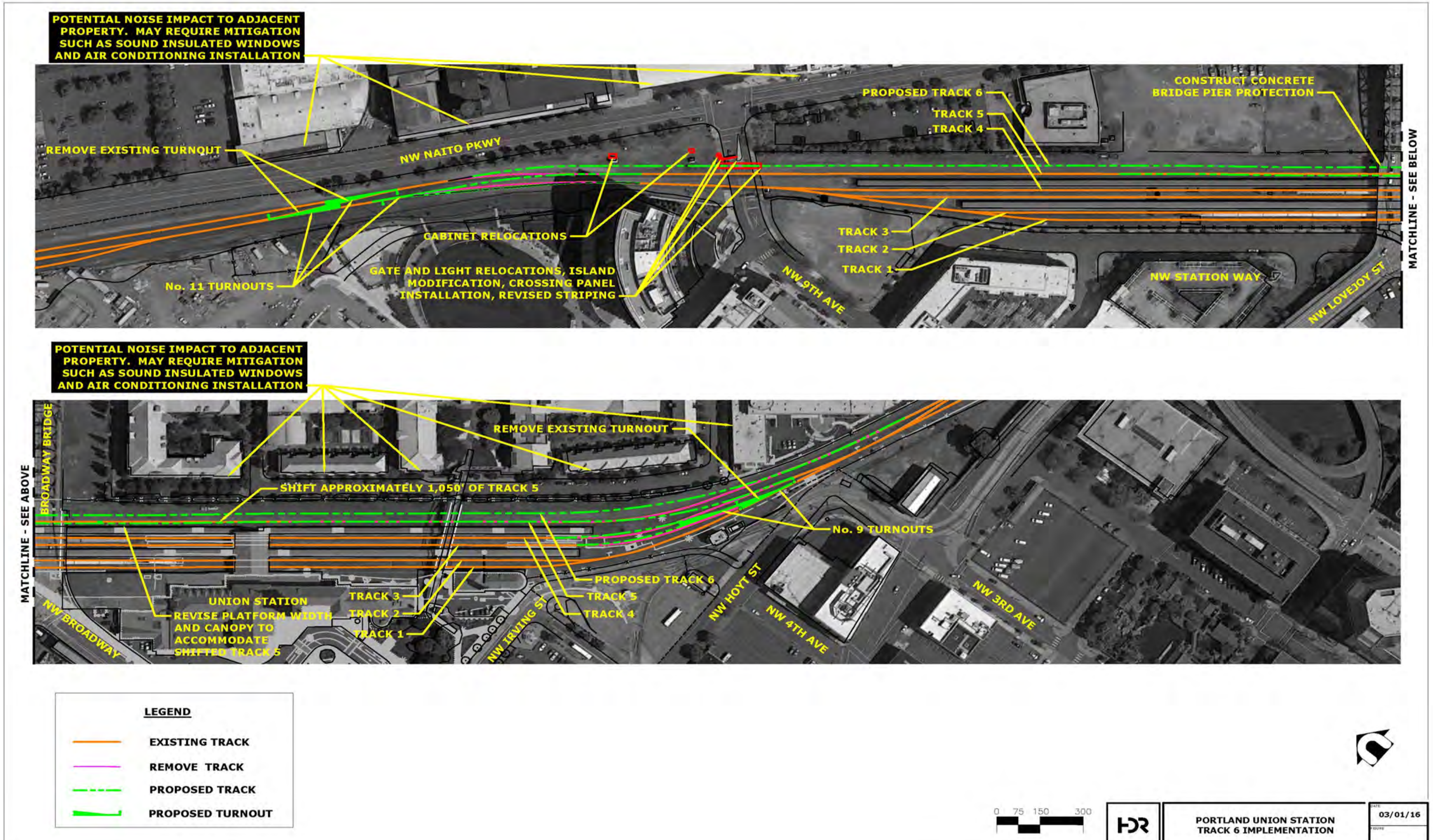
Conceptual Scope

- Construct new trackwork (Track #6)
- Construct special trackwork
- Shift approx.1050’ of Track #5 to make space for Track #6
- Construct bridge pier protection
- Revise the existing width of platform 4-5; Reconfigure existing canopy
- Reconstruct NW 9th Avenue crossing
- Signalize trackwork
- Install noise mitigation in nearby residences
- Other improvements as noted on attached sketch

Recommendation

Based on the desire to limit ROW impacts, construct Track #6 to the west of the Broadway Bridge pier and alter the platform to accommodate. If the 2035 expected passenger train volumes are realized, all four tracks within the station will be required for passenger trains, no longer allowing for freight traffic on Track #4. To accommodate the loss in current capacity, and to allow for the most flexible operating plan for passenger trains into and out of the station, construction of Track #6 is recommended. Track #6 will also likely be needed for phasing of other track, canopy, and platform improvements.

Figure 9 Construct Track #6



Matrix 7 Construct Track #6

CONSTRUCT TRACK 6 - DRAFT EVALUATION MATRIX

Evaluation Ratings: ● Positive Imapct | □ Neutral Impact | ◆ Negative Impact

		Evaluation Criteria	A	Construct Track 6 West of Bridge Pier	B	Construct Track 6 East of Bridge Pier	C	Do not construction Track 6
			CONSTRUCT TRACK 6					
A: Ability to Meet Project Goals	A.1.	Accommodate Future Capacity and Operational Needs of Passenger and Freight Rail	●	Will allow for Tracks 1-4 for passenger only, Track 5 predominantly for freight, and Track 6 for freight only, providing greater passenger rail flexibility and capacity - addition of track 6 will allow for desired 2035 passenger train volumes; improved operations of trains will improve passenger experiences through reduced delays and improved on-time performance; implementation will result in two main lines through area, improving freight traffic	●	Will allow for Tracks 1-4 for passenger only, Track 5 predominantly for freight, and Track 6 for freight only, providing greater passenger rail flexibility and capacity - addition of track 6 will allow for desired 2035 passenger train volumes; improved operations of trains will improve passenger experiences through reduced delays and improved on-time performance; implementation will result in two main lines through area, improving freight traffic	◆	Based on analysis completed, Union Station and the local rail network unlikely to be able to handle predicted 2035 passenger trains without implementation
	A.2.	Preserve and Protect the Historic Character of Union Station	□	No impact to historic features or finishes	□	No impact to historic features or finishes	□	No Change
	A.3.	Improve Economic and Social Vitality	●	Construction of Track 6 is considered necessary to accommodate the 2035 train volumes; higher capacity means more passengers accommodated, improving economic and social vitality of neighborhood; no impact to building efficiency	●	Construction of Track 6 is considered necessary to accommodate the 2035 train volumes; higher capacity means more passengers accommodated, improving economic and social vitality of neighborhood; no impact to building efficiency	◆	No immediate impact (2017 train volumes can be accommodated), but as train volumes increase, traffic through the station will be difficult to manage operationally and delays to passenger and freight trains are likely to occur
	A.4.	Improve Environmental Sustainability	●	No impact to LEED rating; The addition of Track 6 will allow for the desired 2035 passenger train volumes and improve the ability of freight to move through the area, increasing the mode share for passenger trains in the I-5 corridor and reducing emissions; no impacts to stormwater	●	No impact to LEED rating; The addition of Track 6 will allow for the desired 2035 passenger train volumes and improve the ability of freight to move through the area, increasing the mode share for passenger trains in the I-5 corridor and reducing emissions; no impacts to stormwater	◆	Not implementing alternative may not allow for the desired 2035 passenger train volumes, thereby reducing the ability to reduce vehicle emissions along the I-5 corridor
B. Cost and Financing	B.1.	Estimated Capital Cost	◆	Requires relatively high capital cost to realign track 5, construct track 6, and procure turnouts for connections. Powering-up switches and signalization would also probably be required	◆	Requires relatively high capital cost to realign track 5, construct track 6, and procure turnouts for connections. Powering-up switches and signalization would also probably be required	□	No capital cost
	B.2.	Lifecycle Cost Impacts	●	Assuming maintenance for Tracks 5 and 6 will be paid for by the Railroads, there will be a reduction in maintenance due to freight trains not using Track 4	●	Assuming maintenance for Tracks 5 and 6 will be paid for by the Railroads, there will be a reduction in maintenance due to freight trains not using Track 4	□	Continued use of Track 4 for freight will provide more need for maintenance in future
	B.3.	Cost Risk	◆	Negotiators with the BNSF, UP, and/or PTRR may require other investments to the local rail network in the area before agreeing to project	◆	Negotiators with the BNSF, UP, and/or PTRR may require other investments to the local rail network in the area before agreeing to project	□	No Change
	B.4.	Financial Leverage					□	No Change
C. Implementability and Constructability	C.1.	Technical Complexity and Constructability	◆	Approval from BNSF, UP, and PTRR required; Track lead realignment is complex due to fitting an additonal turnout in limited horizontal space; concept has been completed but not agreed to by railroads. Track construction would need to keep freight traffic unimpeded, which can lead to increased cost and liability during construction; Medium to high duration of construction relative to other track alternatives. Construction west of bridge pier will require altering the width of the platform between tracks 4 & 5, which could impact the architectural design of the canopies	◆	Approval from BNSF, UP, and PTRR required; Track lead realignment is complex due to fitting an additonal turnout in limited horizontal space; concept has been completed but not agreed to by railroads. Track construction would need to keep freight traffic unimpeded, which can lead to increased cost and liability during construction; Medium to high duration of construction relative to other track alternatives. Construction east of the bridge requires additional right of way	□	No Change
	C.2.	Schedule and Schedule Risk	◆	High potential for schedule delay due to the fact that the design and operations plan must be approved by railroads, Amtrak, and FRA.	◆	High potential for schedule delay due to the fact that the design and operations plan must be approved by railroads, Amtrak, and FRA.	□	No Change
	C.3.	Impact on Passenger and Freight Rail Operations	◆	High degree of disruption to ongoing rail operations when compared with other track alternatives - detailed construction staging will be required; staging will be required to minimize reductions in trackside capacity; implementation will require freight rail impacts - staging plans will require minimal disruptions to network and continued negotiations / approvals from railroads.	◆	High degree of disruption to ongoing rail operations when compared with other track alternatives - detailed construction staging will be required; staging will be required to minimize reductions in trackside capacity; implementation will require freight rail impacts - staging plans will require minimal disruptions to network and continued negotiations / approvals from railroads	◆	Track 6 may be required as a "shoo fly" track (temporary use track) for other track alternative - not building track 6 could negate construction of other alternatives, including raising track 5 and raising platforms to 15" high
	C.4.	Impact on Union Station Tenants	□	Not expected to significantly affect tenants	□	Not expected to significantly affect tenants	□	No Change
	C.5.	Phasing and Project Segmentation	◆	Low to no ability to phase work to spread costs; The construction of Track 6 would also likely require the powering up of turnouts and the signalization of the switches within the station; High probability of cost efficiencies if work is combined with track improvements within yard	◆	Low to no ability to phase work to spread costs; The construction of Track 6 would also likely require the powering up of turnouts and the signalization of the switches within the station; High probability of cost efficiencies if work is combined with track improvements within yard	□	No Change
	C.6.	Risks, Assumptions and Unknowns	◆	Without modeling the station and surrounding rail network beyond the minimal amount of work to date, it is difficult to draw conclusions regarding whether or not the station and surrounding network could operate at the desired 2035 volumes. The minimal scheduling and routing within the station performed so far have led to conservative assumptions regarding the need for Track 6; High ability to minimize risks based on assumptions through modeling and scheduling	◆	Without modeling the station and surrounding rail network beyond the minimal amount of work to date, it is difficult to draw conclusions regarding whether or not the station and surrounding network could operate at the desired 2035 volumes. The minimal scheduling and routing within the station performed so far have led to conservative assumptions regarding the need for Track 6; High ability to minimize risks based on assumptions through modeling and scheduling	□	No Change
D. Environmental Impacts and Approvals	D.1	Environmental Impacts and Project Classification	◆	The addition of Track 6 will likely trigger an investigation into mitigating for increases in noise and vibration to the nearby condominiums, suggesting low probability for categorical exclusion; Noise and vibration requirements with nearby residences could lead to schedule delays during implementation	◆	The addition of Track 6 will likely trigger an investigation into mitigating for increases in noise and vibration to the nearby condominiums, suggesting low probability for categorical exclusion; Noise and vibration requirements with nearby residences could lead to schedule delays during implementation. Construction east of the bridge pier also requires purchasing ROW from neighboring parcels	□	No Change
	D.2	Historic Impacts and Approvals	●	No issues of concern to historic features. Track 6 was in operation until recently (mid-1990's), so this would be a return to an earlier condition	●	No issues of concern to historic features. Track 6 was in operation until recently (mid-1990's), so this would be a return to an earlier condition	□	No Change
	D.3	Decision Making and Approvals	◆	Design must be approved by Class I railroads, who may require investments elsewhere to offset impacts to the freight system. They may also require modeling.	◆	Design must be approved by Class I railroads, who may require investments elsewhere to offset impacts to the freight system. They may also require modeling.	□	No Change

Estimate 7 Construct Track #6

Construct Track #6	
Right-of-Way / Real Estate	$ -
Utilities	$ -
Civil Construction	$117,229
Grade Crossings	$ -
Platform	$ -
Special Trackwork	$421,000
Trackwork	$2,257,260
Special Conditions	$650,000
Storm Water	$ -
Fueling	$ -
Rail Signaling	$90,000
Traffic Signaling	$ -
Subtotal	$3,535,489
Insurance (1.75% of Subtotal w/Allocated Contingencies Only)	$61,871
Allocated Contingency (by category)	$920,872
Eng. & Admin. (Calculated Including Allocated Contingencies Only)	$1,336,909
Total, 2016 $, No Overall Contingency	**$5,855,141**
Overall Contingency for Conceptual Level Design (30%)	$1,756,542
Total, 2016 $, with Contingency	**$7,611,684**
Total, 2035 $, No Overall Contingency	**$11,893,398**
Total, 2035 $, with Contingency	**$15,461,418**

Raise Platform Heights

Raise the existing two platform heights to 15” above TOR. This will enable level-boarding status for the Amtrak Superliner cars and qualify for Federal Railroad Administration funding linked to the level boarding requirement.

