

NW MARSHALL STREET PEDESTRIAN BRIDGE

FEASIBILITY STUDY



ACKNOWLEDGEMENTS

Project Team

BOORA Architects, Inc.

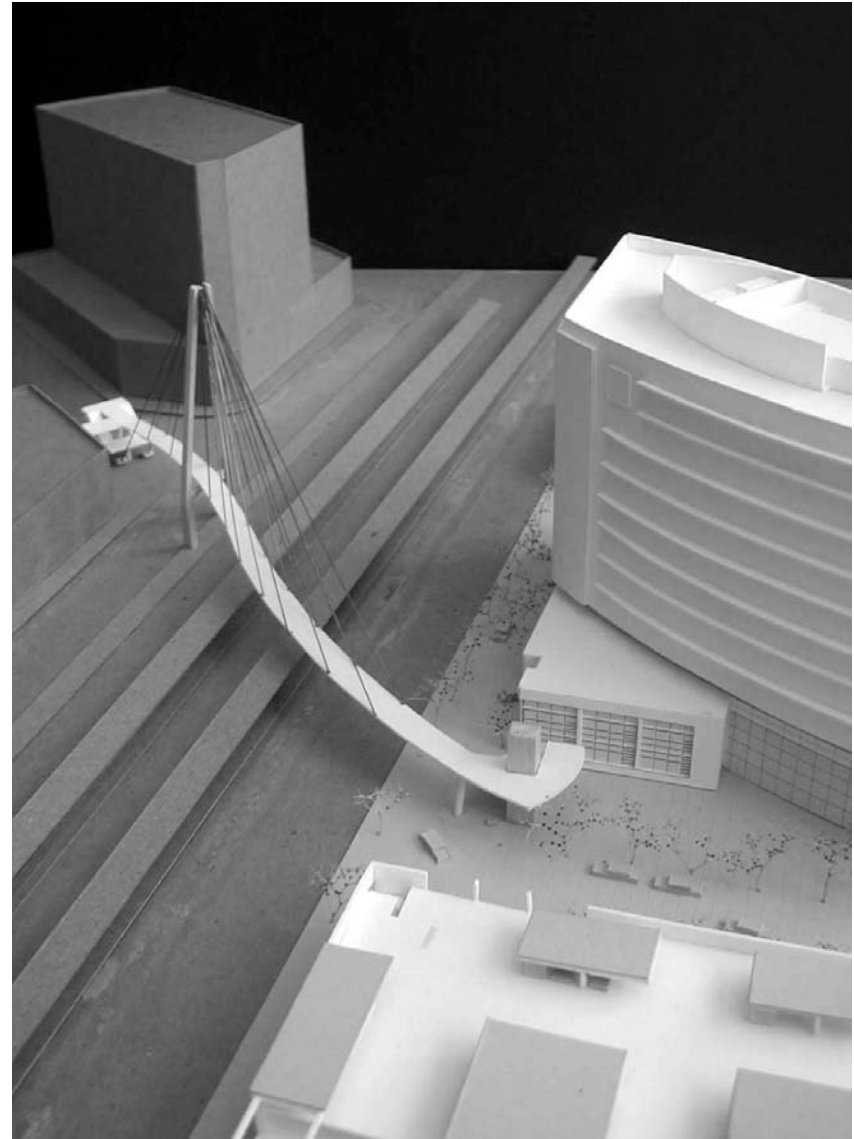
Grant Davis, PE

Urban Design & Architecture

R&H Construction

THANKS TO:

River District Steering Committee
Pearl District Neighborhood Association
Robert S. Leeb, Architects
Portland Department of Transportation
Portland Terminal Railroad Company
Portland Development Commission



Model Photo - View Looking Northwest

Funding for the NW Marshall Street Pedestrian Bridge Feasibility Study provided by the Portland Development Commission

CONTENTS

1 Executive Summary	4
2 Introduction	6
History	
3 Urban Design Issues and Opportunities	8
River District Context	
Connections to the River	
River District Themes/Character	
The Boardwalk	
Opportunities Along the Boardwalk	
NW Marshall Street Corridor	
Bridge Users	
4 Site	16
Site Issues	
Rail & Street Crossings	
One Waterfront Place Project	
9th & Lovejoy Project	
5 Conceptual Structural Alternatives	20
Suspension	
Truss	
Arch	
Asymmetrical Cable Stayed	
6 Concept Design	22

APPENDIX

7 Regulatory Requirements	26
Property Ownership	
Regulatory Authority	
Street and Rail Height Clearances	
8 Project Schedule	28
Coordination with Adjacent Projects	
Phasing and Construction Issues	
9 Project Costs	30
Estimate	
Cost	
10 Contacts	32
11 Meeting Notes	33

1 EXECUTIVE SUMMARY

The 1994 River District Development Plan, 1996 River District Design Guidelines and the subsequent Portland River District Park System Urban Design Study establish an exciting vision for the River District. All consistently encourage the need to better connect the Willamette River with the district neighborhoods. This study looks at an opportunity to help achieve these goals.

New high density development in the River District west of the Union Station rail yards is increasing at a rapid rate and the success of the new Streetcar line points to strong continued development. A new project planned at NW 9th Avenue and Lovejoy Street includes retail, senior housing and a parking structure. The Yards at Union Station, the new One Waterfront Place office building and parking garage, a potential new City waterfront park, along with the existing Albers Mill and the Food Innovation Center, create a new density and vitality in the area. The synergy of these projects creates the need and the opportunity to bridge the railroad tracks, which divide neighborhoods and separate the district from the river.

A new pedestrian bridge is proposed to extend pedestrian circulation from NW Marshall Street, at the new 9th and Lovejoy project, across the NW 6th Avenue extension and the railroad tracks, to the sculpture court of One Waterfront Place, thereby extending the pedestrian path to NW Naito Parkway and to the future riverfront park. The new pedestrian bridge will:

- Connect the River District to the River and the new Waterfront Park
- Connect the development east of the rail yard with extensive River District services, including new retail, restaurants, and other businesses.
- Allow workers at Waterfront Place, Albers Mill and the Food Innovation Center to live in the River District and walk to work.
- Extend transit opportunities from the Streetcar and the new transit mall at NW 6th Avenue to offices, housing and the park east of the rail yard.



View of Proposed Pedestrian Bridge from the Broadway Bridge

The new pedestrian bridge will incorporate district wide themes in its design. The use of boardwalks as bridge decking, the integration of public outdoor sculpture and the use of vertical gateway markers allow the bridge to be an important design element that reinforces the distinct and memorable qualities of the River District.

The site for the new bridge offers few locations for structural supports, thus requiring a relatively long span bridge. Alternative structural designs were reviewed and the most efficient design was selected: an asymmetrical cable-stayed bridge with a single support location at the western edge of the railroad tracks. This design is structurally efficient and is a strong urban design, architectural and sculptural solution. The bridge pylon will create a beautiful visual terminus for the eastern end of NW Marshall Street. The gently curving plan of the bridge assures a good fit with the differing street and building configurations at either end of the bridge. The sculptural qualities of the support towers and the delicate support cables will create a memorable addition to the District.

The design of the 9th and Lovejoy Project and One Waterfront Place have anticipated the new pedestrian bridge and have integrated the bridge into their designs. Coordination will be required during design and construction to achieve the most cost effective solution. Ideally, the bridge foundation will be constructed at the same time as the adjacent projects.

The bridge design is dynamic, sculptural and efficient. The efficient structural system and use of the existing elevator in the City of Portland's new parking garage at the 9th and Lovejoy project create a cost effective solution. The construction cost for the new bridge is estimated at \$2.5 million. This cost assumes construction during 2003 and includes escalation and contingency costs.



View of Proposed Pedestrian Bridge from the 9th & Lovejoy Project

2 INTRODUCTION

History

Couch Lake once surrounded the area where Union Station is now located. Captain John Couch donated the land to several railroad companies to bring a major rail center to the City of Portland in the late 19th century. By the 1930's the station was the transportation hub of the City, receiving more than 100 passenger trains daily. Gradually, with the development of the interstate highway system, the trucking industry and modern air service, the need for rail service declined. By the 1980's, the rail yards were under utilized and the railroads were considering abandonment of most of their holdings.

In 1987 the Portland Development Commission purchased Union Station and the surrounding 31 acres of land, where the active rail yards once stood. This gave the City of Portland a unique opportunity to bring this large parcel of land under public control to further the goals of the City.

In 1992 a handful of citizens identified the need to guide development in the River District. They developed a plan that included public and private strategies to transform the surplus rail yard and gritty industrial properties into a densely populated neighborhood that would be oriented to the Willamette River. The vision that was developed was the catalyst for the River District Development Plan, adopted by City Council in 1994, and subsequently, the River District Design Guidelines, adopted by City Council in 1996. These plans, and others that have followed, have consistently outlined the City's objectives to better connect the Willamette River with the Central City and its neighborhoods. In 1998 the City formed the River District Urban Renewal District that provided a funding mechanism for these plans.

To date, about half of the land has been redeveloped, including a renovation of Union Station, the Yards at Union Station and the Food Innovation Center. The railroad tracks isolate the new housing from the rest of the district and create a barrier to the river. In 1999, the Union Station pedestrian bridge was built over the tracks to begin to knit the district together. Traffic signals and crosswalks were also installed on Naito Parkway that will ultimately create pedestrian paths through the McCormick Pier apartments to the Greenway Trail along the waterfront.



