Bridge Replacement Technical Report

Multnomah County | Earthquake Ready Burnside Bridge

Portland, OR

January 29, 2021

Earthquake Ready Burnside Bridge - Bridge Replacement Technical Report

Prepared for

Multnomah County
Transportation Division - Bridges
1403 SE Water Avenue
Portland, OR 97214

Prepared by

HDR
1050 SW Sixth Avenue, Suite 1700
Portland, OR 97204
T 503.423.3700

Parametrix
700 NE Multnomah Street, Suite 1000
Portland, OR 97232-4110
T 503.233.2400

Exeltech Consulting, Inc.
8729 Commerce Place Drive NE, Suite A
Lacey, WA 98516
T 360.357.8289

Contract# DCS-SVCSGEN-857-2019-conv
HDR Project #10144814

CERTIFICATION

The technical material and data contained in this document were prepared under the supervision and direction of the undersigned, whose seal, as a professional engineer licensed to practice as such, is affixed below.

______________________________Signature Reserved for Final Version

Prepared by Rebecca Bautista (Consultant Bridge Engineer)

______________________________Signature Reserved for Final Version

Checked by Mark Libby (Consultant Bridge Lead)

______________________________Signature Reserved for Final Version

Reviewed by Steve Drahota (Consultant Technical Lead)

______________________________Signature Reserved for Final Version

Approved by Heather Catron (Consultant Project Manager)

Contents

Tables

Figures

Appendices

Acronyms, Initialisms, and Abbreviations

AASHTO	American Association of State Highway and Transportation Officials
ADA	Americans with Disabilities Act
API	Area of Potential Impact
CFR	Code of Federal Regulations
CIP	Capital Improvement Plan
City	City of Portland, Oregon
Couch Extension	Replacement Alternative with Couch Extension
County	Multnomah County, Oregon
CSO	Combined sewer overflow
CSZ	Cascadia Subduction Zone
DSSI	Dynamic soil-structure interaction
EB	Eastbound
EIS	environmental impact statement
EQRB	Earthquake Ready Burnside Bridge
ERS	Earthquake resisting system
Fixed Replacement	Replacement Fixed Bridge on Existing Alignment
FO	Full Operation
I-5	Interstate 5
I-84	Interstate 84
LO	Limited Operation
Long-span Alternative	Replacement Alternative with Long-span Approach
LRT	Light rail transit
MSE	mechanically stabilized earth
NEPA	National Environmental Policy Act of 1969
No Temporary Bridge	Without Temporary Bridge Option
ODOT	Oregon Department of Transportation
Project	Earthquake Ready Burnside Bridge

ROW	right-of-way
RSA	Response Spectrum Analysis
SDC	Seismic Design Criteria
Short-span Alternative	Replacement Alternative with Short-span Approach
Temporary Bridge	Temporary Detour Bridge Option
UPRR	Union Pacific Railroad
USCG	U.S. Coast Guard
WB	westbound

This page is intentionally left blank.

Executive Summary

Objectives

As a part of the preparation of the Environmental Impact Statement (EIS) for the Earthquake Ready Burnside Bridge (EQRB) Project, this technical report has been prepared to document the technical aspects of the bridge replacement alternatives studied. Three replacement alternatives have been evaluated and a wide range of issues investigated. This report describes the criteria and detailed considerations for the bridge replacement alternatives studied.

To establish a consistent and reasonable set of alternative impacts, benefits, and construction costs prior to performing detailed designs; structural typical sections were developed for each alternative. They do not represent a decision on bridge width, lane configurations, lane allocations, or even structure type. Instead, they serve as a basis-of-design in order to establish bridge footprint, verify ability to meet clearances, evaluate seismic demands and impacts related to construction. These parameters are expected to change and evolve during the design phase.

Bridge Replacement Alternatives

The following are the bridge replacement alternatives considered for the National Environmental Policy Act (NEPA) Phase Assessment:

Fixed Bridge on Existing Alignment (Fixed Replacement) – This alternative investigates a high-profile fixed bridge on the existing alignment of Burnside Street.

Replacement Alternative with either Short-span Approaches (aka, Short-span Alternative) or Long-span Approaches (aka, Long-span Alternative). – This alternative proposes to replace the existing structure with a movable bridge span over the primary navigation channel and fixed bridge spans for the east and west approaches. Vertical lift and bascule span types are evaluated. The alignment and profile are set to tie into the existing Burnside Bridge landings at each end.

Replacement Alternative with Couch Extension (aka, Couch Extension) – This alternative proposes to replace the existing structure with a movable bridge span over the primary navigation channel and fixed bridge spans for the east and west approaches. Vertical lift and bascule span types are evaluated. The alignment and profile for the west approach is set to tie into the existing Burnside Bridge landing. The east approach alignment and profile splits into one-way connections on E Burnside Street and NE Couch Street.

Each of the above alternatives was studied with and without a Temporary Detour Bridge Option (aka, Temporary Bridge) for the following modes:

- All modes
- Transit, bicycles and pedestrians only
- Bicycles and pedestrians only

This page is intentionally left blank.

1 Introduction

Multnomah County (County) will be directing the study and development of an EIS as part of the NEPA assessment for the Earthquake Ready Burnside Bridge (EQRB) river crossing. The following summarizes the EQRB Project (Project) background, the problem being addressed, and the Project's intent.

1.1 Background and Bridge Description

Burnside Street, which extends from Washington County to Gresham and crosses the Willamette River via the Burnside Bridge, has been designated as a "lifeline" transportation route, meaning it will be expected to enable emergency response, evacuation, and recovery after a major disaster.