The evaluation matrix considers three options: Raise both platforms between Tracks 2 & 3 and Tracks 4 & 5 to 15” above TOR; Raise the platform between Tracks 2 & 3 to 15” and raise the platform between Tracks 4-5 to 8” above TOR; and the no-build option, which would leave the platforms at existing heights with no modifications.

Conceptual Scope

- Demolish existing platforms and canopies pending selection of preferred canopy alternative
- Construct platforms at 15” above TOR
- Construct new canopies (not included in rail estimate)
- Construct utilities within platform
- Raise Track #5 (see next section)

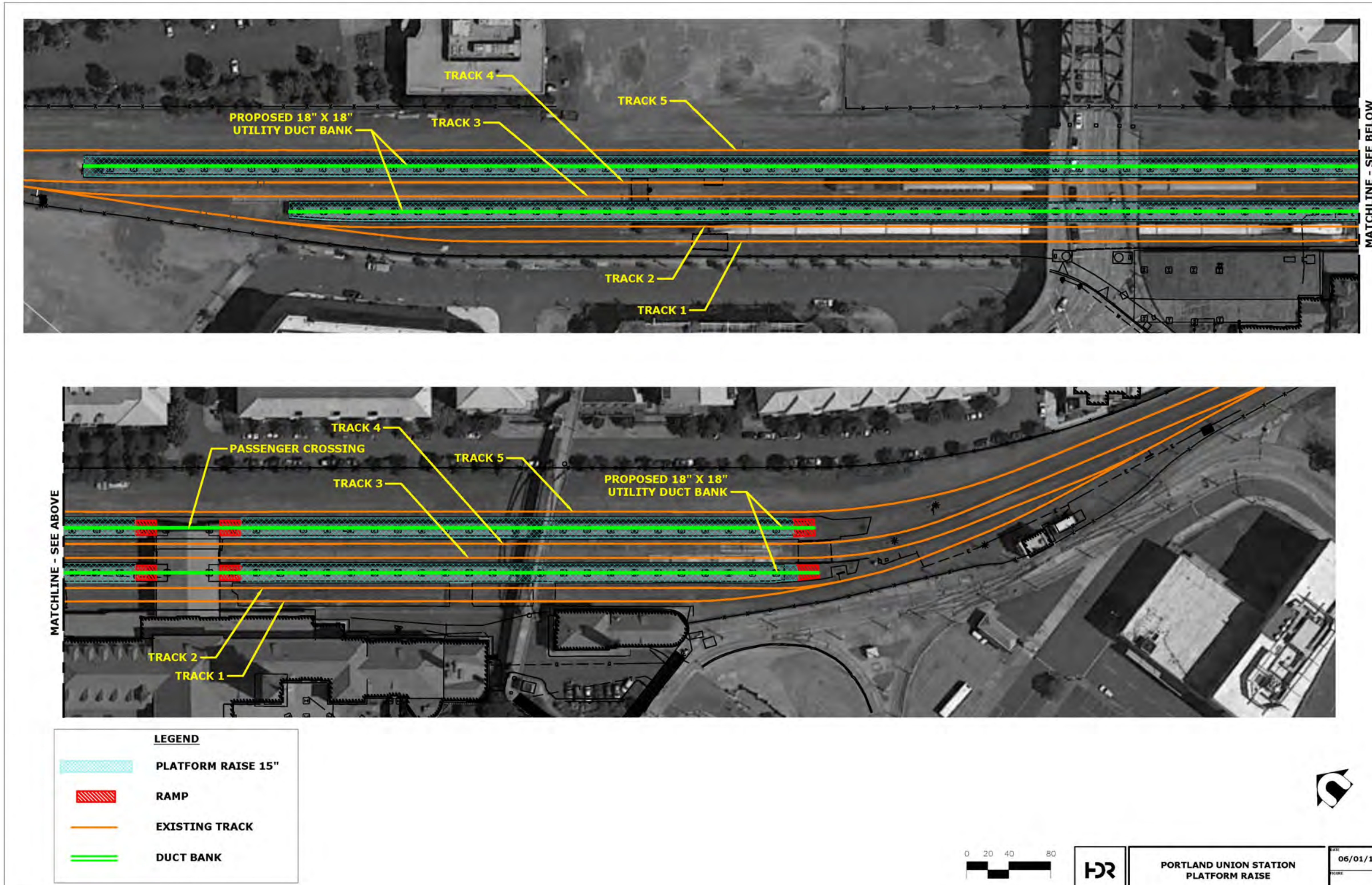
Recommendation

If installing Track 6, raise all platforms to 15” above TOR. FRA has stated that level boarding implementation is a project requirement. If not installing Track 6, then raise only platform 2-3 to 15” and raise platform 4-5 to 8”.

Also recommended is development and implementation of a system-wide design criteria to define the height of the passenger car to be serviced in the future. If a standard height can be agreed upon by all parties, the benefits of level-boarding can be achieved for all car types using the station, not solely the Superliner cars.

The cost for the two build options is similar – in both cases, both platforms are removed and reconstructed, but at different heights above TOR. The cost and figure for raising both platforms to 15” high is shown below.

Figure 10 Raise Platform Heights



Matrix 8 Raise Platform Heights

RAISE PLATFORMS TO 15" ABOVE TOR - DRAFT EVALUATION MATRIX

Evaluation Ratings: ● Positive Imapct ☐ Neutral Impact ◆ Negative Impact

Category	No.	Evaluation Criteria	A	Raise Platforms to 15": Raise Both Platforms to 15" Above TOR	B	Raise Platforms to 15": Raise Platform 2-3 to 15" Above TOR; Raise Platform 4-5 to 8" Above TOR	C	Do Not Raise Platforms
A: Ability to Meet Project Goals	A.1.	Accommodate Future Capacity and Operational Needs of Passenger and Freight Rail	◆	Raising platforms to 15" above TOR fulfills FRA requirements for ADA accessibility and accommodates Amtrak design standards; no impact to seismic or safety; Requires raising Track 5 and construction of Track 6 to accommodate freight movements	☐	FRA requirements for ADA accessibility will be accommodated on platform between Tracks 2 & 3 only - FRA waiver may be required; no impacts to freight during construction. Differences in platform heights would impact Amtrak operating plan	◆	If project chooses to *not* implement raised platforms, a waiver from the FRA will be required, which may not be possible to receive. FRA has already stated need for raised platforms.
A: Ability to Meet Project Goals	A.2.	Preserve and Protect the Historic Character of Union Station	☐	No impact to historic features or finishes - platforms have changed over time and are not considered historic elements; Raising platforms will required modifying the existing canopies which could trigger adverse effect depending on canopy type/form selected.	☐	No impact to historic features or finishes - platforms have changed over time and are not considered historic elements; Raising only one platform would probably require altering canopies on other platform to remain consistent in visual expression	☐	No change
A: Ability to Meet Project Goals	A.3.	Improve Economic and Social Vitality	☐	No impact to neighborhood viability; no impact to marketability of leased spaces	☐	No impact to neighborhood viability; no impact to marketability of leased spaces	☐	No change
A: Ability to Meet Project Goals	A.4.	Improve Environmental Sustainability	☐	No impact on LEED rating; no environmental impacts	☐	No impact on LEED rating; no environmental impacts	☐	No change
B. Cost and Financing	B.1.	Estimated Capital Cost	☐	Medium level of capital cost compared to other track alternatives	☐	Medium level of capital cost compared to other track alternatives	☐	No change
B. Cost and Financing	B.2.	Lifecycle Cost Impacts	☐	No impact on lifecycle costs	☐	No impact on lifecycle costs	☐	No change
B. Cost and Financing	B.3.	Cost Risk	●	Low level of cost risk due to unknowns; low complexity of design	●	Low level of cost risk due to unknowns; low complexity of design	☐	No change
B. Cost and Financing	B.4.	Financial Leverage						
C. Implementability and Constructability	C.1.	Technical Complexity and Constructability	☐	Low complexity of design due to materials and methods - expecting standard methods for platform design; Medium construction duration compared to other track alternatives	☐	Low complexity of design due to materials and methods - expecting standard methods for platform design; Medium construction duration compared to other track alternatives	☐	No change
C. Implementability and Constructability	C.2.	Schedule and Schedule Risk	☐	Low level time frame for design approvals; Medium level of risk due to unforseen conditions underground	☐	Low level time frame for design approvals; Medium level of risk due to unforseen conditions underground	☐	No change
C. Implementability and Constructability	C.3.	Impact on Passenger and Freight Rail Operations	◆	High degree of impact to both passenger and freight rail operations - detailed staging plans will be required; High degree of impacts to passengers - platforms would be closed in sequence to reconstruct; freight rail traffic will be impacted - agreement from railroads on operating plans will be required	☐	Medium degree of impact to passenger rail operations - detailed staging plans will be required; medium degree of impacts to passengers - platform would be closed in sequence to reconstruct	☐	No change
C. Implementability and Constructability	C.4.	Impact on Union Station Tenants	●	Low level of noise due to construction in yard; no impacts to tenants	●	Low level of noise due to construction in yard; no impacts to tenants	☐	No change
C. Implementability and Constructability	C.5.	Phasing and Project Segmentation	☐	Low ability to phase work to spread costs; Low ability to phase work independent of other track alternatives - requires altering canopies, raising track 5 and constructing track 6; High potential for cost efficiencies by combining work with other track alternatives, including replacing canopies, installing utilities, revising width per installation of track 6, and revising passenger crossing width and location	●	Low ability to phase work to spread costs; High ability to phase work independent of other track alternatives; high potential for efficiencies by combining with other track alternatives, including replacing canopies, installing utilities, and revising passenger crossing width and location	☐	No change
C. Implementability and Constructability	C.6.	Risks, Assumptions and Unknowns	☐	High risk of delays due to unforseen conditions from underground work; High ability to mitigate cost of delay due to unforseen conditions by assuming longer construction and contaminated soils	☐	High risk of delays due to unforseen conditions from underground work; High ability to mitigate cost of delay due to unforseen conditions by assuming longer construction and contaminated soils	☐	No change
D. Environmental Impacts and Approvals	D.1	Environmental Impacts and Project Classification	●	No environmental impacts; High likelihood of categorical exclusion; No risk of schedule delay due to NEPA	●	No environmental impacts; High likelihood of categorical exclusion; No risk of schedule delay due to NEPA	☐	No change
D. Environmental Impacts and Approvals	D.2	Historic Impacts and Approvals	◆	Altering platform heights requires reconstruction of platform canopies, which could trigger an adverse effect depending on design of canopy	◆	Altering platform heights requires reconstruction of platform canopies, which could trigger an adverse effect depending on design of canopy	☐	No change
D. Environmental Impacts and Approvals	D.3	Decision Making and Approvals	◆	Low risk of schedule delay due to need for FRA and Amtrak approval; Medium risk of delay due to need for agreement from railroads on temporary operating plans due to impacts to track 5 and installation of track 6; No permitting requirements		Low risk of schedule delay due to need for FRA and Amtrak approval; Medium risk of delay due to need for waiver from FRA to not install raised platforms throughout; No permitting requirements	◆	Approval from FRA would be required in order to *not* install raised platforms

Estimate 8 Raise Platform Heights

Raise Platform Heights	
Right-of-Way / Real Estate	$ -
Utilities	$194,033
Civil Construction	$1,343,819
Grade Crossings	$ -
Platform	$ -
Special Trackwork	$ -
Trackwork	$ -
Special Conditions	$ -
Storm Water	$ -
Fueling	$ -
Rail Signaling	$ -
Traffic Signaling	$ -
Subtotal	$1,537,852
Insurance (1.75% of Subtotal w/Allocated Contingencies Only)	$26,912
Allocated Contingency (by category)	$403,866
Eng. & Admin. (Calculated Including Allocated Contingencies Only)	$582,515
Total, 2016 $, No Overall Contingency	**$2,551,146**
Overall Contingency for Conceptual Level Design (30%)	$765,344
Total, 2016 $, with Contingency	**$3,316,490**
Total, 2035 $, No Overall Contingency	**$5,182,078**
Total, 2035 $, with Contingency	**$6,736,701**

Raise Track #5

Raise Track #5 by 7” (through additional ballast and tamping) in order to remove the potential conflict between raising the platforms to 15” above TOR and the adjacent freight traffic on Track #5; the maximum height of a platform adjacent to a freight track is 8”.

The evaluation matrix considers two options: the build option would raise Track #5 by 7” if platforms are raised by 15”; and the no-build option would leave track #5 15” below the raised platform, leaving a potential conflict with freight trains.