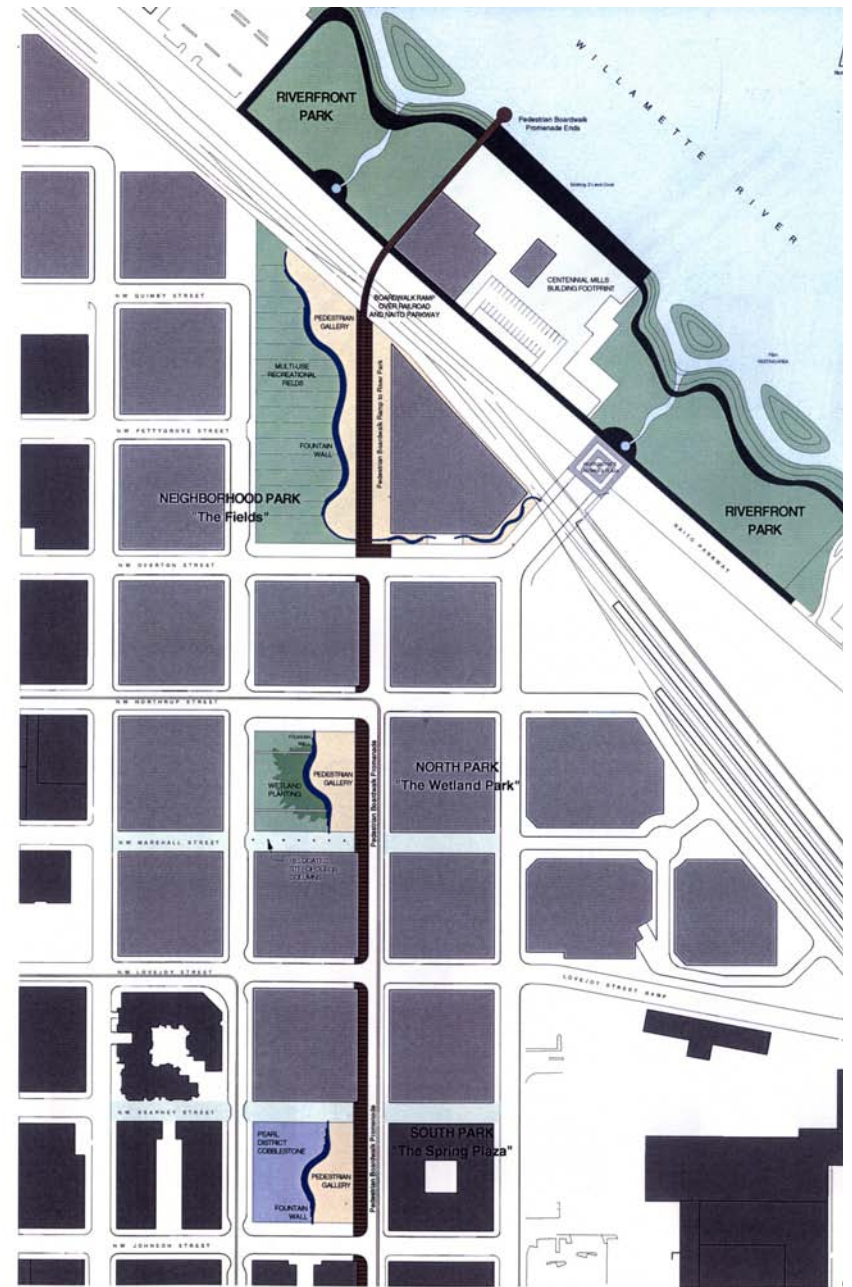
River District Aerial Photo, 1988

To ensure the newest urban community would be truly livable, Portland Parks and Recreation conducted a needs assessment to determine how to meet future recreation and open space needs in the River District. The survey identified the need to connect the River District neighborhoods to the Willamette River. The subsequent Tanner Creek Park and Water Feature Steering Committee Report provided recommendations regarding the location, size and general design considerations for the new parks and a recommendation to continue Waterfront Park north of the Broadway Bridge. Peter Walker and Partners was selected to design the master plan for the open space in the district. The resulting master plan linked three distinct parks with a strong pedestrian emphasis to the riverfront via a boardwalk. The master plan provided the River District with an organizing structure that will inform future development.

Several new projects, currently in design and located on the Union Station property, provide new opportunities to break down the barrier created by the railroad tracks and to link the district to the waterfront. One Waterfront Place, an office building and parking structure, and the 9th and Lovejoy Project, including retail, senior housing and a parking structure, are located opposite each other across the railroad tracks. These two projects, when linked by a second pedestrian bridge, provide connection from the center of the district to the Willamette River. This study looks at this opportunity.



Works in Progress at NW 11th Ave. and Kearney St., June, 2001



Portland River District Park System & Portland Parks and Recreation
Image Courtesy of Portland Parks and Recreation & Peter Walker & Partners, January 2001

3 URBAN DESIGN ISSUES AND OPPORTUNITIES

River District Context

The Portland River District Park System Urban Design Framework Study recommended creating strong and poetic metaphors, synergy between civic and private development initiatives and establishing strong guiding principles to promote a sense of place for the district. The Framework Study proposed consistent and unifying district elements such as boardwalks, water features and pedestrian oriented sculpture galleries, which are currently being implemented in the new parks and walkways along NW 10th Avenue. This new pedestrian bridge and other public and private development projects have the opportunity to extend these themes throughout the neighborhood to provide a distinct, memorable district with ties to its history and with a beauty and vitality unique to Portland.

Connections to the River

The 1992 study, “A Vision for Portland’s North Downtown,” suggests that one of the major goals in this area should be the “re-orientation of the entire district to the Willamette River, including improved public access to the riverfront...”. The railroad tracks present a formidable barrier between the majority of the River District and the Willamette River. Current crossings consist of on-grade access at NW 9th Avenue and NW Naito Parkway and a pedestrian bridge linking the transit mall to The Yards at Union Station. While there is also a future Boardwalk planned to cross over NW Naito Parkway north of Overton Street and link to Centennial Mills, there is no pedestrian connection from the heart of the district to the river. This proposed pedestrian bridge will connect NW Marshall Street to a future Riverfront Park north of Albers Mill and the McCormick Pier Boardwalk along the river. The NW Marshall Street alignment is important as NW Marshall Street is intended to be a major east-west pedestrian street linking the Streetcar line, the new North Park, and the new neighborhood retail planned for the 9th and Lovejoy Project. Future connections to the river should also be provided between NW 9th Avenue and the Fremont bridge.



River District Aerial Photo, 2001



- BOARDWALKS**
- CONNECTIONS TO RIVER**

River District Themes/Character

The River District is comprised of various neighborhoods, such as the Pearl District and Old Town/Chinatown, each with its unique qualities and characteristics, but with certain common elements that echo throughout the larger District. Gateways, vertical markers and pedestrian connections are prominent themes.

Gateways are present in the District as both literal and metaphorical elements. The Chinatown gate on Burnside marks the southern entrance to the River District and the District as a whole serves as the northern “gateway” to the City of Portland. The NW Marshall Street pedestrian bridge reinforces this theme by serving as a gateway to Union Station, and by extension the larger city, as rail passengers arrive from the north. It also provides a gateway to the Willamette River as pedestrians move eastward through the River District.

Vertical markers are another element found in the District. At the largest scale, the Union Station tower is a landmark throughout the area. Smaller elements include the relocated Lovejoy columns proposed to be sited at NW 9th Avenue and NW Naito Parkway and the totems on the west side of Jamison Square. The Pedestrian Bridge reinforces this idea with its vertical support pylons, which mark the termination of NW Marshall Street.



NW 9th Avenue and NW Naito Parkway Looking South Toward Union Station



Gateway to Oldtown/Chinatown



Lovejoy Columns (Photograph by Larry Smith, 1954. Courtesy of Thomas Robinson)

Given the increasing density of the area, pedestrian connections are one of the most important elements of the District. The River District Design Guidelines speak extensively of the need to “provide convenient linkages throughout the River District that facilitate movement for pedestrians to and from the river and to and from adjacent neighborhoods” (A3-1).

The pedestrian emphasis is reflected in a myriad of small gestures, such as the encouragement of street kiosks and the flourishing First Thursday events, but most grandly, in the proposed creation of the Boardwalk, stretching from NW Johnson Avenue, up NW 10th Avenue, across the railroad tracks, to Centennial Mills.

The Pedestrian Bridge could enhance this concept, not only with the use of similar materials as the Boardwalk, but more importantly by providing another much needed east-west pedestrian connection over the railroad tracks to the Willamette River.



Classical Chinese Garden



Kenny Scharf Tiki Totem Moniki Sculptures at Jamison Square



Existing River District Boardwalk

The Boardwalk

Boardwalks are intended to be unifying elements in the River District. They signify the Pearl District's industrial and waterfront heritage and many vestiges of older boardwalks remain throughout the district. A new boardwalk is proposed to extend along the western side of NW 10th Avenue from NW Johnson Street north across the railroad tracks to Centennial Mills and the Willamette River.

The Pedestrian Bridge incorporates the boardwalk theme by using the Ipe wood of the 10th Avenue Boardwalk as the walking surface of the bridge. This material is also used at the plaza at One Waterfront Place, which has incorporated a boardwalk as the pedestrian path along the south edge of its new sculpture court.

This boardwalk element has the potential to extend east to the future Willamette Riverfront Park and west up NW Marshall Street to the NW 10th Avenue Boardwalk. This connection would create two major boardwalks in the River District as elements linking the district to its roots, but more importantly linking it to the Willamette River.



McCormick Pier Boardwalk

This east-west connection is as crucial as the north-south connection along NW 10th Avenue. In addition to the wood boardwalk treatment, other elements including streetlights, benches, street tree species, paving and art totems could provide thematic continuity beyond the bridge and the One Waterfront plaza. These elements should be unique to the east-west axis. They could also incorporate and extend the special features designed for the One Waterfront plaza, such as "shrub walls", bollard blocks and water features. Some of these elements should also cross NW Naito Parkway and reach the river.



River District Boardwalks

Opportunities Along the Boardwalk

The Boardwalk begins at Jamison Square, which is the most urban of the three new parks proposed for the River District, reflecting its location closest to the City Center. This park introduces the themes found throughout the District by incorporating the Boardwalk, a water feature and public art located in pedestrian galleries. Vertical elements, such as the Tiki Totem Sculptures at the western edge of the square, will also be represented elsewhere in the District with the relocation of the Lovejoy Columns and the pylons of the Pedestrian Bridge. The Streetcar stop at the western side of Jamison Square will enhance pedestrian access to this area for those living outside of the district.

The themes begun at Jamison Square are reinforced and expanded at various locations along NW 10th Avenue and NW Marshall Street. Individually and collectively these nodes create urbane cultural spaces, serving as places for permanent and temporary public art and linked thematically by a similar sensibility towards materials and human scaled elements.

When moving north from Jamison Square along the Boardwalk, the next node encountered is the North Park at NW 10th Avenue and NW Marshall Street. This park joins the north-south axis of the Boardwalk with the east-west axis of NW Marshall Street and the Pedestrian Bridge.

On NW Marshall Street, the plaza at the east end of the street serves as the western terminus of the new Pedestrian Bridge. As this end of NW Marshall Street is yet undeveloped, there are opportunities to continue the notion of pedestrian galleries along this axis as well, perhaps through the use of street trees and public art. The axis of NW Marshall Street continues over the new bridge, which lands in the sculpture court of One Waterfront Place. This sculpture court creates another pedestrian gallery with a boardwalk in the plaza, an allee of trees, a water feature and outdoor sculpture. The eastern terminus link in this east-west chain is the existing Albers Mill boardwalk and the Willamette River.

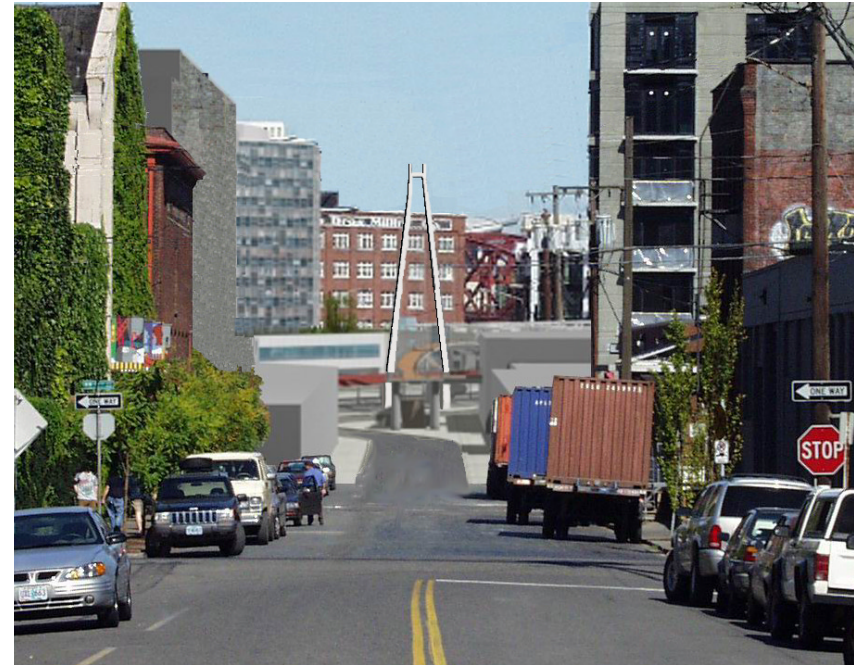


Opportunities Along the Boardwalk

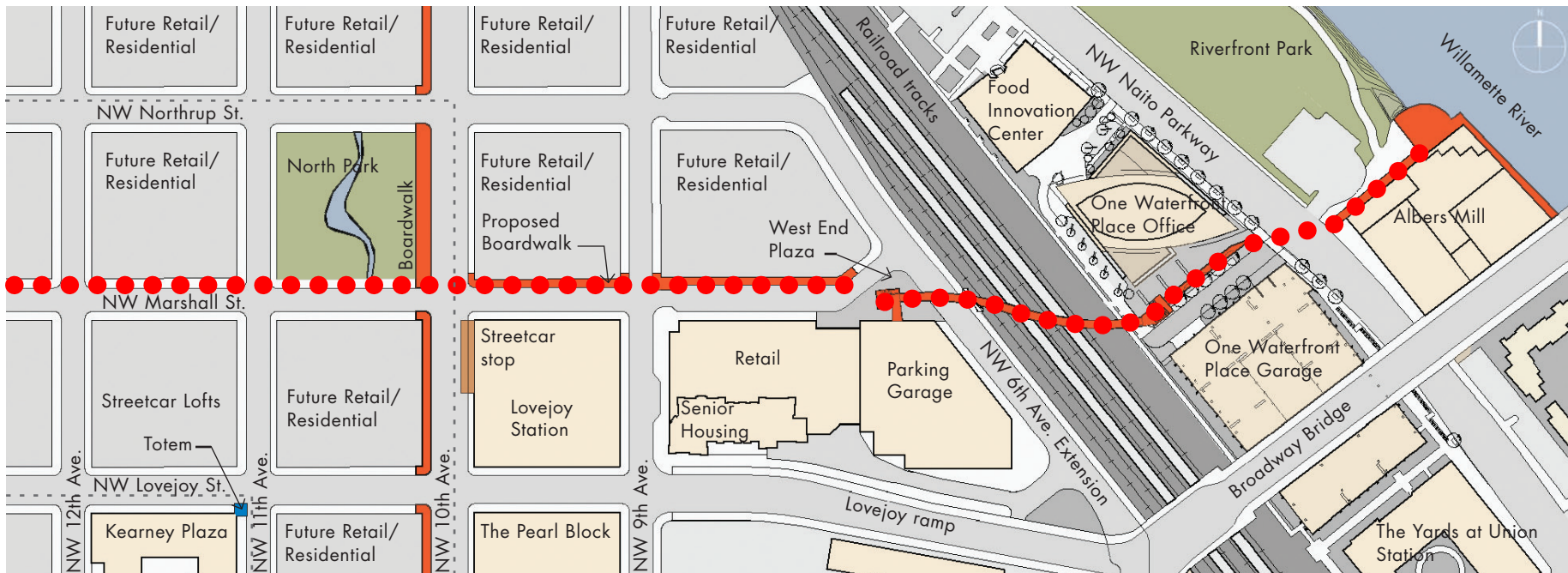
Marshall Street Corridor

Currently development on NW Marshall Street ends at NW 12th Avenue, four blocks west of the railroad tracks. Soon this area will be developed with housing, smaller retail activities, the North Park, and a parking garage.

This corridor can be strengthened by extending activity from the NW 10th Avenue Boardwalk at the North Park eastward along NW Marshall Street to the river. Unifying district elements such as planting materials, paving materials (such as the historic cobblestones found in the district) and light fixtures are all elements that could be incorporated along NW Marshall Street, terminating at the small plaza that serves as the western landing for the Pedestrian Bridge. The pylons of the bridge structure are an intentional punctuation along this corridor, while the bridge itself provides the opportunity to physically extend this axis over the railroad tracks and connect it to the Willamette River. The new Pedestrian Bridge will establish NW Marshall Street as a vital pedestrian street in the River District.



Proposed View Looking East on Marshall Street to Pedestrian Bridge



NW Marshall Street Corridor

Bridge Users

The Pearl District Development Plan attests to the importance of maintaining a dense urban fabric without neglecting the “amenities and services necessary to create a livable neighborhood”. The proposed River District Pedestrian Bridge will serve as an important pedestrian connection for people and services located on either side of the railroad tracks. Without this centralized link, people will take to their cars to make the journey north to NW 9th Avenue or south to NW Everett Street, in order to travel a few blocks east or west.

The bridge will allow residents living in the district to walk to work at Albers Mill or One Waterfront Place. Office workers in those buildings or residents of The Yards at Union Station can cross the tracks for lunch at a Pearl District café or shop at the 9th and Lovejoy Project. Residents of the new senior housing and residents and visitors west of the railroad tracks will have a pleasant and safe connection to the future Riverfront Park.

At a larger scale, the new Streetcar line, the extended Bus Mall and Union Station will be able to serve the waterfront with the creation of the Pedestrian Bridge. It will provide viable public transportation options to and from the future Riverfront Park and to offices along NW Naito Parkway.



Existing View Looking West on NW Marshall Street



Union Station Pedestrian Bridge



Proposed View Looking West on NW Marshall Street

4 SITE

Site Issues

The proposed pedestrian bridge spans the railroad tracks and lands at two new commercial projects currently being designed. The eastern bridge landing occurs in a sculpture courtyard at the One Waterfront Place office building and the western landing is in a pedestrian plaza fronting the new 9th and Lovejoy parking garage. Both of these projects anticipate the potential for the new bridge and provides space to serve as landings and connections to the adjacent neighborhoods.

The design of the bridgeheads will require careful coordination with the adjacent new construction projects at each end of the bridge. This study allows each project to make design provisions to integrate the new bridge landings into planned open spaces. Additionally, in the case of the NW 9th and Lovejoy Project, the parking garage will be designed so that the bridge can make use of the garage elevator, reducing the cost of the bridge.

While the bridge can be fully integrated into the design of the surrounding projects, the property constraints below the bridge allow few alternatives for supporting the bridge, resulting in a requirement for a long span bridge of 250 feet.



Site Plan

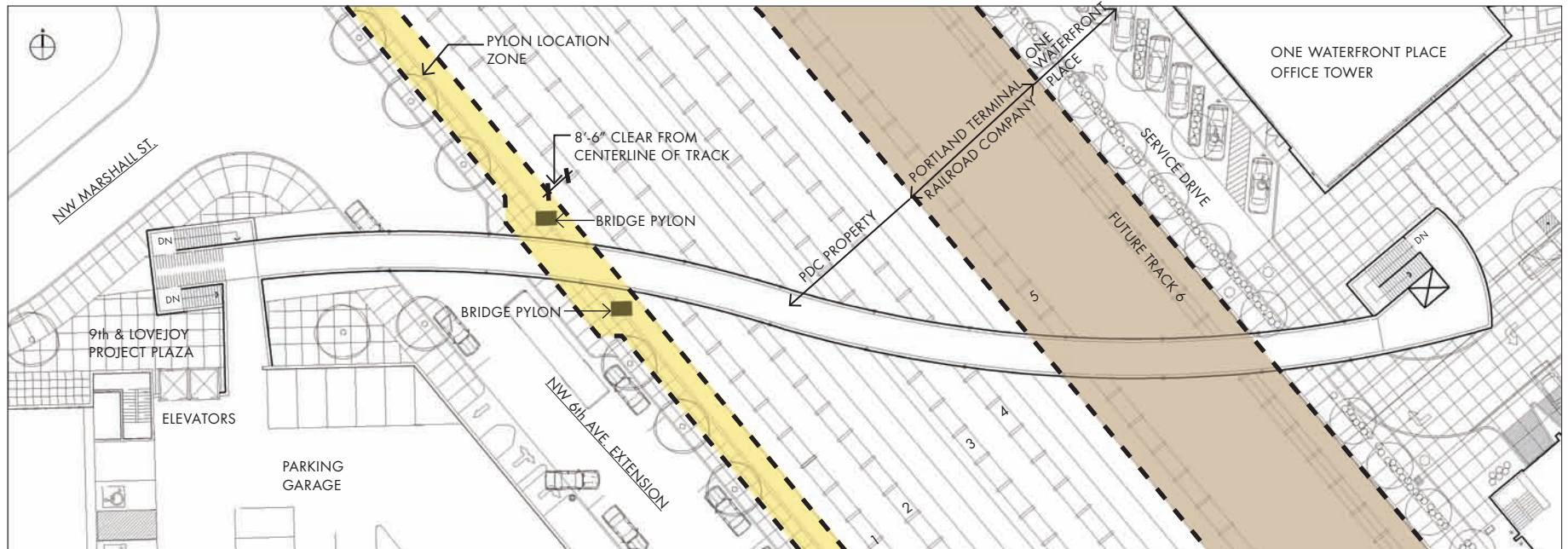
Rail and Street Crossings

The proposed pedestrian bridge crosses a planned extension of NW 6th Avenue and the rail lines serving Union Station. Amtrak, Burlington Northern and Union Pacific currently serve the station. Vertical clearances and regulatory requirements are outlined in detail in the Appendix. In brief, these crossings provide few opportunities for bridge supports, due to the existing and proposed operations below the bridge and required horizontal clearances required for operation and safety.