Conceptual Scope

- Install ballast
- Surface, Line and Dress ballasted track
- Reconstruct at grade crossing of NW 9th Avenue

Recommendation

Implementing this alternative is recommended if raising the platforms to 15” above TOR is implemented.

Figure 11 Raise Track #5

Matrix 9 Raise Track #5

RAISE Track 5 by 7" - DRAFT EVALUATION MATRIX

Evaluation Ratings: ● Positive Impact □ Neutral Impact ◆ Negative Impact

Evaluation Criteria			RAISE Track 5 by 7"					
			A	Raise Track 5	B	Do not Raise Track 5	C	
A: Ability to Meet Project Goals	A.1.	Accommodate Future Capacity and Operational Needs of Passenger and Freight Rail	●	Raising Track 5 allows for the raising of platform 3-4 to 15" above top of rail on Track 4, which is required for Level Boarding of passenger trains, while still allowing freight trains to use Track 5 (which can not operate adjacent to a 15" high platform). Level boarding improves ADA accessibility and is required by FRA. No impact to security, seismic concerns, or safety.	◆	If Track 5 isn't raised, either freight will not be able to access Track 5, or the platform cannot be raised for level boarding, both of which are required by their respective stakeholders		
	A.2.	Preserve and Protect the Historic Character of Union Station	□	This is a transportation need and is not expected to impact historical character	□	No change		
	A.3.	Improve Economic and Social Vitality	●	Increasing the capacity of Union Station to accept more trains per day, and improving passenger experience with new platforms, requires that the platforms be raised to level boarding height (per FRA regulations). Increasing capacity and improving the platforms will improve the economic and social vitality of the station itself, and thus the neighborhood.	□	No change		
	A.4.	Improve Environmental Sustainability	□	No significant environmental impact	□	No change		
B. Cost and Financing	B.1.	Estimated Capital Cost	◆	Medium order of magnitude cost impact - requires alterations to the crossing at NW 9th avenue. This crossing would also be impacted by the addition of Track 6, which would probably be constructed as a construction staging solution	□	No change		
	B.2.	Lifecycle Cost Impacts	●	Low order of magnitude cost impact	□	No change		
	B.3.	Cost Risk	●	Low order of magnitude cost risk	□	No change		
	B.4.	Financial Leverage						
C. Implementability and Constructability	C.1.	Technical Complexity and Constructability	●	Low complexity of design - would require modifying Track 5 for approximately 650' - 750' beyond platform. This includes raising Track 5 through the 9th Avenue grade crossing, while keeping Track 4 crossing at the existing elevation. Low construction timeframe.	□	No change		
	C.2.	Schedule and Schedule Risk	◆	High schedule risk for approvals and permitting for associated construction of Track 6. High schedule risk for stakeholder decision making as well for Track 6. Low schedule risks for raising Track 5 itself.	□	No change		
	C.3.	Impact on Passenger and Freight Rail Operations	●	Project would be required to raise Track 5 without interference to freight and passenger operations. Risk is lowered with the addition of Track 6 for freight movements and the use of overnight/weekend work for connections as needed. Low impacts to passengers - would limit Track 5 to freight use only. Low impact to passenger trains as these would be limited to Tracks 1-4 during construction.	◆	If Track 5 isn't raised, either freight will not be able to access Track 5, or the platform cannot be raised for level boarding, both of which are required by their respective stakeholders		
	C.4.	Impact on Union Station Tenants	●	No significant impact to tenants. Construction staging would be required to accommodate passenger and freight trains. Staging would probably require night/weekend work. Limited impacts to Union Station tenants - construction would need to be done quickly (bulk of work in 2-3 week's time)	□	No change		
	C.5.	Phasing and Project Segmentation	◆	No ability to phase work. Requires the construction of Track 6 for construction staging, as well as alterations to NW 9th Avenue grade crossing.	□	No change		
	C.6.	Risks, Assumptions and Unknowns	□	No significant risk associated with track raise. Freight railroads could require modeling of train network before giving approval. No risk to historic features	◆	Not increasing the height of Track 5 would require keeping platform 4-5 at 8" above TOR, which will require a variance from FRA, which is a significant risk		
D. Environmental Impacts and Approvals	D.1	Environmental Impacts and Project Classification	◆	Low impact from raising Track 5. However, constructing Track 6 for staging purposes requires mitigation to nearby residences, a high environmental impact. Low likelihood of receiveing categorical exclusion due to impacts from Track 6 installation. Medium to High schedule risk due to NEPA process regarding Track 6	□	No change		
	D.2	Historic Impacts and Approvals	●	Low impact to historical elements and approvals	□	No change		
	D.3	Decision Making and Approvals	◆	Raising Track 5, and installing Track 6 for staging purposes, will require approvals from FRA, State of Oregon, and Railroads. Permitting for revised NW 9th crossing required from State and Federal agencies. Construction of Track 6 requires approval from railroads. Could see high impacts to schedule due to railroad approvals.	◆	Not raising Track 5 will require keeping the adjacent platform at 8" above TOR; this will require an FRA allowance, which does not seem likely at this time.		

Estimate 9 Raise Track #5

Raise Track #5	
Right-of-Way / Real Estate	$ -
Utilities	$ -
Civil Construction	$76,840
Grade Crossings	$ -
Platform	$ -
Special Trackwork	$ -
Trackwork	$378,963
Special Conditions	$ -
Storm Water	$ -
Fueling	$ -
Rail Signaling	$ -
Traffic Signaling	$ -
Subtotal	$455,803
Insurance (1.75% of Subtotal w/Allocated Contingencies Only)	$7,977
Allocated Contingency (by category)	$113,951
Eng. & Admin. (Calculated Including Allocated Contingencies Only)	$170,926
Total, 2016 $, No Overall Contingency	**$748,656**
Overall Contingency for Conceptual Level Design (30%)	$224,597
Total, 2016 $, with Contingency	**$973,253**
Total, 2035 $, No Overall Contingency	**$1,520,727**
Total, 2035 $, with Contingency	**$1,976,945**

Construct On-Site Yard Control

Employ a Yardmaster for Union Station in order to coordinate between BNSF and Union Pacific (UP) dispatchers directly, rather than coordination being routed through the Portland Terminal Railroad (PTRR). The Yardmaster would control switching within station limits via a locked control panel located on one of the platforms; this control panel would include phone and/or data lines to communicate with the appropriate dispatch.

The Existing Rail Infrastructure Report discussed including a control room within Union Station; however, the project team has determined that the necessary control could be provided via a locked console on the platform. This would be more desirable from a safety standpoint if the installation of the scissor crossovers was also implemented: the Yardmaster would be able to see each of the scissor switch points before switching, adding another layer of safety.

The evaluation matrix considers two options: the build option would implement on-site yard control; and the no-build option would leave the existing system in place requiring coordination through PTRR.

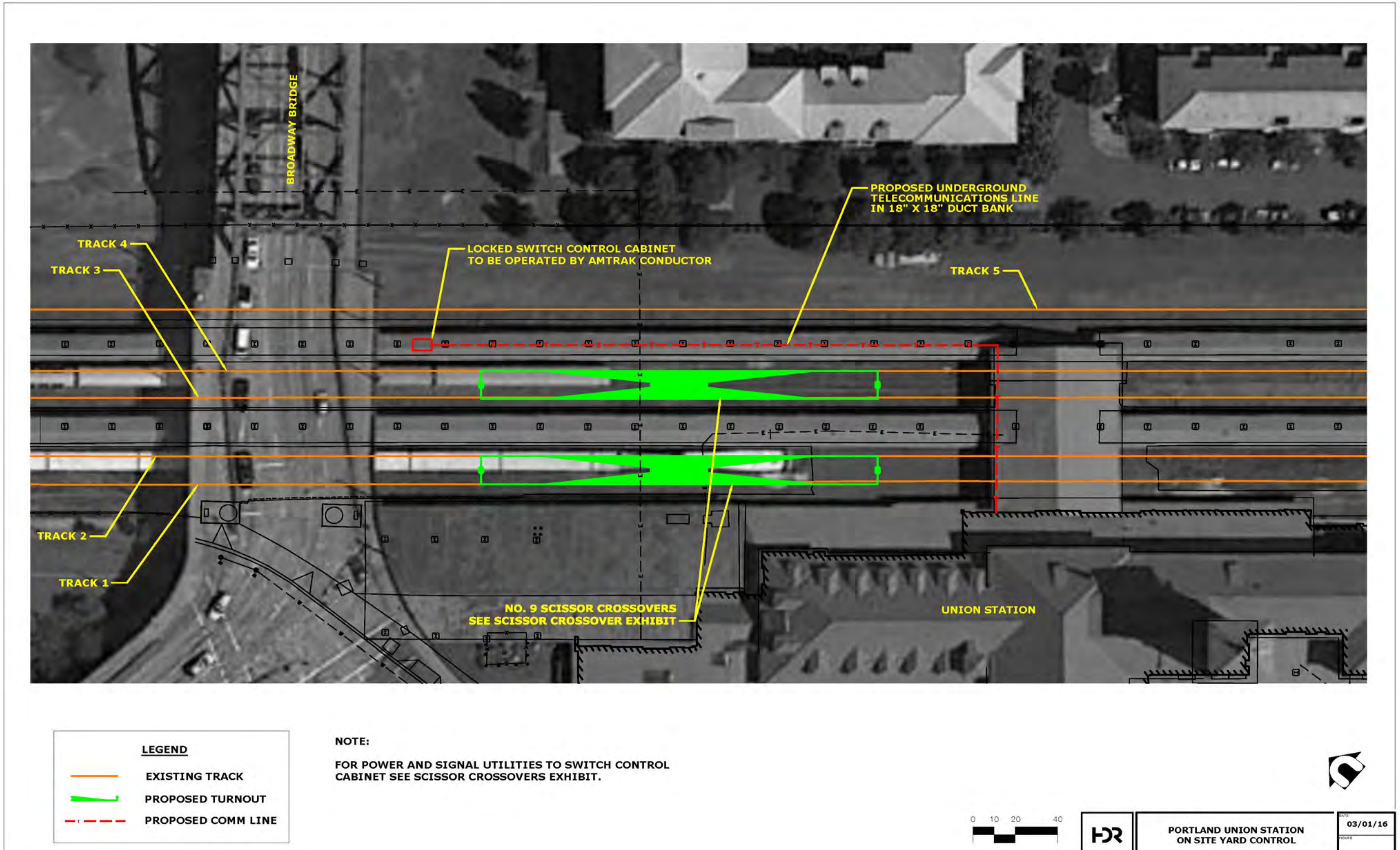
Conceptual Scope

- Construct switching console on platform 2-3
- Conduit installation (currently assumed to run back to building)
- Amtrak staffing change to include Yardmaster (not included in the Capital cost estimate)

Recommendation

Installation of on-site yard control is recommended to support the 2035 passenger train volumes if the yard is signalized and all switches powered up.

Figure 12 Construct On-Site Yard Control



Matrix 10 Construct On-Site Yard Control

EMPLOY ON-SITE YARDMASTER AND CONTROL TRAIN SWITCHING LOCALLY - DRAFT EVALUATION MATRIX

Evaluation Ratings: ● Positive Imapct ☐ Neutral Impact ◆ Negative Impact

Evaluation Criteria			Yardmaster Control Room					
			A	Employ On-Site Yardmaster and Switch Locally	B	Remotely control Switching	C	
A: Ability to Meet Project Goals	A.1.	Accommodate Future Capacity and Operational Needs of Passenger and Freight Rail	●	Will increase efficiency of trains coming through the station by eliminating the need for PTRR to assist train routing between BNSF and UPRR - this increased efficiency will be needed to accommodate desired 2035 train volumes; increased efficiency will improve passenger experience and will accommodate Amtrak business/operational needs; no impacts to freight movements - yardmaster would only control switching of passenger trains within the station limits; no impacts to seismic or safety issues	◆	Inefficient operations due to a yardmaster being offsite could result in delays as passenger train volumes through the station increase, and could ultimately limit the ability of Amtrak to achieve its desired 2035 train volumes		
	A.2.	Preserve and Protect the Historic Character of Union Station	●	No impacts to historic character of Union Station, or its materials or finishes	☐	No change		
	A.3.	Improve Economic and Social Vitality	●	Will increase efficiency of trains coming through the station, which will improve the economic vitality of the neighborhood	◆	Poor efficiency in train movements could limit the ability of Amtrak to achieve its desired 2035 passenger train volumes, thereby limiting the economic vitality of the neighborhood		
	A.4.	Improve Environmental Sustainability	●	Increased passenger train efficiency will improve the reduction of carbon emissions due to increased mode share along the I-5 corridor; no impacts to stormwater	◆	Medium potential that poor efficiency in train movement due to current operational model could lead to increased idling time for locomotives, as well as a reduction in the mode share of traffic along the I-5 corridor		
B. Cost and Financing	B.1.	Estimated Capital Cost	●	Low capital cost with respect to other track alternatives	☐	No change		
	B.2.	Lifecycle Cost Impacts	◆	Employment of on-site yardmaster will require increase in operational budget for Amtrak, a significant cost increase	☐	No change		
	B.3.	Cost Risk	◆	Medium to high risk of design and schedule delays due to requirement for approvals with Amtrak, FRA, BNSF, UP, and PTRR	☐	No change		
	B.4.	Financial Leverage						
C. Implementability and Constructability	C.1.	Technical Complexity and Constructability	◆	Medium complexity of design requried to custom-design cabinet and switching components within; Technical and operational solutions suggested will require approvals from Amtrak and FRA	☐	No change		
	C.2.	Schedule and Schedule Risk	◆	Medium to high risk to schedule due to need for approvals for both equipment and operating plan from Amtrak, FRA, UP, BNSF, and PTRR; Low schedule risk due to local approvals and permitting	☐	No change		
	C.3.	Impact on Passenger and Freight Rail Operations	☐	Low to medium impacts to passengers and rail operations due to underground construction of utility feeds as well as installation of switching cabinet; No impacts to freight; construction impacts to platforms can be staged to minimize disruption and loss of capacity	☐	No change		
	C.4.	Impact on Union Station Tenants	●	Low degree of disruption to Union Station tenants due to construction - construction duration would be relatively short when compared to other track alternatives being considered	☐	No change		
	C.5.	Phasing and Project Segmentation	☐	Medium ability to phase work - underground work could be done before cabinet installation or platform reconstruction; Medium ability to accomplish independent of other alternatives, but would need to be decided upon as part of an overall program ahead of time in order to stage the work correctly; High ability to economize if coordinated with installation of other utilities or improvements to switches	☐	No change		
	C.6.	Risks, Assumptions and Unknowns	●	Low risk due to unknown conditions; High degree of ability to mitigate unknown risks due to need for alternative to be decided upon as part of an overall program before implementation	☐	No change		
D. Environmental Impacts and Approvals	D.1	Environmental Impacts and Project Classification	●	No potential for environmental impacts or adverse effects; high likelihood of categorical exclusion; no schedule or implementation risk due to NEPA	☐	No change		
	D.2	Historic Impacts and Approvals	●	Equipment being considered would be placed in a cabinet on a platform and would be directly related to station functioning; No issues of potential concern to review agencies with respect to historical review and approval; no risk to schedule due to historical impact	☐	No change		
	D.3	Decision Making and Approvals	◆	Key stakeholder approvals include Amtrak, BNSF, UP, FRA, and PTRR and will be requried to move forward; Medium to High likelihood of delay to schedule due to required approvals from stakeholders; High likelihood of schedule delays due to need to develop agreed-upon operating procedures with all stakeholders	☐	Agreement to continue current operations procedures beyond 2035 will be required from Amtrak, BNSF, UP, FRA, and PTRR		

Estimate 10 Construct On-Site Yard Control

Construct On-Site Yard Control	
Right-of-Way / Real Estate	$ -
Utilities	$19,080
Civil Construction	$5,100
Grade Crossings	$ -
Platform	$ -
Special Trackwork	$ -
Trackwork	$ -
Special Conditions	$ -
Storm Water	$ -
Fueling	$ -
Rail Signaling	$20,000
Traffic Signaling	$ -
Subtotal	$44,180
Insurance (1.75% of Subtotal w/Allocated Contingencies Only)	$773
Allocated Contingency (by category)	$13,953
Eng. & Admin. (Calculated Including Allocated Contingencies Only)	$17,440
Total, 2016 $, No Overall Contingency	**$76,346**
Overall Contingency for Conceptual Level Design (30%)	$22,904
Total, 2016 $, with Contingency	**$99,250**
Total, 2035 $, No Overall Contingency	**$155,080**
Total, 2035 $, with Contingency	**$201,604**

Reconfigure Drip Pans

Replace the existing drip pan system to accommodate the future 2035 train berthing locations, install a new oil water separator for the improved lines, and replace the existing piping as needed to account for the removal of the storm water feeds from the existing platform canopies into the drip pan system.

The evaluation matrix considers two options: the build option would replace the existing drip pan system and locate the pans to correspond to the berthing locations; and the no-build option would leave the existing pans in place with no modifications.

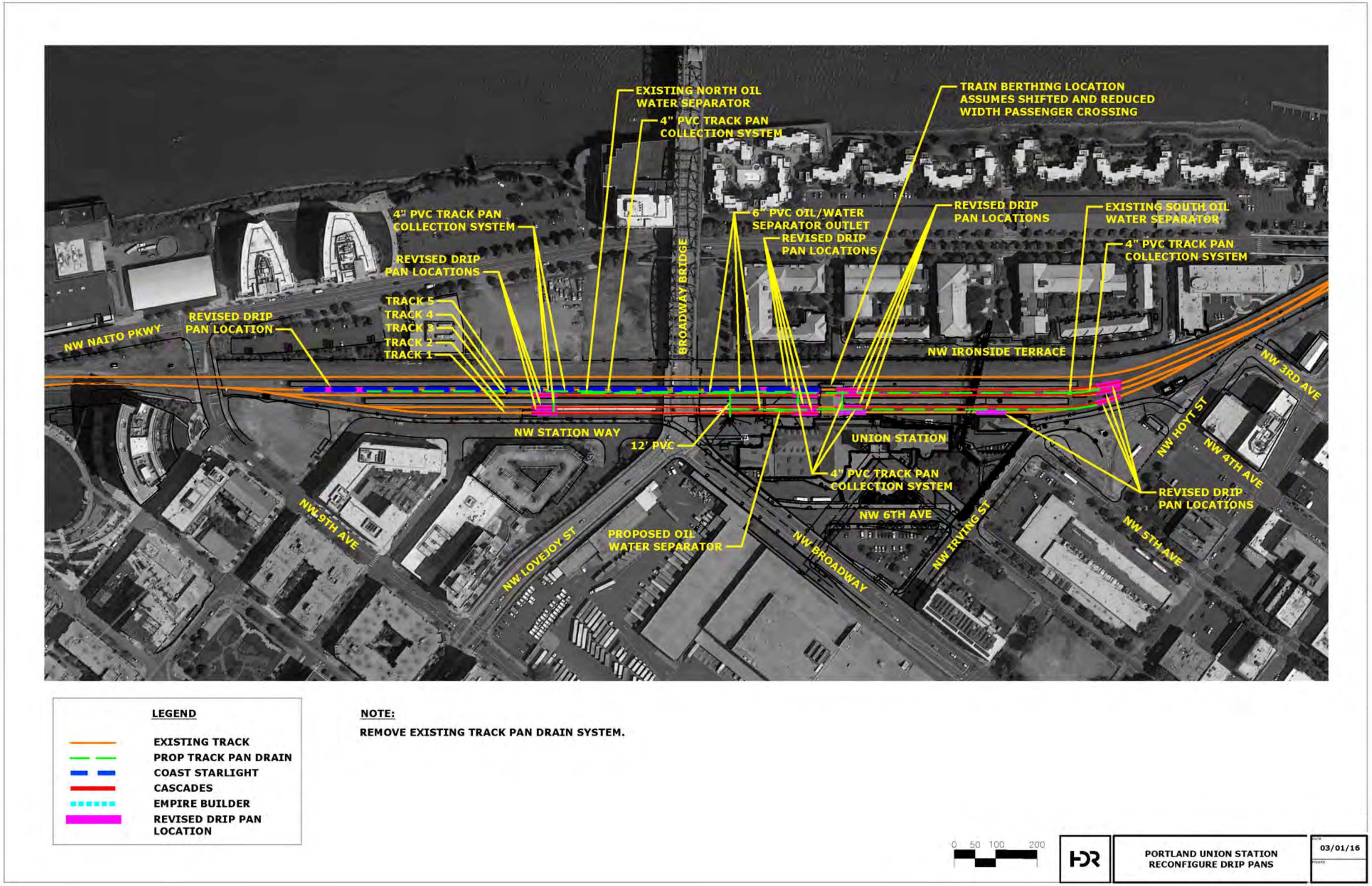
Conceptual Scope

- Replace existing piping
- Install new oil water separator
- Other improvements noted on the attached sketch

Recommendation

Replace the drip pan system. Connection of the platform canopy drainage into the track drip pan system is not good practice, as the pollution control system was not designed to accept that stormwater. This is unnecessary treatment of canopy runoff, and increases the maintenance needs for the oil water separators. Furthermore, as 2035 train volumes are implemented, replacement of the drip pan system will be required.

Figure 13 Reconfigure Drip Pans



Matrix 11 Reconfigure Drip Pans

RECONFIGURE DRIP PANS - DRAFT EVALUATION MATRIX

Evaluation Ratings: ● Positive Imapct □ Neutral Impact ◆ Negative Impact

Evaluation Criteria			Reconfigure Drip Pans					
			A	**Reconfigure Drip Pans**	**B**	**Use Existing Drip Pans**	**C**	
A: Ability to Meet Project Goals	A.1.	Accommodate Future Capacity and Operational Needs of Passenger and Freight Rail	●	Revising the drip pan locations will be required in order to accommodate new train berthing locations based on future train volumes; revisions will accommodate Amtrak operational needs; no impact to freight movement	◆	Drip pans must be located under fueling locomotives; if drip pans are not adjusted to match future train berthing locations (based on future train volumes), a waiver from the regulating authority will be required; this may be difficult to obtain. Some of the existing platform canopies drain into the track pan system, which is not good practice		
	A.2.	Preserve and Protect the Historic Character of Union Station	□	No impact to historical features	□	No change		
	A.3.	Improve Economic and Social Vitality	●	Adjusting the drip pans to future train berthing locations will enable increased passenger train volumes at the station, increasing the economic and social viability of the station; no impact on leased spaces within building	◆	Drip pans must be located under fueling locomotives; if drip pans are not adjusted to match future train berthing locations (based on future train volumes), a waiver from the regulating authority will be required; this may be difficult to obtain, potentially limiting the desire to increase passenger train volumes		
	A.4.	Improve Environmental Sustainability	●	Reconfiguring drip pans will reduce the potential for fuel spills, improving stormwater quality and reducing the potential for contamination. Adjusting the drip pans to future train berthing locations will enable increased passenger train volumes, increasing the mode share for passenger rail along the I-5 corridor and thereby reducing emissions	◆	Drip pans must be located under fueling locomotives; if drip pans are not adjusted to match future train berthing locations (based on future train volumes), a waiver from the regulating authority will be required; this may be difficult to obtain, potentially limiting the desire to increase passenger train volumes.		
B. Cost and Financing	B.1.	Estimated Capital Cost	●	Reconfiguring drip pans has a low capital cost with respect to other track alternatives	□	No change		
	B.2.	Lifecycle Cost Impacts	●	No significant lifecycle cost impact	□	No change		
	B.3.	Cost Risk	□	Low cost risk associated with underground work	◆	Not reconfiguring the drip pans could lead to increased fines and cleanup costs in the event of a spill		
	B.4.	Financial Leverage						
C. Implementability and Constructability	C.1.	Technical Complexity and Constructability	●	Low technical complexity	□	No change		
	C.2.	Schedule and Schedule Risk	●	Low schedule risk	□	No change		
	C.3.	Impact on Passenger and Freight Rail Operations	●	Low degree of disruption to passenger operations during construction when compared with other track alternatives; No freight impacts	□	No change		
	C.4.	Impact on Union Station Tenants	●	Low impact on tenants at Union Station during construction; Low potential for noise to impact tenants - construction schedule would be relatively quick	□	No change		
	C.5.	Phasing and Project Segmentation	●	Ability to phase work to reduce cost is low to none; Work can be phased independent of other alternatives; Strong chance of gaining efficiency by staging work with other alternatives, especially with improvements to Existing Trackwork	□	No change		
	C.6.	Risks, Assumptions and Unknowns	□	Medium risk due to unknown conditions of working underground; Medium risk due to required interface with existing oil water separator; No risk to damage to historic features; High ability to mitigate risk by investigation during preliminary engineering	□	No change		
D. Environmental Impacts and Approvals	D.1	Environmental Impacts and Project Classification	●	Low potential for environmental impacts or adverse effects; High likelihood of categorical exclusion; Low schedule and implementation risk due to NEPA process	◆	Medium risk due to potential for fuel spill due to not relocating drip pans to accommodate future train berthing locations; Medium risk that not implementing drip pan reconfiguration will lead to difficulty in approvals from local DEQ		
	D.2	Historic Impacts and Approvals	□	No impacts to historic features; No risk to approvals process due to historic features	□	No change		
	D.3	Decision Making and Approvals	●	Alternative will make it easier to get approvals from local DEQ; Permitting may require alternative to be undertaken; Implementing alternative could make permitting process faster, improving schedule risk	◆	Medium risk that not implementing alternative could lead to difficulty in obtaining permits; Local DEQ and permitting process may require alternative to be implemented; Medium risk to feasibility of not implementing due to local DEQ permitting		

Estimate 11 Reconfigure Drip Pans

Reconfigure Drip Pans	
Right-of-Way / Real Estate	$ -
Utilities	$250,800
Civil Construction	$22,404
Grade Crossings	$ -
Platform	$ -
Special Trackwork	$ -
Trackwork	$664,000
Special Conditions	$ -
Storm Water	$ -
Fueling	$ -
Rail Signaling	$ -
Traffic Signaling	$ -
Subtotal	$937,204
Insurance (1.75% of Subtotal w/Allocated Contingencies Only)	$16,401
Allocated Contingency (by category)	$259,381
Eng. & Admin. (Calculated Including Allocated Contingencies Only)	$358,976
Total, 2016 $, No Overall Contingency	**$1,571,962**
Overall Contingency for Conceptual Level Design (30%)	$471,588
Total, 2016 $, with Contingency	**$2,043,550**
Total, 2035 $, No Overall Contingency	**$3,193,085**
Total, 2035 $, with Contingency	**$4,151,011**

Provide 480V Locomotive Power

Replace the existing 480V power supply feeds for idling locomotives with new feeds in underground ducts, leading to power stanchions within the yard. Stanchions would be located at berthing locations coordinated with anticipated 2035 passenger train volumes, consists, and lengths. The conceptual design considers placement of electrical ducts beneath new, 15” high platforms.