The only viable location for vertical support at these crossings is at the western property line of the rail yard, adjacent to the proposed street and sidewalk. The available space for the new street and sidewalks is limited, providing only about seven feet for the placement of vertical bridge supports at this location. All other bridge supports will need to be located east of the rail yard on the One Waterfront Place property or west of the 6th Avenue extension on the 9th and Lovejoy Project property.



Centennial Mill, 2001



Site Plan

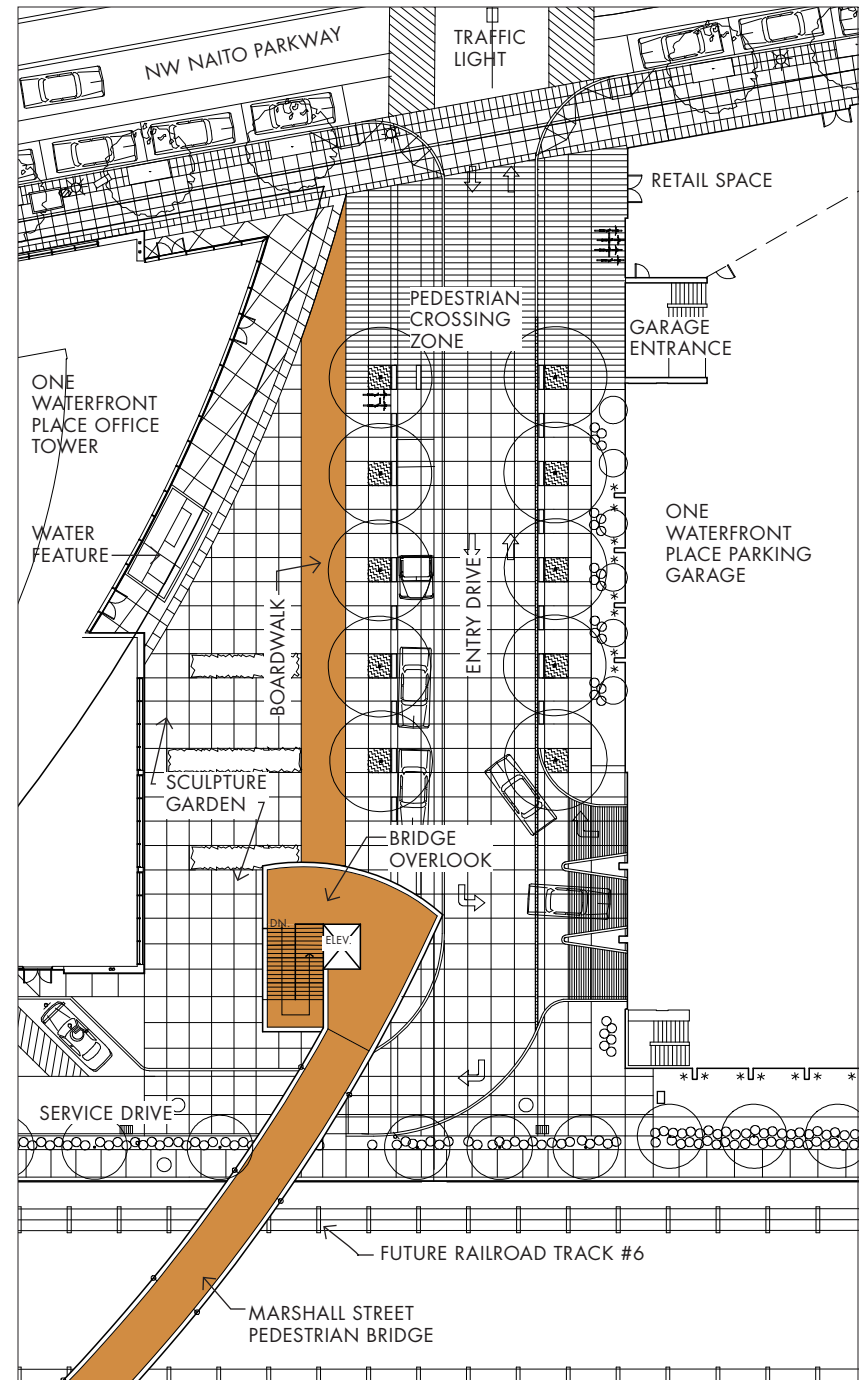
One Waterfront Place

The bridge landing at One Waterfront Place presents both opportunities and challenges. As it lands on axis with the major pedestrian circulation path through the site, adjacent to the entry drive, the landing can be integrated with a boardwalk path through the site, thus continuing the Boardwalk theme of the River District and strengthening the connection to the river.

The design of this landing needs to be carefully considered. This eastern terminus is a freestanding element, the largest “sculpture” in the sculpture plaza. The structure includes stairs and an elevator, as well as a viewing platform that overlooks the artwork and provides a visual connection to the river beyond.



One Waterfront Place Plaza

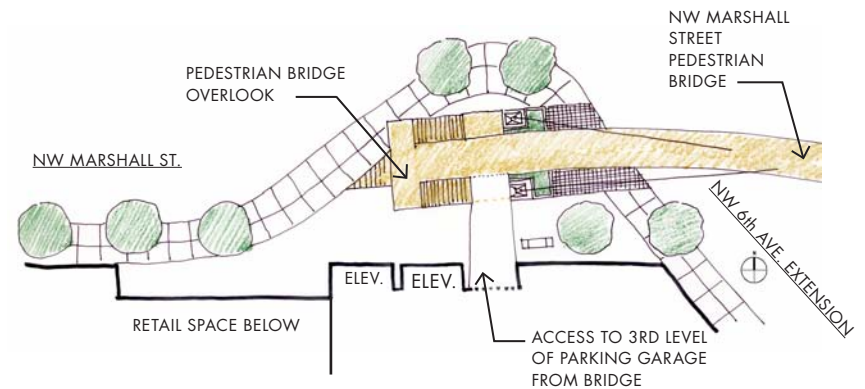


One Waterfront Place Plaza Plan

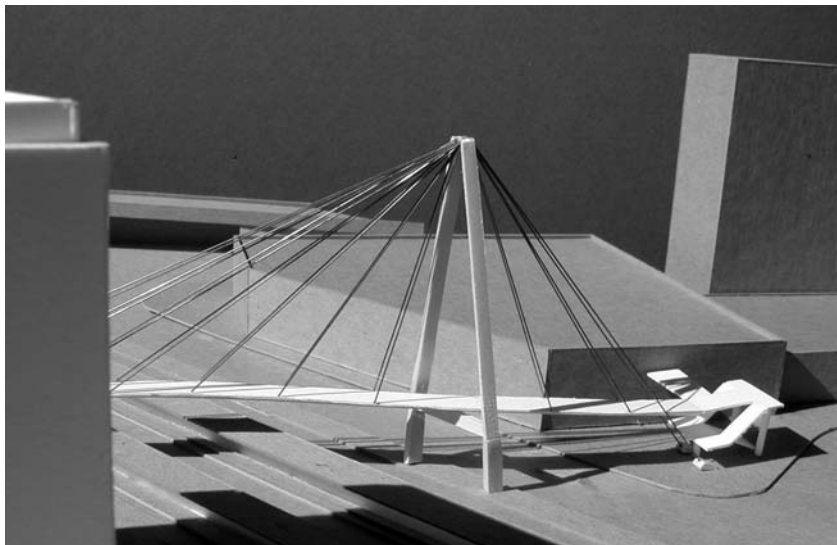
NW 9th & Lovejoy Project

The western landing at the 9th & Lovejoy Project occurs on a more constricted site than the eastern landing. The accessibility needs at this end of the bridge are met by providing an elevated connection from the bridge to the adjacent Parking Garage. As this is also a PDC owned facility, there is the opportunity for joint use of the garage elevator.

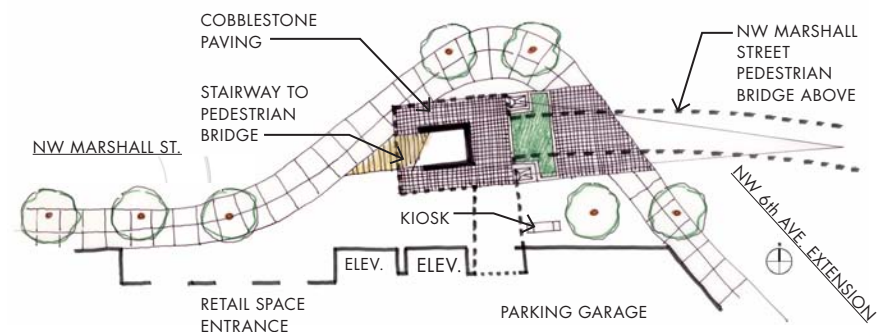
The bridge landing, due to its size, will substantially impact the small plaza at the end of NW Marshall Street, therefore, it is vital that the two be well integrated. The plaza will serve as a "front yard" to the adjacent retail space and there are opportunities to incorporate seating elements into the bridge supports, as well as to provide areas for small street kiosks or flower carts. A portion of the plaza may be treated with cobblestones, referencing the traditional paving material of the River District. This material can still be found on the eastern end of NW Marshall Street.