The evaluation matrix considers two options: the build option would replace the entire 480V system; and the no-build option would leave the existing system in place with no modifications.

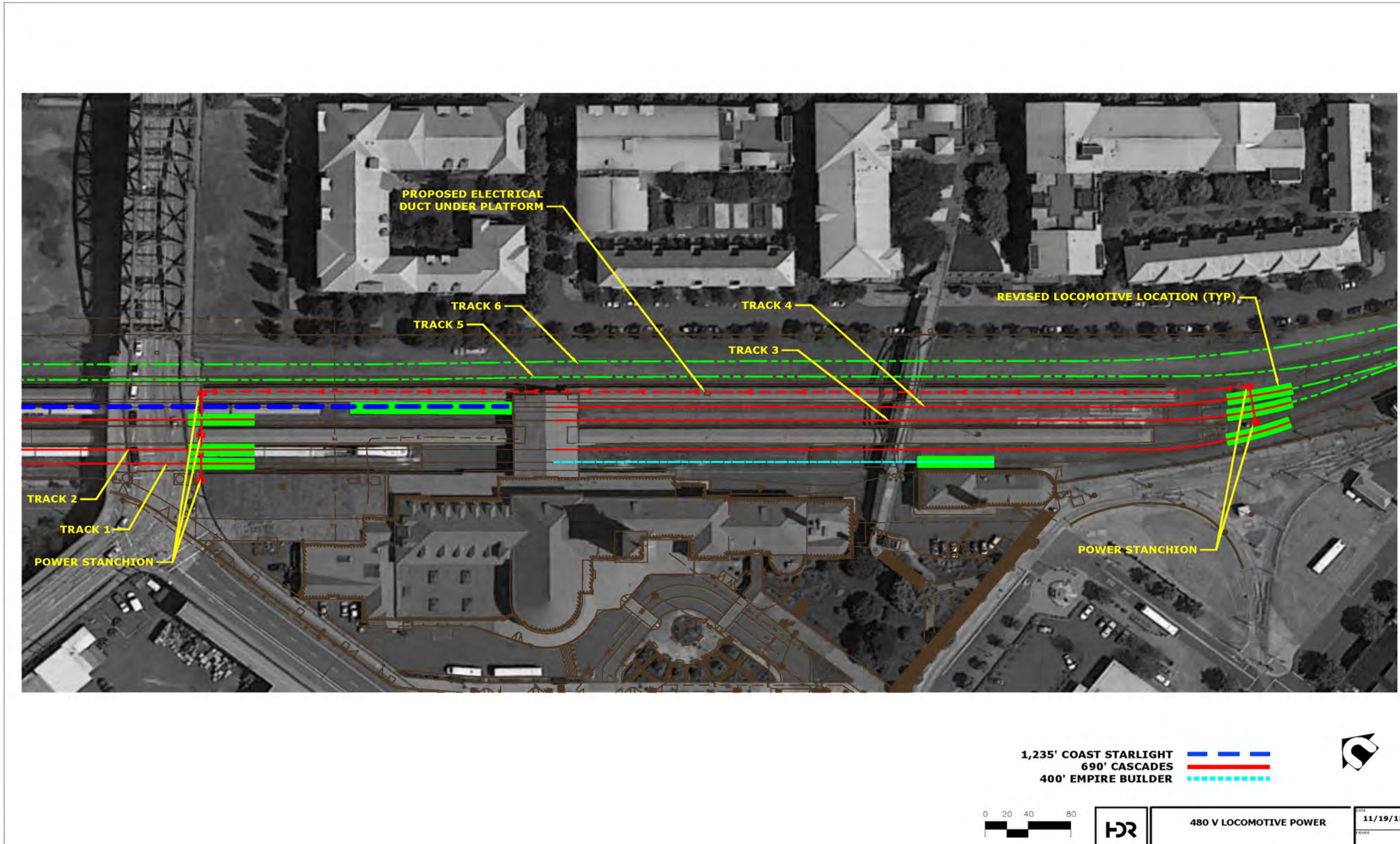
Conceptual Scope

- Construct new electrical ductbank under platform
- Install new power stanchions within yard

Recommendation

Construct new 480V Locomotive Power to accommodate the anticipated 2035 passenger volumes.

Figure 14 Provide 480V Locomotive Power



Matrix 12 Provide 480V Locomotive Power

480 V LOCOMOTIVE POWER - DRAFT EVALUATION MATRIX

Evaluation Ratings:	● Positive Imapct	□ Neutral Impact	◆ Negative Impact

Evaluation Criteria			480V Locomotive Power				
		A	Reconfigure 480V Locomotive Power	B	Do not reconfigure 480V power		
A: Ability to Meet Project Goals	A.1. Accommodate Future Capacity and Operational Needs of Passenger and Freight Rail	●	If berthing locations are revised to accommodate future capacity, reconfiguration of locomotive power will meet operating needs of Amtrak	◆	If berthing locations are revised to accommodate future capacity the existing locomotive power will not be located at locomotives.		
	A.2. Preserve and Protect the Historic Character of Union Station	□	No change	□	No change		
	A.3. Improve Economic and Social Vitality	●	Increasing the rail capacity of the station increases the economic and social vitality of the neighborhood as a whole; reconfiguration of the locomotive power enables this increased capacity	◆	If locomotive power is not provided to future berthing locations, future capacity will be limited, reducing the effectiveness of the station		
	A.4. Improve Environmental Sustainability	●	Reconfiguring locomotive power increases the rail capacity of the station, which will help in reducing transporation emissions along the I-5 corridor	◆	If locomotive power is not provided to future berthing locations, future capacity will be limited, reducing the effectiveness of the station		
B. Cost and Financing	B.1. Estimated Capital Cost	●	Relatively low capital cost relative to other trackwork improvements	□	No change		
	B.2. Lifecycle Cost Impacts	●	Low to no operating and maintenance costs	◆	If locomotive power is not distributed to future berthing locations, it may be that Amtrak will need to move trains around the station in order to store them before the next trip. This would increase operating costs for Amtrak		
	B.3. Cost Risk	◆	Contaminated soil or other unknowns from excavating the site could increase cost unexpectedly.	□	No change		
	B.4. Financial Leverage						
C. Implementability and Constructability	C.1. Technical Complexity and Constructability	□	Installation of underground utilities throughout storage yard while maintaining passenger service will require a detailed staging plan; relatively low time to construct compared to other track alternatives	□	No change		
	C.2. Schedule and Schedule Risk	◆	Design schedule risk due to need to define exactly where trains will berth in future; Relatively low schedule risk due to permitting - no change in existing site uses; construction schedule risk due to uncertainties with underground work	□	No change		
	C.3. Impact on Passenger and Freight Rail Operations	◆	Probable use of utility corridor within reconstructed platforms, which would be a large impact to passenger operations; If combined with platform reconstruction, will be a relatively short component of a longer construction time for platforms; Passenger operations will need to be staged to minimize impacts; Construction must be staged so some tracks remain in operation at all times; Track 5 (freight) must remain open at all times or be provide a shoo-fly track	□	No change		
	C.4. Impact on Union Station Tenants	□	Low to medium risk of construction noise within yard impacting tenants	□	No change		
	C.5. Phasing and Project Segmentation	◆	Low ablitiy to phase independent of other track alternatives: recommended to be included as part of utility corridor within new platforms; possible to construct outside of utility corridor in platforms but would impact rail operations more. High cost efficiency if included as part of utility corridor under new platforms	□	No change		
	C.6. Risks, Assumptions and Unknowns	◆	Medium to high risk of unknown conditions due to underground work; Currently assumed to be within utility duct under new platform; Low ability to mitigate risks due to underground work	□	No change		
D. Environmental Impacts and Approvals	D.1 Environmental Impacts and Project Classification	●	No significant environmental impact; high likelihood of categorical exclusion; minimal risk for NEPA schedule increases	□	No change		
	D.2 Historic Impacts and Approvals	●	No issues of potential concern to review agencies; no risk associated with historic review	□	No change		
	D.3 Decision Making and Approvals	◆	High risk of schedule delay due to need for Amtrak to determine final locations of power connections, which could require the train length to be standardized	□	No change		

Estimate 12 Provide 480V Locomotive Power

480V Locomotive Power	
Right-of-Way / Real Estate	$ -
Utilities	$129,900
Civil Construction	$ -
Grade Crossings	$ -
Platform	$ -
Special Trackwork	$ -
Trackwork	$ -
Special Conditions	$25,000
Storm Water	$ -
Fueling	$ -
Rail Signaling	$ -
Traffic Signaling	$ -
Subtotal	$154,900
Insurance (1.75% of Subtotal w/Allocated Contingencies Only)	$ 2,711
Allocated Contingency (by category)	$52,965
Eng. & Admin. (Calculated Including Allocated Contingencies Only)	$62,359
Total, 2016 $, No Overall Contingency	**$272,935**
Overall Contingency for Conceptual Level Design (30%)	$81,880
Total, 2016 $, with Contingency	**$354,815**
Total, 2035 $, No Overall Contingency	**$554,405**
Total, 2035 $, with Contingency	**$720,727**

Stormwater and Sewer Improvements

Rehabilitate and/or replace certain elements of the stormwater and sewer system identified as deficient in the Site Utilities Report. This analysis only considers improvements outside the envelope of the existing structures; improvements within the building are covered in the Architectural report.

The evaluation matrix considers two options: the build option would implement identified system improvements; and the no-build option would leave the existing system in place with no modifications, ongoing maintenance would be necessary.

The scope and estimate for inspecting, cleaning, and connecting the canopy downspouts assumes the presence of the existing canopies. If the canopies are replaced, the estimate will need to be revised to accommodate any changes to the number and/or location of downspouts. Also, the estimate and scope do not take into account the possible addition of a grey water cistern. The addition of a cistern will require coordination and reassessment of the stormwater system.

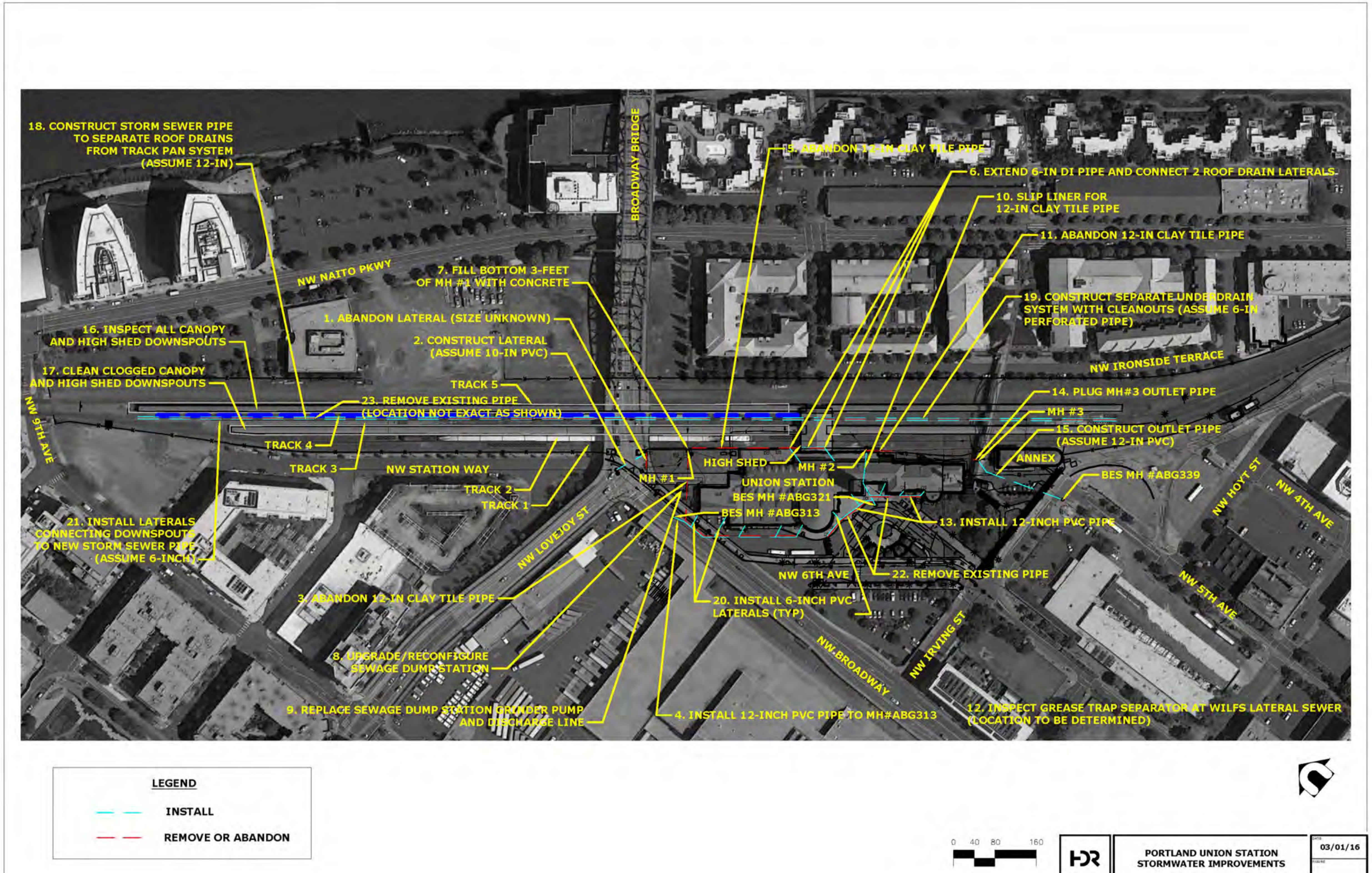
Conceptual Scope:

- Abandon certain existing pipes
- Replace certain existing pipes
- Install pipe liners in certain pipes
- Inspect and clean canopy downspouts and connect to a new pipe
- Upgrades to sewer dump station, grinder pump and discharge line
- Other improvements noted on attached Figure 14

Recommendation:

Construct the recommended improvements. The existing storm water system is not adequately sized, includes very old pipes, has been partially removed, is clogged in several places, experiences combined sewage overflows during large storms, and portions connect to the existing track plan system, which was not designed for stormwater flows. The site sees frequent flooding of stormwater into ballast during large rain events, contributing to the soft spots and sink holes seen in the yard in the past.

Figure 15 Stormwater and Sewer Improvements



Matrix 13 Stormwater and Sewer Improvements

STORM WATER / SEWER IMPROVEMENTS - DRAFT EVALUATION MATRIX

Evaluation Ratings: ● Positive Imapct ☐ Neutral Impact ◆ Negative Impact

Evaluation Criteria			Storm Water Improvements					
			A	Implement recommended storm water improvements	B	Do not make any stormwater changes	C	
A: Ability to Meet Project Goals	A.1.	Accommodate Future Capacity and Operational Needs of Passenger and Freight Rail	☐	No impact to capacity; Little impact to passenger experience; Little impact to Amtrak operation or design standards; No impact to freight; no impact to safety or security	☐	No change		
	A.2.	Preserve and Protect the Historic Character of Union Station	●	No impact to historic character or finishes	☐	No change		
	A.3.	Improve Economic and Social Vitality	●	Little to no impact to surrounding neighborhood; Option reduces the chance of surcharge at manholes during rain events, as well as reduces maintenance costs, improving building efficiency and marketability of leased spaces	◆	High probability that not implementing improvements will result in higher operating costs for maintenance on existing system over time		
	A.4.	Improve Environmental Sustainability	●	No impact on LEED certification; No reduction in energy use or consumption; Implementation lessens chance of surcharge at manholes, reducing environmental impacts due to sewage exposure.	◆	Not implementing option means system will continue to experience surcharge at manholes during rain events, causing raw sewage to flood the surrounding area		
B. Cost and Financing	B.1.	Estimated Capital Cost	◆	Low to medium capital costs compared to other track alternatives, including rerouting pipes, adjusting elevation of manholes, lining 120+ year old clay pipes, replacing clay pipe laterals, etc.	☐	No change		
	B.2.	Lifecycle Cost Impacts	●	High probability in reduction in operating costs by reducing maintenance issues involving clogs and overflowing pipes.	◆	High probability that not implementing improvements will result in higher operating costs for maintenance on existing system over time		
	B.3.	Cost Risk	☐	Medium risk of cost uncertainty due to underground work; Risk of design delay if clay tile pipes are deemed too degraded to line	◆	If clay pipe under Union Station fails before being lined, repairing it could be much more expensive than lining it.		
	B.4.	Financial Leverage			☐	No change		
C. Implementability and Constructability	C.1.	Technical Complexity and Constructability	◆	Medium risk for design delay due to need to slip line existing clay-tile pipes - pipes may be determined to not be good candidates for slip lining, or could be determined to be too degraded for slip lining; Relatively short construction time frame compared to other track alternatives	◆	Not implementing improvements may prove to be not viable due to occaisional manhole surcharges causing sewage overflows on site		
	C.2.	Schedule and Schedule Risk	☐	Relatively short timeframe for design and approvals due to relatively small extent of work; High risk of delays during construction due to unforseen conditions underground	◆	Due to occaisional manhole surcharge causing sewage overflows, project may not be permittable without correcting this issue		
	C.3.	Impact on Passenger and Freight Rail Operations	◆	Medium probability of staged track closure due to construction near building and reconnection of canopy downspouts; High probability of impacts to passenger operations near building entrance/exit to yard - detailed staging plans will be required; High probability of reduction in trackside capacity (Track 1) during construction	☐	No change		
	C.4.	Impact on Union Station Tenants	◆	High potential for displacement of tenants to reroute laterals to internal site drains; High probability of construcion noise expected	☐	No change		
	C.5.	Phasing and Project Segmentation	☐	Medium to high ability to phase work to spread costs, performing work within track area at separate time from work near building; High ability to accomplish work independent of other improvements; Cost and schedule efficiencies available through staging work with other underground track options (ie: water improvements)	☐	No change		
	C.6.	Risks, Assumptions and Unknowns	◆	High probability of contaminated soils being exposed due to underground construction; Medium to High probability of encountering unforeseen conditions, including unknown existing utilities, during construction; Low to no risk to historic features; Low ability to minimize underground risk of contaminated materials	◆	Not implementing stormwater improvements assumes that existing pipes, including original clay-lined pipes, will not fail; No implementation assumes project will be able to obtain permits for other work without improvements to system; Risks can be mitigated by implementing improvements		
D. Environmental Impacts and Approvals	D.1	Environmental Impacts and Project Classification	●	Lessens chance of surcharge at manholes, reducing environmental impacts due to sewage exposure; High likelihood of categorical exclusion; Low to no risk due to NEPA process	◆	The existing system experiences surcharge at manhole MH-2 during rain events, causing raw sewage spills in the area; The existing downspouts from canopies and sheds are disconnected, leading to poor drainage in track areas, which degrades track		
	D.2	Historic Impacts and Approvals	●	No issues of concern to historic review agencies	☐	No change		
	D.3	Decision Making and Approvals	●	Low risk of delay due to need for approval of stormwater management plan and permits from City; Permits needed from City include Site Development Plan, Erosion Control Plan, and stormwater management report	◆	Due to occaisional manhole surcharge causing sewage overflows at MH-2, project may not be permittable without correcting this issue		

Estimate 13 Stormwater and Sewer Improvements

Stormwater and Sewer Improvements	
Right-of-Way / Real Estate	$ -
Utilities	$ -
Civil Construction	$ -
Grade Crossings	$ -
Platform	$ -
Special Trackwork	$ -
Trackwork	$ -
Special Conditions	$ -
Storm Water	$623,775
Fueling	$ -
Rail Signaling	$ -
Traffic Signaling	$ -
Subtotal	$623,775
Insurance (1.75% of Subtotal w/Allocated Contingencies Only)	$10,916
Allocated Contingency (by category)	$155,944
Eng. & Admin. (Calculated Including Allocated Contingencies Only)	$233,916
Total, 2016 $, No Overall Contingency	**$1,024,551**
Overall Contingency for Conceptual Level Design (30%)	$307,365
Total, 2016 $, with Contingency	**$1,331,917**
Total, 2035 $, No Overall Contingency	**$2,081,145**
Total, 2035 $, with Contingency	**$2,705,488**

Water System Improvements

Replacement, rehabilitation, and upgrades to the existing potable water delivery system within the yard and station area, as well as new sprinkler supply lines to the annex and main terminal buildings are included in the evaluation matrix.

This option does not consider any water or Fire Life Safety improvements within either of the buildings on site (the main terminal or annex); however, it does consider service stubs to each building for sprinklers and water service.

The evaluation matrix considers two options: the build option would implement identified system improvements; and the no-build option would leave the existing system in place with no modifications.

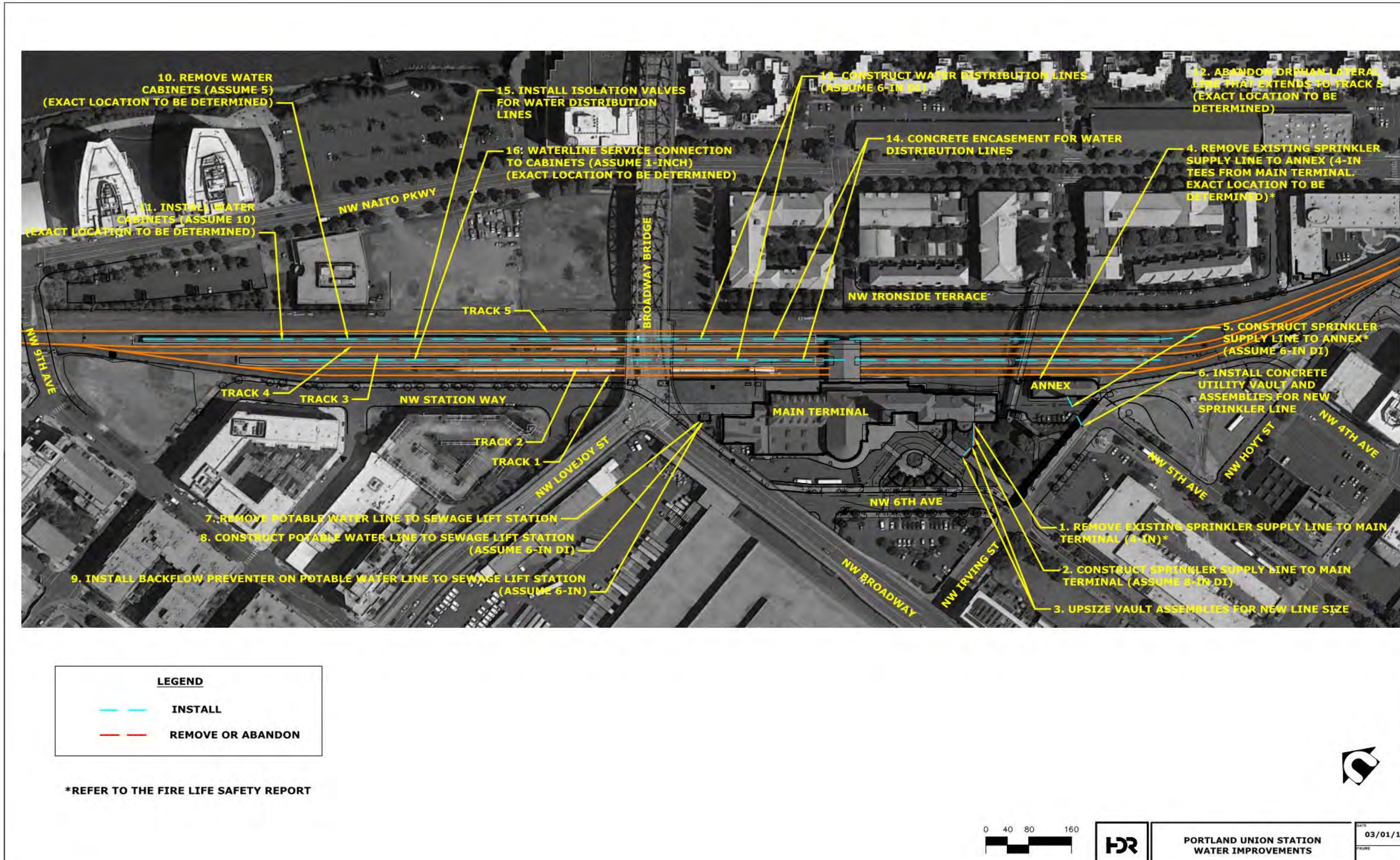
Conceptual Scope

- Install new water cabinets on platforms
- Install supply piping and valve fixtures for new water cabinets
- Removal and replacement of some existing water lines
- Concrete encasement for some water lines
- Other noted improvements on attached sketch

Recommendation

Construct water system improvements to accommodate the anticipated 2035 passenger volumes, and/or prior to new platform construction.