WEST END PLAZA PLAN - BRIDGE LEVEL



Model Photo - 9th & Lovejoy Project



WEST END PLAZA PLAN - STREET LEVEL

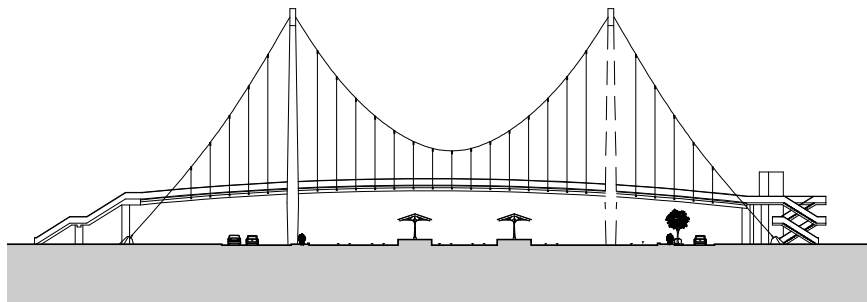
5 CONCEPTUAL STRUCTURAL ALTERNATIVES

The site constraints play a determining role in the structural design solution for the pedestrian bridge. The presence of the railroad under most of the bridge eliminates the possibility of mid-span supports, while the public and private roads on either side of the tracks push the possible support locations even further to the ends. Additionally, the landing area for the bridge on the east side is constrained by the fact that it is occurring on private property and must interface with a proposed outdoor sculpture gallery.

Among the structural approaches considered were suspension, truss, arch and cable-stayed bridges. The cable-stayed bridge addressed the site constraints in the most cost efficient and effective manner.

Suspension

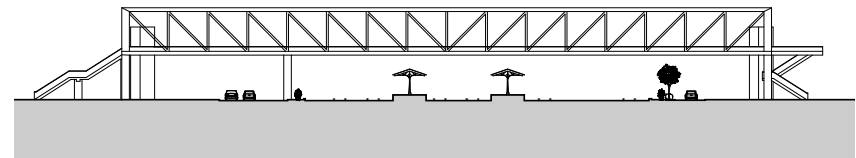
Because of the presence of the railroad, two towers within the middle half of the span are not possible. This effectively eliminates a suspension bridge approach.



Suspension Bridge

Truss

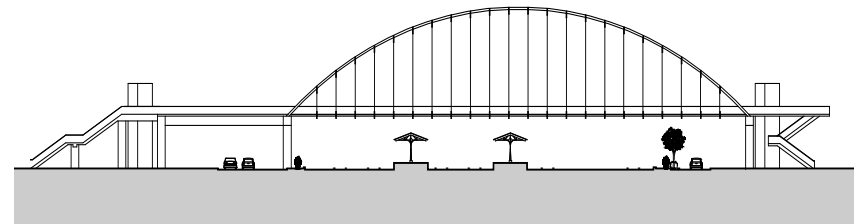
A conventional parallel chord truss could span the required distance, however, given the length of the span, with or without supports at the west edge of the tracks the truss members would be quite large. Additionally, erection would be difficult, as the truss would require extensive shoring during construction, thus substantially disrupting rail service. Preliminary analysis indicates that this would be the most expensive of the available options. Curving the bridge in plan would also be difficult and costly with this scheme. The bridge support would adversely impact the sculpture courtyard at the east end.



Parallel Chord Truss Bridge

Arch

Using an arch to span the railroad right of way would be more efficient and employ lighter members than the parallel chord truss, although it would have the same erection difficulties. The arch approach would also need to have an asymmetrical west end span that would be shorter and more difficult to integrate with the longer main span. Curving the bridge in plan could be possible with an off set arch, but the bridge abutments at the east end would be quite large and negatively impact the sculpture courtyard.



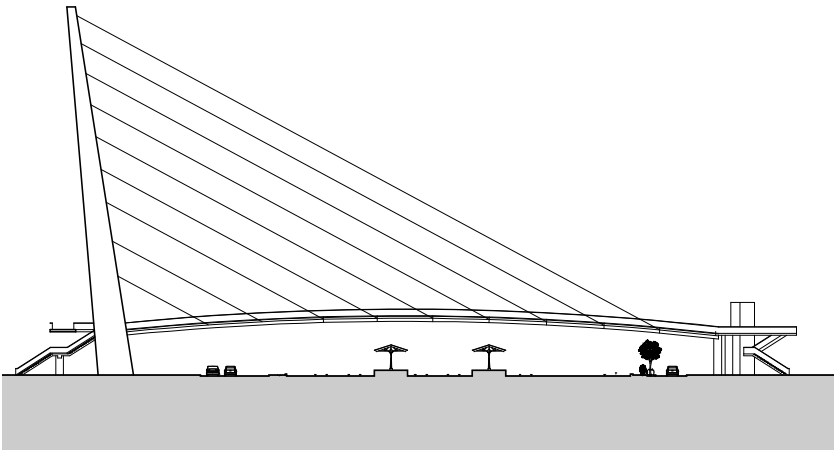
Arch Bridge

Asymmetrical Cable-Stayed

An asymmetrical cable-stayed bridge appears to be the most viable structure and a logical response for this site with its design constraints. A strong tower with the necessary back span is only possible at the west side of the railroad tracks. A lighter deck is possible with cable assist. The cable design allows for the use of high strength steel in tension, its most efficient mode. The tower also creates an opportunity for efficient erection by launching bridge sections symmetrically east and west from the tower to minimize shoring from the railroad right of way. This option also appears to be the lowest cost of the available options. The tower design could be either cantilevered or have backspan cables.

CANTILEVERED TOWER

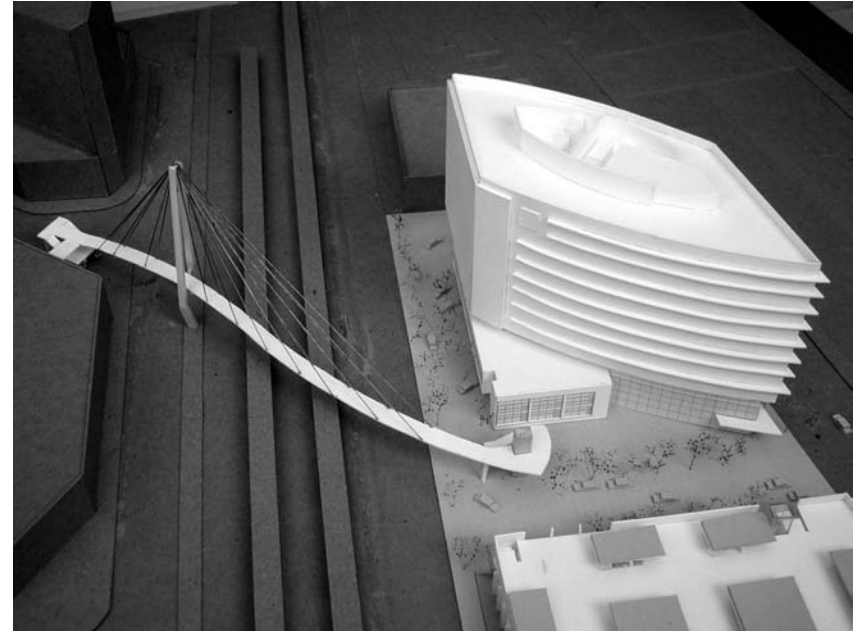
A cantilevered tower at the west end of the bridge without backspan cables is possible. This approach has been executed successfully in Europe and creates a very dramatic bridge. Optimally, the tower is tilted, in order to use gravity to balance the cable forces. This option requires a large cross section for the tower, since the tower must resist a large amount of bending stress, as compared to the backspan option. Consequently, there is a corresponding need for a rather massive foundation and heavier structure. Given these large structural elements, it is a somewhat more expensive approach.



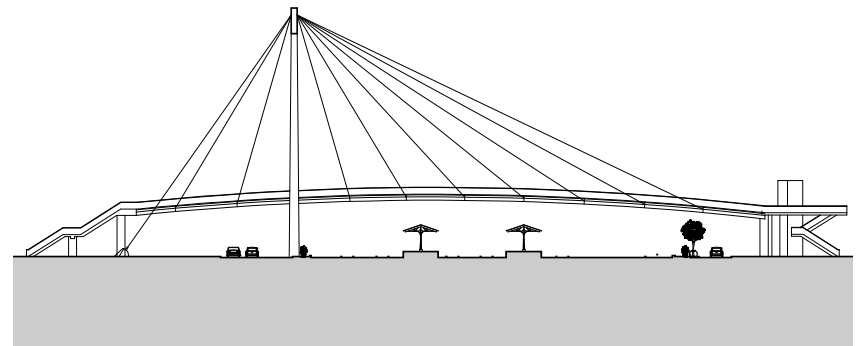
Cable-Stayed Bridge with Cantilevered Tower

BACKSPAN

This design uses backspan cables at the west end of the bridge, which terminate in concrete abutments that can be placed above or below grade in the western plaza. This structure is far more efficient than the cantilevered tower and therefore allows the pylons to be much smaller. Bending in the tower is almost eliminated, as the anchored back span cables balance the long span cable forces.



Model photo - View Looking North



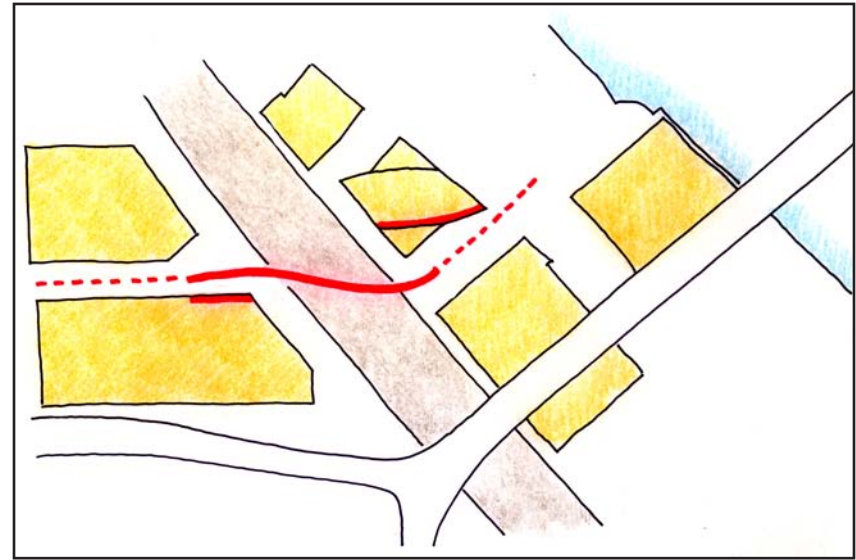
Cable-Stayed Bridge with Backspan Cables

6 CONCEPT DESIGN

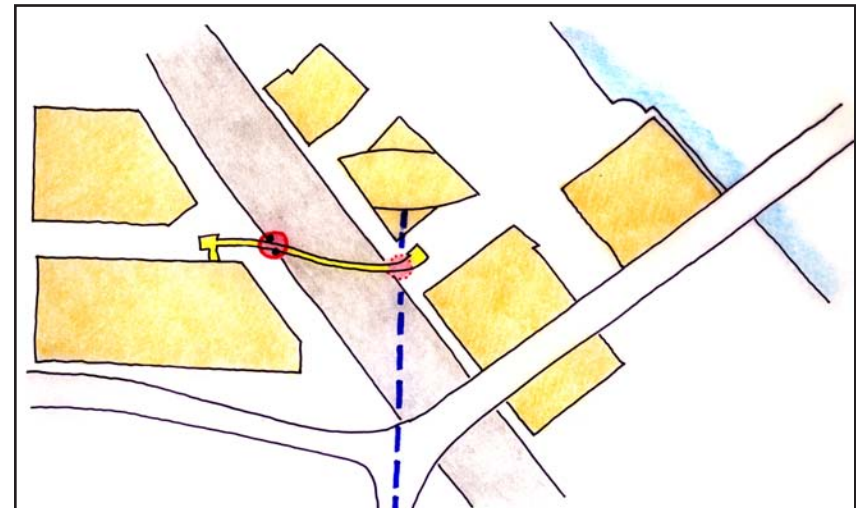
The form of the NW Marshall Street Pedestrian Bridge is generated by both its structural requirements and the unique geometry of the site. Structurally, the asymmetrical cable stayed bridge with a backspan element is the most efficient and cost effective. It allows a single point of support for the bridge proper, a requirement of the constricted site.

The bridge is curved in plan so that the landings may respond to the shift in the city grid that occurs at the railroad tracks. On the west side of the tracks the grid is oriented in a north/south direction. On the east side of the tracks the grid is oriented to the river. Additionally, this curve responds to the shape of the One Waterfront Place office building and avoids a direct axial view of the two parking structures adjacent to the project at both ends of the bridge. The bridge is curved in elevation to provide continuous disabled access and meet the required railroad clearances.

The pylons of the cable stay bridge will align with the NW Marshall Street axis, acting as a landmark indicating both the termination of the street and marking the pedestrian connection to the river. The location of the pylons, at the limit of the west railroad property line, is remote from the adjacent buildings and avoids any visual conflict with the Broadway Bridge from the Broadway ramp. The simple vertical elements of the pylons, two tilted masts connected at their top, relates to the other gateways and towers found in the River District.

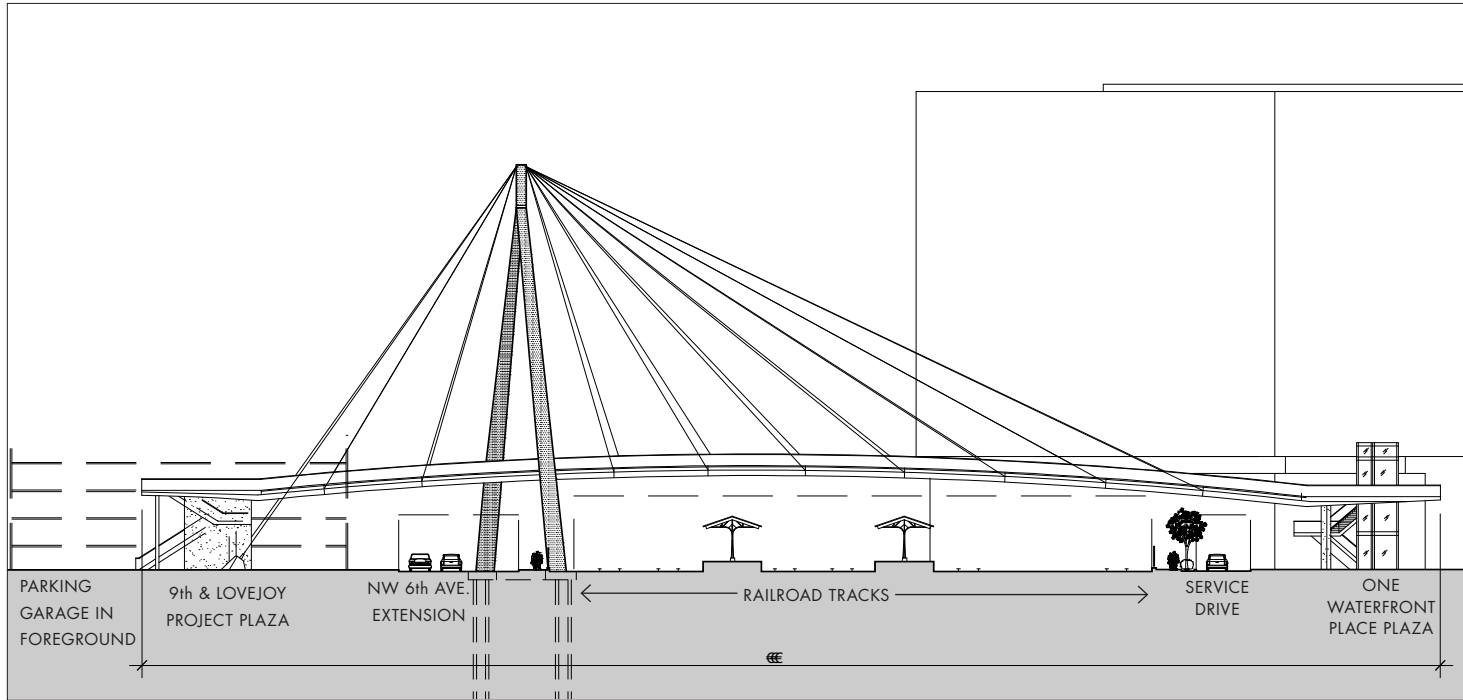


Bridge Form Diagram

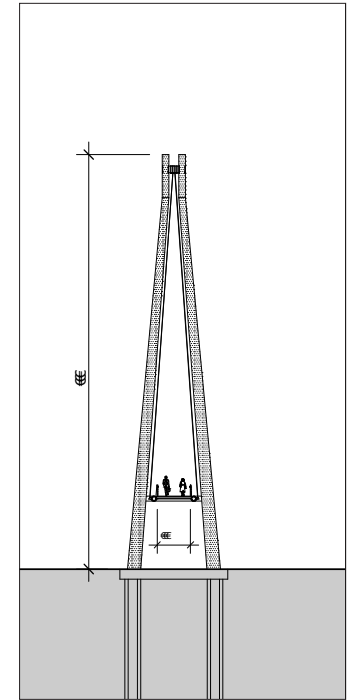


Pylon Location Diagram

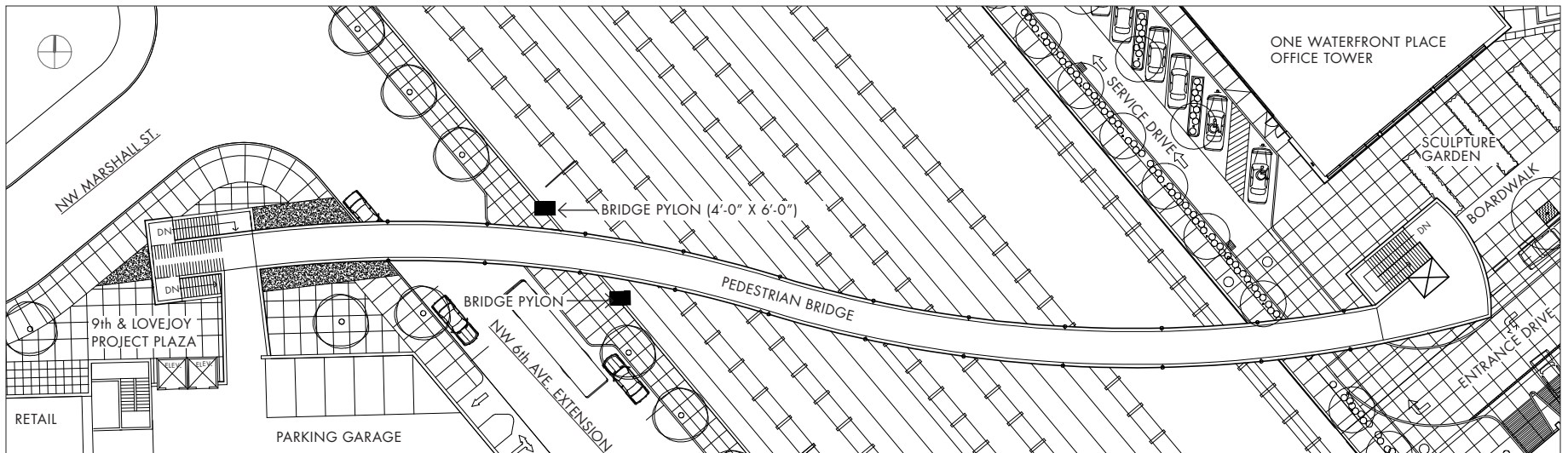
Concept Drawings



Elevation



Cross-Section



Site Plan

The two bridgeheads are asymmetrical and provide different spatial experiences. At its western extremity, the bridge ends with a double stair run and a direct connection to the elevators of the adjacent parking structure. At its eastern end, the bridge deck extends to create a viewing platform around a glass elevator. The platform overlooks the One Waterfront Place sculpture courtyard and the Willamette River beyond, before continuing to a stair aligned with the plaza boardwalk.