Figure 16 Water System Improvements



Matrix 14 Water System Improvements

WATER IMPROVEMENTS - DRAFT EVALUATION MATRIX

Evaluation Ratings: ● Positive Imapct □ Neutral Impact ◆ Negative Impact

Evaluation Criteria			A	Implement Water Improvements	B	Do not implement water improvements	C	
A: Ability to Meet Project Goals	A.1.	Accommodate Future Capacity and Operational Needs of Passenger and Freight Rail	●	Implementation will meet operating needs of Amtrak; no impact to passengers; implementation will meet design and operating standards of Amtrak; no impact to freight; no impact to seismic or security; implementation will separate potable from non-potable sources, improving public health	◆	If berthing layout is modified to accommodate future rail capacity, current potable water cabinets will not be in the proper location to service trains		
	A.2.	Preserve and Protect the Historic Character of Union Station	●	No impact to historic features or finishes	□	No change		
	A.3.	Improve Economic and Social Vitality	□	No impact to economic viability of neighborhood; No improvement to building managmenet or operation	□	No change		
	A.4.	Improve Environmental Sustainability	□	No impact to LEED certification; No reduction in water or energy consumption; No impact to greenhouse gas emissions; No impact to stormwater	□	No change		
B. Cost and Financing	B.1.	Estimated Capital Cost	◆	Low to medium cost relative to other track alternatives; Capital costs include new potable water system, RV dump station redesign to bring up to code	□	No change		
	B.2.	Lifecycle Cost Impacts	●	No significant lifecycle cost impacts	□	No change		
	B.3.	Cost Risk	◆	Low to medium cost risk due to unforseen conditions underground	□	No change		
	B.4.	Financial Leverage			□	No change		
C. Implementability and Constructability	C.1.	Technical Complexity and Constructability	□	Low technical complexity using standard designs and materials; Medium construction timeframe relative to other track alternatives due to staging requirements with respect to passengers and platforms	□	No change		
	C.2.	Schedule and Schedule Risk	◆	Relatively low time frame for design and approvals; Medium risk of delay during construction due to need to have train length and berthing locations deined and agreed upon by Amtrak, WSDOT, and ODOT	□	No change		
	C.3.	Impact on Passenger and Freight Rail Operations	◆	High degree of disruption to rail operations and passengers expected during construction due to utility placement within platform - detailed staging plans will be required; High probability of reduction in trackside capacity during construction; no impacts to freight rail	□	No change		
	C.4.	Impact on Union Station Tenants	●	No significant impact on tenants; Low construction noise expected since work will be in train yard	□	No change		
	C.5.	Phasing and Project Segmentation	●	High ability to phase work to spread costs; High ability to accomplish work independent of other track alternatives; Definite cost and schedule efficiencies available if coordinated with other utility, platform, and canopy work	□	No change		
	C.6.	Risks, Assumptions and Unknowns	◆	High likelihood of unforseen conditions due to underground work, including unknown utilities and contaminated soil; Little to no risk of damage to historic features; Little ability to minimize risk of unforseen conditions due to underground work	◆	The existing system includes potable and non potable water systems not appropriately separated, increasing risk of contamination of potable water - continued use of system may not be permitted		
D. Environmental Impacts and Approvals	D.1	Environmental Impacts and Project Classification	●	No significant environmental impact; high likelihood for categorical exclusion; Low to no risk for delay due to NEPA process	□	No change		
	D.2	Historic Impacts and Approvals	□	No issues of concern to historic review agencies	□	No change		
	D.3	Decision Making and Approvals	◆	Final water cabinet locations will depend on agreement between Amtrak, ODOT, WSDOT on design train length for Cascades service - agreement could be difficult to achieve and could delay design schedule; little to no permitting or regulatory requirements from City or State	□	The existing system includes potable and non potable water systems not appropriately separated, increasing risk of contamination of potable water - continued use of system may not be permitted		

Estimate 14 Water System Improvements

Water System Improvements	
Right-of-Way / Real Estate	$ -
Utilities	$ -
Civil Construction	$892,865
Grade Crossings	$ -
Platform	$ -
Special Trackwork	$ -
Trackwork	$ -
Special Conditions	$ -
Storm Water	$ -
Fueling	$ -
Rail Signaling	$ -
Traffic Signaling	$ -
Subtotal	$892,865
Insurance (1.75% of Subtotal w/Allocated Contingencies Only)	$15,625
Allocated Contingency (by category)	$223,216
Eng. & Admin. (Calculated Including Allocated Contingencies Only)	$334,824
Total, 2016 $, No Overall Contingency	**$1,466,531**
Overall Contingency for Conceptual Level Design (30%)	$439,959
Total, 2016 $, with Contingency	**$1,906,490**
Total, 2035 $, No Overall Contingency	**$2,978,926**
Total, 2035 $, with Contingency	**$3,872,604**

Electrical System Improvements

Replace the existing electrical ductbank on the north end of the terminal with a new line to a new electrical vault located north of the terminal. The existing line would be abandoned in place.

The evaluation matrix considers two options: the build option would replace the existing line and vault; and the no-build option would leave the existing system in place with no modifications.

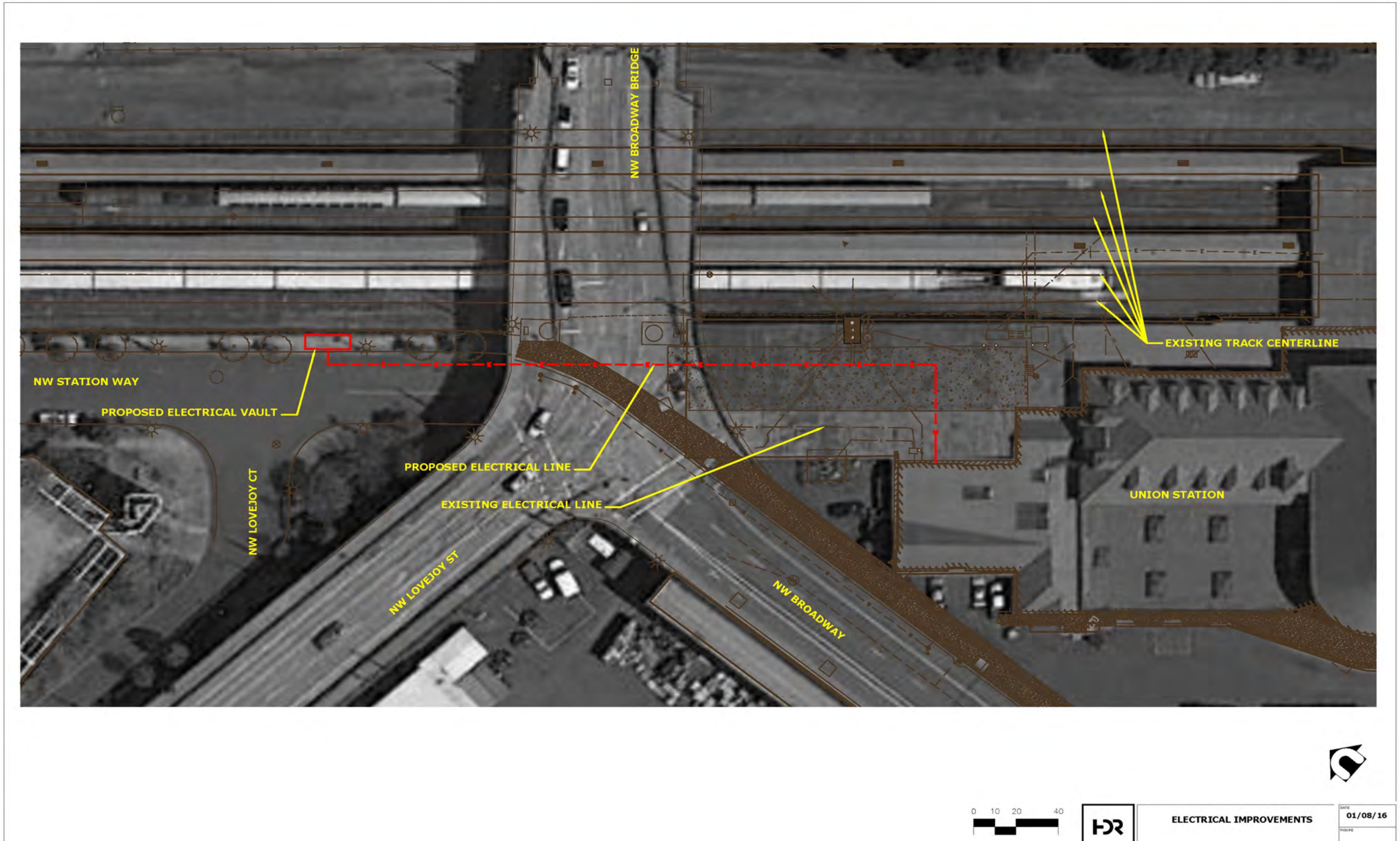
Conceptual Scope

- Construct new electrical feed and new vault
- Abandon existing electrical feed

Recommendation

Construct electrical system improvements to accommodate the anticipated 2035 passenger volumes, and/or prior to new platform construction.

Figure 17 Electrical System Improvements



Matrix 15 Electrical System Improvements

ELECTRICAL IMPROVEMENTS - DRAFT EVALUATION MATRIX

Evaluation Ratings: ● Positive Imapct ☐ Neutral Impact ◆ Negative Impact

Evaluation Criteria			ELECTRICAL IMPROVEMENTS					
			A	Implement Electrical Improvements	B	Do not implement Electrical improvements	C	
A: Ability to Meet Project Goals	A.1.	Accommodate Future Capacity and Operational Needs of Passenger and Freight Rail	☐	Implementation will allow for the 2035 passenger train volumes by providing improved reliability and the needed capacity for increased train idling; no impact to passenger experience; Abandonment and replacement will mean the terminal and yard feed no longer originate or cross PTRR property; no impact to safety or security	◆	Not implementing could mean that the existing service will be unreliable and not able to support the increased loads that the 2035 passenger train volumes will call for		
	A.2.	Preserve and Protect the Historic Character of Union Station	●	No impact to historic character, materials or finishes	☐	No change		
	A.3.	Improve Economic and Social Vitality	●	implementation will support the desired increase in passenger train volumes, improving economic vitality of the neighborhood; No impact to marketability of leased spaces; no impact to building efficiency	◆	Not implementing could mean that the existing service will be unreliable and not able to support the increased loads that the 2035 passenger train volumes will call for, restricting the potential improvements to the economic vitality of the neighborhood		
	A.4.	Improve Environmental Sustainability	●	No impact to LEED rating; No reduction in energy consumption; implementation will support the desired increase in passenger train volumes to 2035 levels, increasing the mode share of passenger rail on the I-5 corridor and reducing emission; No improvement to stormwater	◆	Not implementing could mean that the existing service will be unreliable and not able to support the increased loads that the 2035 passenger train volumes will call for, restricting the potential to reduce emissions on the I-5 corridor		
B. Cost and Financing	B.1.	Estimated Capital Cost	☐	Low to medium capital cost relative to other track alternatives	☐	No change		
	B.2.	Lifecycle Cost Impacts	☐	No significant lifecycle cost impacts	☐	No change		
	B.3.	Cost Risk	◆	Low to medium risk of cost uncertainty due to underground work	☐	No change		
	B.4.	Financial Leverage						
C. Implementability and Constructability	C.1.	Technical Complexity and Constructability	●	Low risk of delay due to complexity - expect to use standard methods and materials; Low construction timeframe relative to other track alternatives	☐	No change		
	C.2.	Schedule and Schedule Risk	☐	Low risk to delay due to approvals and permitting - expect to use standard methods and materials; Medium risk of delay due to unforseen condtions related to underground work	☐	No change		
	C.3.	Impact on Passenger and Freight Rail Operations	◆	Medium potential for disruption to rail operations due to potential for work underneath tracks; Little disruption to passengers expected; Potential for freigh impacts due to work under tracks	☐	No change		
	C.4.	Impact on Union Station Tenants	●	Little impact to union station tenants; Low degree of noise to tenants due to construction in yard	☐	No change		
	C.5.	Phasing and Project Segmentation	●	High ability to phase work related to other track alternatives; High ability to accomplish work independent of other track improvements; Medium potential for efficiencies for coordinating with other work may be able to take advantage of staging of other underground work in yard	☐	No change		
	C.6.	Risks, Assumptions and Unknowns	◆	High likelihood of risk of unforseen conditions due to underground work; Design assumes vault placement will be possible in existing sidewalk; No risk of damage to existing historic features; Little ability to minimize risk of unforseen conditions underground	☐	No change		
D. Environmental Impacts and Approvals	D.1	Environmental Impacts and Project Classification	●	No potential for environmental impacts; High likelihood of categorical exclusion; no risk to schedule due to NEPA process	☐	No change		
	D.2	Historic Impacts and Approvals	●	No issues of concern for historic review	☐	No change		
	D.3	Decision Making and Approvals	◆	Permit from City would be required for placing vault in sidewalk; Permitting from PGE required; Little risk to schedule due to permitting - concept uses standard materials and methods	☐	No change		

Estimate 15 Electrical System Improvements

Electrical System Improvements	
Right-of-Way / Real Estate	$ -
Utilities	$21,748
Civil Construction	$ -
Grade Crossings	$ -
Platform	$ -
Special Trackwork	$ -
Trackwork	$ -
Special Conditions	$ -
Storm Water	$ -
Fueling	$ -
Rail Signaling	$ -
Traffic Signaling	$ -
Subtotal	$21,748
Insurance (1.75% of Subtotal w/Allocated Contingencies Only)	$381
Allocated Contingency (by category)	$7,612
Eng. & Admin. (Calculated Including Allocated Contingencies Only)	$8,808
Total, 2016 $, No Overall Contingency	**$38,549**
Overall Contingency for Conceptual Level Design (30%)	$11,565
Total, 2016 $, with Contingency	**$50,113**
Total, 2035 $, No Overall Contingency	**$78,303**
Total, 2035 $, with Contingency	**$101,794**

Telephone and Voice System Improvements

Install a new data and telecommunications line into the main terminal building from the existing vault on NW Irving Street. The design and estimate for this do not consider any improvements within either the main terminal building or the annex.

The evaluation matrix considers two options: the build option would construct the proposed data and telecommunications improvements; and the no-build option would leave the existing system in place with no modifications.

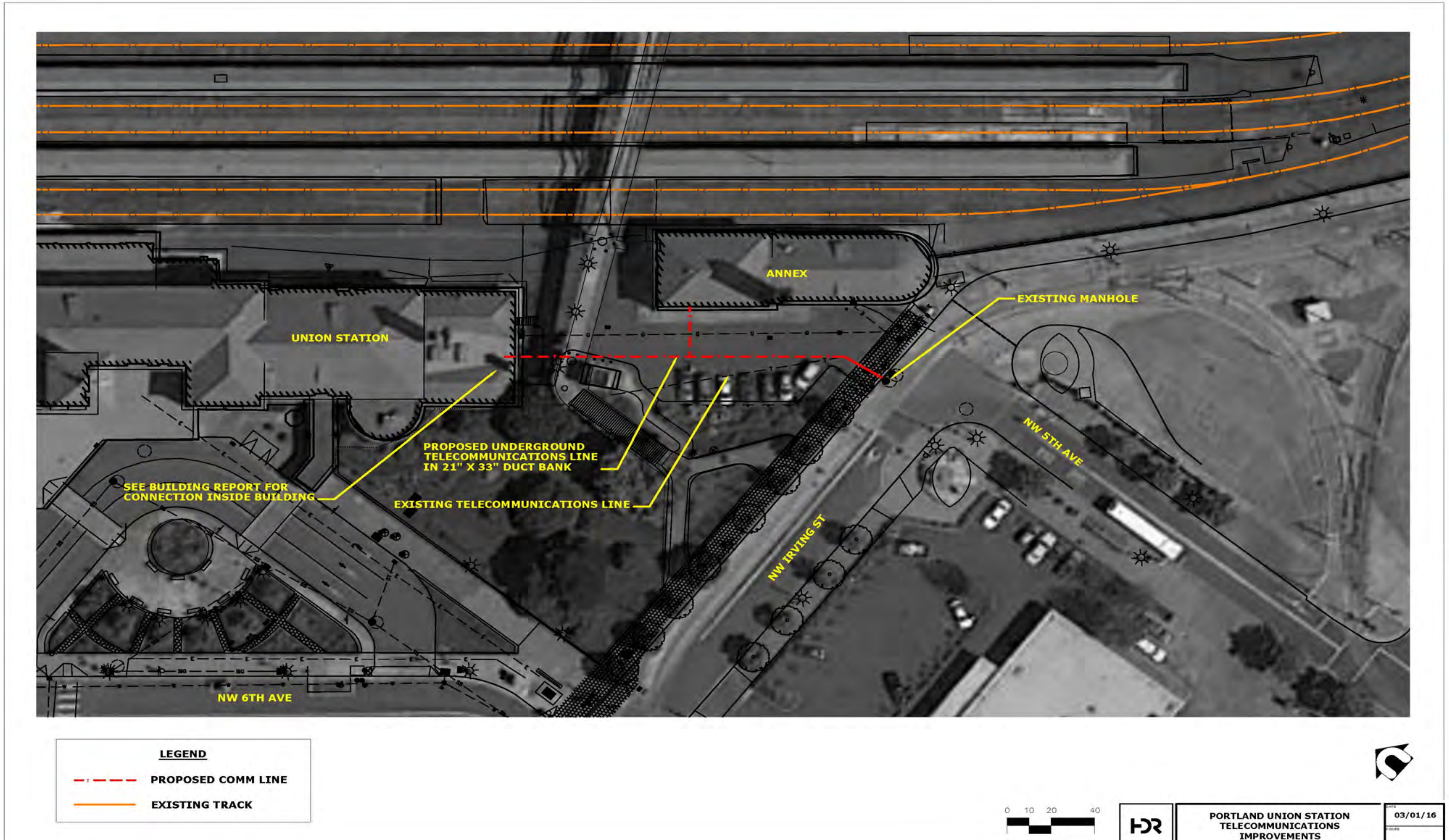
Conceptual Scope

- Install telecommunications ductbank

Recommendation

Install the proposed telecommunications and data ductbank to support modern business needs within the main terminal and annex building, as well as to support the installation of on-site yard control.

Figure 18 Telephone and Voice System Improvements



Matrix 16 Telephone and Voice System Improvements

TELECOMMUNICATIONS AND DATA IMPROVEMENTS - DRAFT EVALUATION MATRIX

Evaluation Ratings: ● Positive Imapct □ Neutral Impact ◆ Negative Impact

Evaluation Criteria			TELECOMMUNICATIONS AND DATA IMPROVEMENTS					
			A	Implement Telecom. and Data Improvements	B	Do not implement Telecom and Data improvements	C	
A: Ability to Meet Project Goals	A.1.	Accommodate Future Capacity and Operational Needs of Passenger and Freight Rail	□	Depending on communications use, improvement could be used to enhance site security	□	No change		
	A.2.	Preserve and Protect the Historic Character of Union Station	□	No change	□	No change		
	A.3.	Improve Economic and Social Vitality	●	Implementation will improve marketability of leased tenant space	◆	Decision to not implement could lead to less desirability for leased space due to limited or out dated communications		
	A.4.	Improve Environmental Sustainability	□	No change	□	No change		
B. Cost and Financing	B.1.	Estimated Capital Cost	●	Low order-of-magnitude capital cost compared to other track alternatives	□	No change		
	B.2.	Lifecycle Cost Impacts	□	No impact to operations or maintenance cost	□	No change		
	B.3.	Cost Risk	◆	Medium to high risk of cost uncertainty due to undergound work	□	No change		
	B.4.	Financial Leverage			□			
C. Implementability and Constructability	C.1.	Technical Complexity and Constructability	●	Low level of technical complexity - standard materials and methods expected; Relatively short timeframe compared to other track alternatives	□	No change		
	C.2.	Schedule and Schedule Risk	◆	Low risk of delay due to approvals and permitting; Medium to high risk of delay due to unforseen conditions underground	□	No change		
	C.3.	Impact on Passenger and Freight Rail Operations	●	Low to no impact to rail operations; Low to no impacts to passengers; no reduction in trackside capacity; no freight impacts	□	No change		
	C.4.	Impact on Union Station Tenants	●	Low impact to tenants based on construction noise outside building	□	No change		
	C.5.	Phasing and Project Segmentation	●	High ability to phase work independently of other utility alternatives; High ability to accomplish work independent of other alternatives; High likelihood of efficiency through combination with other underground work	□	No change		
	C.6.	Risks, Assumptions and Unknowns	□	Medium to high risk of unknown conditions due to underground work; no critical assumptions; low risk of damage to historic features; low ability to mitigate risk of underground work	□	No change		
D. Environmental Impacts and Approvals	D.1	Environmental Impacts and Project Classification	●	No potential adverse effects; High likelihood for categorical exclusion; No risk to schedule due to NEPA process	□	No change		
	D.2	Historic Impacts and Approvals	●	No issues of potential concern to historic review agencies	□	No change		
	D.3	Decision Making and Approvals	●	No key stakeholder decisions required; No permitting/regulatory requirements anticipated	□	No change		

Estimate 16 Telephone and Voice System Improvements

Telephone and Data System Improvements	
Right-of-Way / Real Estate	$ -
Utilities	$20,655
Civil Construction	$ -
Grade Crossings	$ -
Platform	$ -
Special Trackwork	$ -
Trackwork	$ -
Special Conditions	$ -
Storm Water	$ -
Fueling	$ -
Rail Signaling	$ -
Traffic Signaling	$ -
Subtotal	$20,655
Insurance (1.75% of Subtotal w/Allocated Contingencies Only)	$361
Allocated Contingency (by category)	$7,229
Eng. & Admin. (Calculated Including Allocated Contingencies Only)	$8,365
Total, 2016 $, No Overall Contingency	**$36,611**
Overall Contingency for Conceptual Level Design (30%)	$10,983
Total, 2016 $, with Contingency	**$47,594**
Total, 2035 $, No Overall Contingency	**$74,367**
Total, 2035 $, with Contingency	**$96,677**

Compressed Air System Improvements

Reconfigure the compressed air system within the yard to accommodate the 2035 passenger train schedule, and resulting berthing locations for the trains.

The new compressed air piping is assumed to run within a utility ductbank in the new, 15” high platforms; however, replacement of the platforms is not required for the installation of the new air system; the piping could be run within the yard.

The evaluation matrix considers two options: the build option would implement identified Air System improvements; and the no-build option would leave the existing system in place with no modifications.

Conceptual Scope

- Install new air piping system
- Install new air stanchions on the platform

Recommendation

Construct air system improvements to accommodate the anticipated 2035 passenger volumes, and/or prior to new platform construction.

Figure 19 Compressed Air System Improvements

Matrix 17 Compressed Air System Improvements

COMPRESSED AIR RECONFIGURED - DRAFT EVALUATION MATRIX

Evaluation Ratings: ● Positive Imapct □ Neutral Impact ◆ Negative Impact

Evaluation Criteria			COMPRESSED AIR RECONFIGURED					
			A	Reconfigure Compressed Air	B	Use Existing Compressed Air Locations	C	
A: Ability to Meet Project Goals	A.1.	Accommodate Future Capacity and Operational Needs of Passenger and Freight Rail	●	Alternative will enable the desired increase in passenger train volumes to Union Station; No impact to experience of passengers; Alternative will meet Amtrak operational and design standards; No impact to freight; no impact to ADA; No impact to seismic or safety	◆	Decision to not implement will reduce the ability to increase passenger train volumes in the station to desired 2035 volumes; Not reconfiguring the compressed air system will not meet Amtrak operational or design needs		
	A.2.	Preserve and Protect the Historic Character of Union Station	□	No impact to historic character of station; no impact to historic finishes	□	No change		
	A.3.	Improve Economic and Social Vitality	●	Alternative will enable the desired increase in passenger train volumes to Union Station, increasing the economic vitality of the neighborhood; No impact to existing reusable space; Increased passenger train traffic will increase marketability of Station leased spaces; no impact to building management	◆	Decision to not implement will reduce the ability of Amtrak/ODOT/WSDOT to increase passenger train volumes in the station, reducing the ability to increase the economic viability of the neighborhood as well as the ability to increase the marketability of the station leased spaces		
	A.4.	Improve Environmental Sustainability	●	No impact to LEED certification; No impact to energy use or trash generation; Alternative will enable increase in passenger train volumes, increasing the mode share of passenger rail along the I-5 corridor and reducing emissions; No impact to hazardous materials or stormwater managment	◆	Decision to not implement will reduce the ability of Amtrak/ODOT/WSDOT to increase passenger train volumes in the station, reducing the ability to increase mode share by rail along the I-5 corridor		
B. Cost and Financing	B.1.	Estimated Capital Cost	●	Low level of cost relative to other track alternatives	□	No change		
	B.2.	Lifecycle Cost Impacts	●	No lifecycle cost impact for Amtrak	□	No change		
	B.3.	Cost Risk	◆	Medium to high risk to design cost due to need for final train berthing locations based on agreed-upon design train length between Amtrak, ODOT, and WSDOT	□	No change		
	B.4.	Financial Leverage			□	No change		
C. Implementability and Constructability	C.1.	Technical Complexity and Constructability	●	Low level of complexity associated with proposed design; Relatively short timeframe for construction relative to other track alternatives	□	No change		
	C.2.	Schedule and Schedule Risk	◆	Medium to high schedule risk for design of final locations for air connections due to need for agreement on design train length between Amtrak, ODOT and WSDOT; Low risk of delay due to need for underground work	□	No change		
	C.3.	Impact on Passenger and Freight Rail Operations	□	Low to medium duration of track closures due to implementation - would require detailed construction staging plans to implement; Low impacts to passenger operations; Low to medium duration for reduction in trackside capacity; No freight rail impacts	□	No change		
	C.4.	Impact on Union Station Tenants	●	Low level of disruption to Union Station tenants due to relatively short construction duration; Little to no impacts on ability of tenants to conduct business	□	No change		
	C.5.	Phasing and Project Segmentation	●	High level of ability to phase underground work with other track projects; High ability to phase work independent of other track projects, but efficiencies can be gained by grouping instead; High probablity of cost and schedule efficiencies by coordinating with other track options	□	No change		
	C.6.	Risks, Assumptions and Unknowns	●	Low to medium risk due to need for underground work; Design will require decision regarding train berthing locations and an agreed-upon design train length between Amtrak, ODOT and WSDOT; High ability to minimize risk by coordination between agencies	□	No change		
D. Environmental Impacts and Approvals	D.1	Environmental Impacts and Project Classification	●	No environmental impacts; High likelihood for categorical exclusion; No risk to schedule or implementation due to NEPA	□	No change		
	D.2	Historic Impacts and Approvals	●	Little to no issues of concern for review agencies; No risk associated with historic review; No impacts to process and schedule	□	No change		
	D.3	Decision Making and Approvals	□	Decision to implement will depend on agreement between Amtrak, ODOT, and WSDOT to increase passenger train volumes; Timing of implementation will depend on Amtrak schedule and berthing location updates; Little to no permitting or regulatory requirements	□	No change		

Estimate 17 Compressed Air System Improvements

Compressed Air System Improvements	
Right-of-Way / Real Estate	$ -
Utilities	$221,500
Civil Construction	$10,000
Grade Crossings	$ -
Platform	$ -
Special Trackwork	$ -
Trackwork	$ -
Special Conditions	$ -
Storm Water	$ -
Fueling	$ -
Rail Signaling	$ -
Traffic Signaling	$ -
Subtotal	$231,500
Insurance (1.75% of Subtotal w/Allocated Contingencies Only)	$4,051
Allocated Contingency (by category)	$80,025
Eng. & Admin. (Calculated Including Allocated Contingencies Only)	$93,458
Total, 2016 $, No Overall Contingency	**$409,034**
Overall Contingency for Conceptual Level Design (30%)	$122,710
Total, 2016 $, with Contingency	**$531,744**
Total, 2035 $, No Overall Contingency	**$830,860**
Total, 2035 $, with Contingency	**$1,080,118**

Appendix A. Matrix Evaluation Criteria