The walking surface of the bridge will be Ipe, a dense South American wood chosen by Portland Parks and Recreation for the River District Boardwalk, so that this boardwalk reference is carried from NW 10th Avenue through to the river.

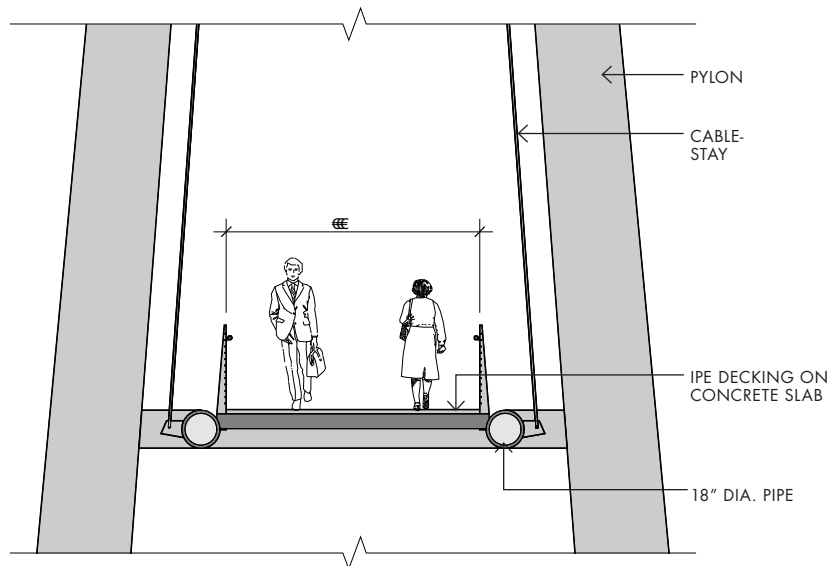
The cables supporting the bridge deck will spring from the apex of the pylons and accentuate the perception of the bridge curves in a delicate succession of triangular frames. The structural and site forces shaping the bridge are efficient, cost effective and highly sculptural. This bridge will have a unique beauty that will be an integral part of the River District's personality and vitality.



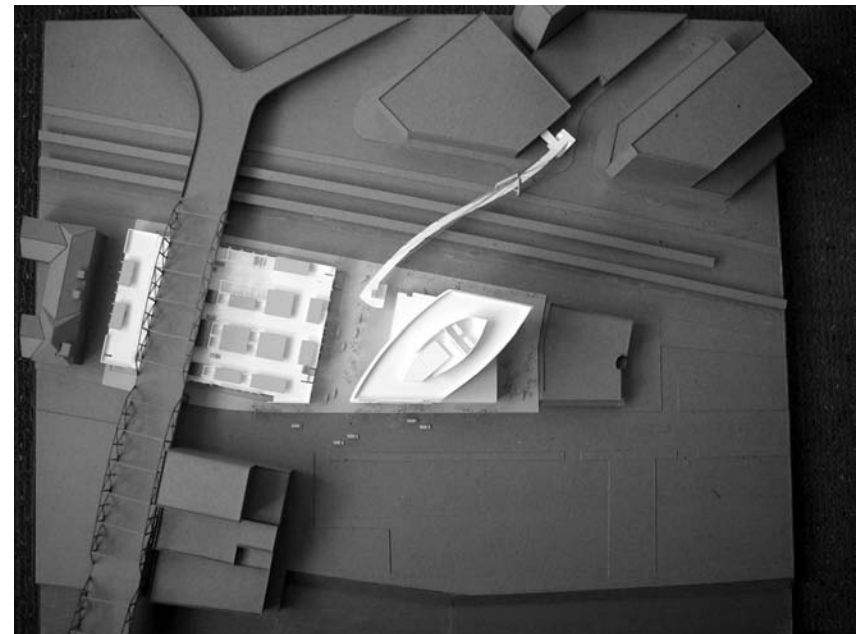
Model Photo



Model Photo



Enlarged Cross Section



Model Photo

APPENDIX

7 REGULATORY REQUIREMENTS

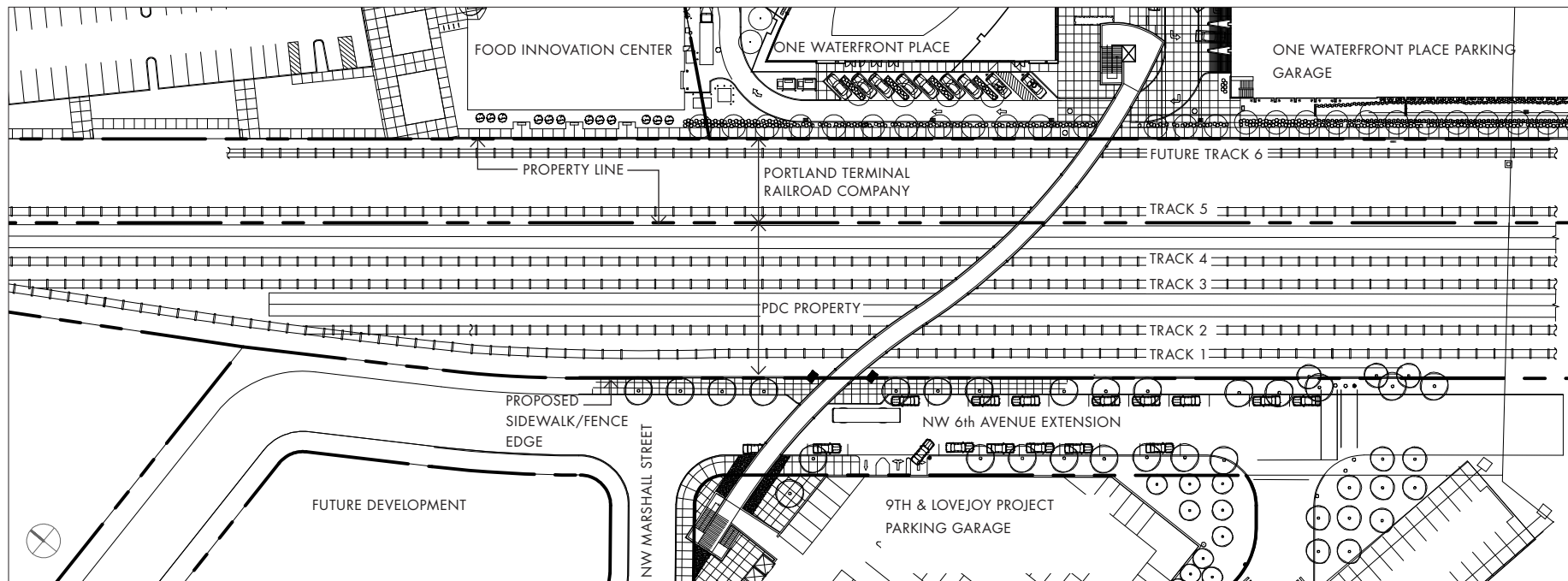
Property Ownership

The eastern bridge landing is on the One Waterfront Place property. This land is privately owned. Preliminary conversations with the owners indicate that they view the bridge as a positive addition to their project and are predisposed to accommodate it.

The bridge spans the Union Station railroad tracks. Starting at the western property line of One Waterfront Place and extending 50 feet to the west, one track (Tracks 5) is owned by the Portland Terminal Railroad Company (PTRR), which is owned by Burlington Northern and Union Pacific. PTRR has indicated that they are considering the addition of another rail line between their current Track 5 and their eastern property line.

The Portland Development Commission owns the remainder of the rail yard, comprised of Tracks 1, 2, 3 and 4. They also own the adjacent parcel to the west, where the NW 6th Avenue Extension and the 9th and Lovejoy Project parking garage will be located. The NW 6th Avenue extension right-of-way will be transferred to the City and the western boundary of the rail yard will be defined by the sidewalk/fence edge.

The western bridge landing is in the small plaza adjacent to the 9th and Lovejoy Project parking garage. The Portland Development Commission owns this plaza and the garage.



Site Plan

Regulatory Authority

Given the number of property owners impacted by this pedestrian bridge, coordination will be required among various owners and agencies.

The City of Portland will require a Type III Design Review, in addition to a building permit.

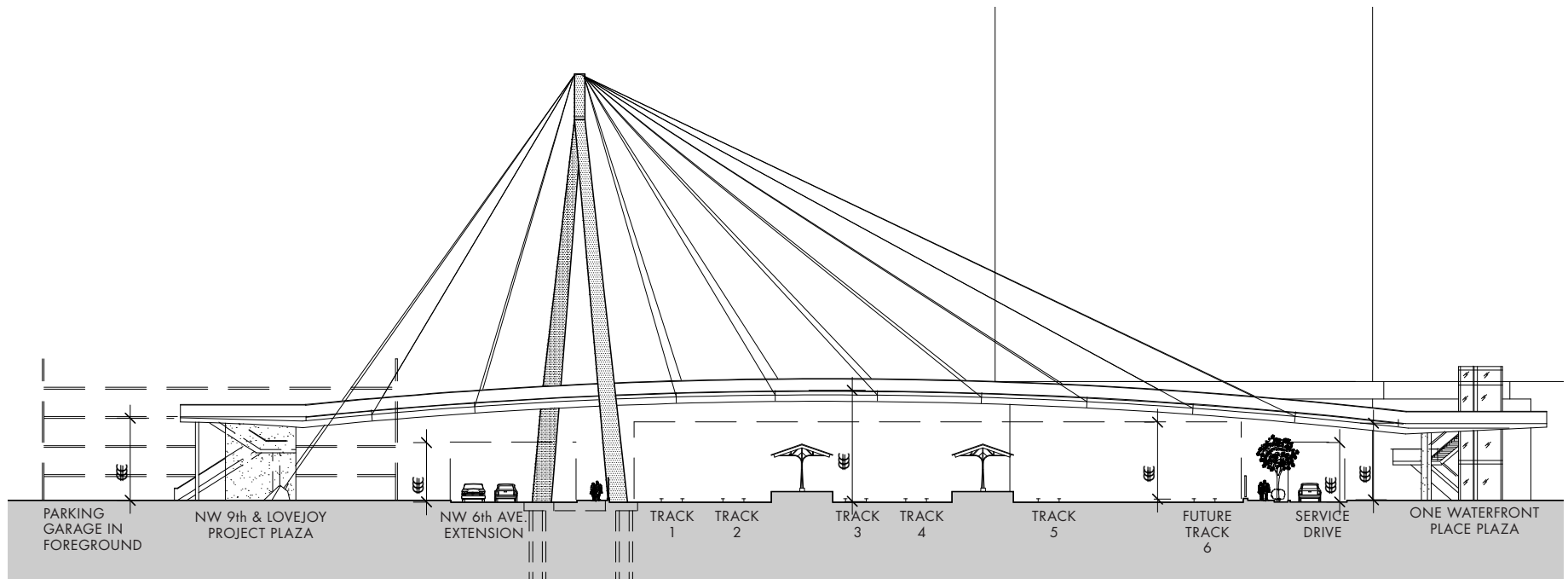
ODOT must approve all overhead public utility crossings and will notify appropriate landowners. A pedestrian easement will be required for the bridge landing on the One Waterfront property and for any boardwalk extension through that property.

PDOT will review the project and must approve any encroachments onto the sidewalk adjacent to the NW 6th Avenue Extension. Currently the bridge pylons project one or two feet into this sidewalk. There must also be coordination with TriMet regarding bus stop locations and any possible curb extensions.

The Portland Terminal Railroad Company has requested structural drawings for a Peer Review during the Design Development phase of the project. During construction Portland Terminal Railroad must grant a Right of Entry permit and will provide flag service within 25 feet of the tracks. This is similar to the process used successfully on the Union Station Pedestrian Bridge.

Street and Rail Height Clearances

The minimum vertical clearance permitted over streets is 17 feet and at the railroad tracks is 22 feet above the rail (+/-7"). Minimum required horizontal clearance is 8-1/2 feet from the centerline of the track.



Elevation

8 PROJECT SCHEDULE

Coordination with Adjacent Projects

The NW Marshall Street Pedestrian Bridge construction must be carefully coordinated with three adjacent projects. One Waterfront Place, NW 9th and Lovejoy Project and the NW 6th Avenue Extension. As the following schedule indicates, the One Waterfront Place project is currently scheduled for completion in the fall of 2003. The NW 9th and Lovejoy Project should be completed at about the same time.

Phasing and Construction Issues

The primary concerns are the coordination of footings and foundation work, as well as interfacing heavy equipment, such as tower cranes. As the foundations will likely be driven piles, this work should be phased with pile foundations on the adjacent NW 9th and Lovejoy parking garage for economy and to minimize later disruption from pile construction. Ideally, design documents for the Pedestrian Bridge would be completed at the same time as documents on the parking garage, so that the foundation work can be coordinated. The remainder of the work will coincide with the completion of the adjacent projects.

The NW 6th Avenue Extension work is planned to be substantially complete before the bridge work commences, thus there will be some repair of flatwork needed as a result of bridge construction in the street right of way.

PROJECT	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.		
ONE WATERFRONT PLACE OFFICE BUILDING	CONSTRUCTION DOCUMENTS				PERMITTING						CONSTRUCTION																			
ONE WATERFRONT PLACE PARKING GARAGE	CD'S					PERMITTING																CONSTRUCTION								
NW 9TH & LOVEJOY GARAGE	DESIGN & CONSTRUCTION DOCUMENTS										PERMITTING						CONSTRUCTION													
NW 6TH AVE. EXTENSION (NORTH OF LOVEJOY RAMP)	CONSTRUCTION DOCUMENTS				PERMITTING		CONSTRUCTION																							
NW MARSHALL STREET PEDESTRIAN BRIDGE				DESIGN & CONSTRUCTION DOCUMENTS						BIDDING/ PERMITTING						CONSTRUCTION														

9 PROJECT COSTS

Estimate

R&H Construction prepared a preliminary construction cost estimate with the assistance of the design team. The estimate is based on today's costs and includes a 5% escalation allowance for construction in 2003. Given the conceptual nature of the architectural and engineering design, a 10% design and estimating contingency is included to account for unforeseen conditions. Estimated construction costs for the bridge built in 2003 are \$2,544,523.

Description	Item Detail \$	Item \$
DIVISION 1 - GENERAL CONDITIONS		
General Conditions	\$76,500	\$76,500

DIVISION 2 - SITEWORK		
Structural Excavation/backfill		\$10,000
Structural Excavation/Backfill at Ftg's	\$10,000	
Piling		\$120,000
Augercast Piling - Main Legs	\$15,000	
Augercast Piling - West Stair	\$15,000	
Augercast Piling - East Stair	\$15,000	
Tension Piling for Cable Stays	\$45,000	
Premium for Small Quantity/4 Locations	\$10,000	
Load Test - Compression	\$5,000	
Load test - Tension	\$15,000	
West Plaza		\$32,800
Cobblestone Paving	\$15,000	
Planter & Landscaping in Planter	\$4,800	
Concrete Paving	\$9,000	
Tree & Tree Well/Grate	\$2,000	
Bench	\$2,000	
Misc. Sitework		\$10,000
Misc.	\$10,000	

DIVISION 3 - CONCRETE		
Footings & Foundations		\$70,088
Foundations & Pile Caps	\$70,088	
Slab On Grade		\$7,000
Slab	\$7,000	
Structural Suspended Slab		\$94,304
Structural Suspended Slab - Bridge	\$68,000	
Structural Suspended Slab - Landings	\$26,304	
Cast Concrete Walls		\$18,503
Shear Walls	\$14,303	
Premium for Architectural Finish	\$4,200	
Exterior Architectural Concrete		\$100,636
Non-Structural Architectural Walls	\$68,236	
Stairs	\$32,400	
Concrete Reinforcement		\$39,175
Reinforcing Steel	\$39,175	
Misc. Concrete	\$16,485	\$16,485

DIVISION 5 - METALS		
Structural Steel		\$731,250
Steel Structure Furnish & Installed	\$731,250	
Misc. and Architectural Steel		\$64,750
Bridge Railings - Cable	\$0	
Stair Railings	\$17,000	
Landing Railings	\$12,750	
Elevator Room with SS Cladding	\$20,000	
Misc Steel	\$15,000	

DIVISION 6 - CARPENTRY		
Exterior Finish Carpentry		\$98,160
Ipe - Walkway	\$55,500	
Ipe - Landings	\$24,660	
Ipe - Stairs	\$18,000	
Misc. Carpentry	\$10,000	\$10,000

DIVISION 7 - THERMAL & MOISTURE PROTECTION		
Roofing		\$500
Roofing - Elevator	\$500	
Sheetmetal		\$1,000
Misc. Flashing	\$1,000	
Waterproofing & Membranes		\$25,000
Elevator Pit	\$1,000	
Deck Membrane	\$24,000	

DIVISION 8 - DOORS & WINDOWS		
Windows & Cladding		\$8,640
Glazed Window - Elevator Backwall	\$8,640	
Doors		\$1,400
Exterior HM Doors - SS at Elevator Rooi	\$1,400	
Misc Doors & Windows	\$1,000	\$1,000

DIVISION 9 - FINISHES		
Exterior Painting		\$84,772
Structural Steel	\$69,000	
Cable Railing Supports	\$740	
Ipe Sealer	\$3,032	
Exposed Concrete - Clean & Seal	\$10,000	
Misc.	\$2,000	

DIVISION 10 - SPECIALTIES		
Signage - Allowance	\$2,000	\$2,000
Misc Specialties	\$1,000	\$1,000

DIVISION 14 - CONVEYING SYSTEMS		
Elevator - Passenger - Hydraulic	\$40,000	\$40,000
Upgrade Premium for Rear Wall Glass	\$5,000	\$5,000
Cab Finish Upgrade Allowance	\$5,000	\$5,000
Jackhole Drill & Case	\$5,000	\$5,000
Construction Hoisting - Misc.	\$10,000	\$10,000

DIVISION 15 - MECHANICAL		
Plumbing:		\$21,800
Services	\$5,000	
Hose Bibbs	\$4,800	
Drains	\$4,000	
Trench Drains	\$2,000	
Elevator Sumps	\$1,000	
Misc. Plumbing	\$5,000	

DIVISION 16 -ELECTRICAL		
Electrical Service		\$361,796
Service & Power	\$16,000	
Walkway/ Landing/Stair Lighted Railing	\$310,122	
Tower Lights	\$35,674	
Misc Electrical	\$5,000	\$5,000

Subtotal Estimated Shell Costs	\$2,083,558	\$2,083,558
---------------------------------------	--------------------	--------------------

Contractor Fee	5.0%	\$104,178
Subtotal		\$2,187,736
Liability Insurance	0.7%	\$15,314
Subtotal		\$2,203,050
Cost Escalation/ Inflation for 2003 Construction	5.0% allowance	\$110,153
Subtotal		\$2,313,203
Design/Estimating Contingency	10.0% allowance	\$231,320
TOTAL ESTIMATED SHELL COSTS		\$2,544,523

ESTIMATED SOFT COSTS		
Design Fees, Agency Fees, Geotech, Survey, PTRC flagger		\$533,250
Subtotal		\$3,077,773
Owner's Construction Contingency	10.0% allowance	\$307,777

TOTAL ESTIMATED PROJECT COSTS	\$3,385,550
--------------------------------------	--------------------

10 CONTACTS

Owner:
Portland Development Commission
Contact: Kathryn Krygier
503.823.2033

Architect:
BOORA Architects, Inc.
Contact: John Meadows
503.226.1575

Planning Consultant:
G. Papers Urban Design
Contact: Garry Papers
619.237.1960 x3266

Structural:
Grant Davis, PE
503.357.8824

Cost Estimator:
R&H Construction
Contact: Norm Dowty
503.228.7177

Architect - NW 9th & Lovejoy Project:
Robert S. Leeb Architects & Planners
Contact: Robert Leeb
503.228.2840

Civil Engineer - NW 6th Ave. Extension:
KPFF Consulting Engineers
Contact: Steve Murray
503.227.3251

Railroad:
Portland Terminal Railroad Company
Contact: Tom Simon
503.241.9890

Transportation:
ODOT:
Contact: Howard Fegles
503.986.4094

PDOT:
Contact: Chon Wong
503.823.7050

11 MEETING NOTES

Following are meeting notes taken by BOORA Architects during the Feasibility Study process, May through October, 2001.