The existing Burnside Bridge carries a total of 35,000 vehicles per day, with 19,000 eastbound and 16,000 westbound vehicles (traffic counts are from 2019). Built in 1926, the Burnside Bridge is an aging structure requiring increasingly frequent and significant repairs and maintenance. The Burnside Bridge crosses the Willamette River, multiple City of Portland (City) streets, parking lots, parks, TriMet Max lines, and other facilities along Burnside Street. The bridge carries three eastbound and two westbound lanes of vehicle traffic as well as bike lanes and sidewalks in each direction. The total bridge length is approximately 2,307 feet and consists of three separate structures:

- West Approach Bridge (Br. No. 00511A) spans 602 feet
- Main River Bridge (Br. No. 00511) spans 856 feet
- East Approach Bridge (Br. No. 00511B) spans 849 feet

The bridge is designated a historically significant structure and is listed on the National Register of Historic Places.

Figure 1. Burnside Bridge Main River Span Bridge over the Willamette River, Portland, Oregon

1.1.1 The Need for Seismic Resilience

Geologically, Oregon is located in the Cascadia Subduction Zone (CSZ), making it subject to some of the world's most powerful recurring earthquakes. The last major earthquake in Oregon occurred over 300 years ago, in 1700, a timespan that exceeds 75 percent of the intervals between the major earthquakes to hit Oregon over the last 10,000 years. There is a significant risk that the next event will occur relatively soon. Such an earthquake will cause major ground shaking, settling, and landslides, and it is expected to result in major and widespread damage to buildings, utilities, and transportation facilities (OSSPAC 2014), leaving the City divided, and isolating members of the community.

The next major earthquake is expected to cause moderate to significant damage to the aging downtown bridges, including the existing Burnside Bridge, rendering them potentially unusable immediately following the earthquake. In their existing condition, all of the downtown bridges and/or approaches fail to provide communities and the region with timely and reliable critical emergency response, evacuation, and recovery functions.

In response to this risk from a future seismic event, Multnomah County recently completed its 20-year Willamette Bridges Capital Improvement Plan (CIP), 2015. This plan was a comprehensive study of the County's six bridges crossing the Willamette River, focusing mainly on the four downtown structures, and provided a high-level assessment of their conditions and a list of required improvements to promote safety and reliability for those critical transportation infrastructures. The CIP identified the Burnside Bridge seismic resiliency as a top priority for Multnomah County in the next 20 years.

1.1.2 Burnside Street Lifeline Designation

Burnside Bridge is designated as the only County-owned Primary Emergency Transportation Route across the Willamette River in downtown Portland in a 1996 report to Metro's Regional Emergency Management Group. This group was formed by intergovernmental agreement among the region's cities, counties, Metro, and the Red Cross to improve disaster preparedness, response, recovery, and mitigation plans and programs. (Metro 1996).

The Burnside Street emergency route is approximately 18.7 miles in length and extends from SW 57th Avenue in Washington County to US Highway 26 in Gresham, crossing the Willamette River via the Burnside Bridge.

Other agency plans have also identified Burnside Street as an important lifeline route. For example, the City's Citywide Evacuation Plan addresses evacuation needs for general disasters. The Plan identifies Burnside Street as a secondary east-west evacuation route and an emergency transportation route (PBEM 2017).

The statewide Oregon Resilience Plan does not make specific recommendations for seismic resilience of locally owned roads or bridges. The plan's specific roadway and bridge recommendations focus on state-owned facilities. However, the statewide plan does acknowledge and emphasize the importance of creating seismically resilient local bridges and roads, particularly to support lifeline functions in urban areas. Relevant statements in the Oregon Resilience Plan include:

- Enhance the proposed (state) Highway Lifeline Maps by considering the use of highway segments, owned by cities and counties, to provide access to critical facilities. Prioritize local routes to provide access to population centers and critical facilities from the identified (state) Tier-1 routes (OSSPAC 2013, 105-159).
- When developing projects for seismic retrofit of (state) highway facilities, consider whether a local agency roadway may offer a more cost-effective alternative for all or part of a lifeline route (OSSPAC 2013, 105-159).
- Recommend seismically upgrading lifeline transportation routes into and out of major business centers statewide by 2030 (OSSPAC 2013, xiii).

1.1.3 Project Intent

The primary purpose of the Project is to build a seismically resilient Burnside Street lifeline crossing over the Willamette River that will remain fully operational and accessible for vehicles and other modes of transportation following a major CSZ earthquake. The Burnside Bridge will provide a reliable crossing for emergency response, evacuation, and economic recovery after an earthquake. Additionally, the bridge will provide a long-term safe crossing with low-maintenance needs.

It would enable:

- Emergency medical, fire, and life safety response
- Evacuation of survivors to safe locations
- Reunification of families and households
- Post-disaster restoration of services
- Regional recovery

The Project would help to implement specific and general recommendations for seismic resilience outlined in relevant local, regional, and state plans and policies.

The Project would be compatible with existing major infrastructure.

The Project would provide long-term, low-maintenance, multi-modal transportation functions over the Burnside Street Willamette River crossing consistent with the County's values.

1.1.4 Bridge Replacement Technical Report Intent

The purpose of the EQRB Bridge Replacement Technical Report is to document the technical aspects of the bridge replacement alternatives studied. A variety of replacement alternatives were previously evaluated in the Feasibility Study Phase. This report herein describes the more detailed evaluation for the three replacement bridge alternatives selected for further study. The following are the focus of this evaluation:

- Refinement of Bridge layout and foundation footprint
- Seismic Resiliency
- Constructability

This technical report does not represent a decision on bridge Type Size and Location; but rather serves as a basis-of-design in order to establish a bridge footprint, verify ability to meet clearances, evaluate seismic demands, and impacts related to construction.

1.2 Major Transportation Facilities and Critical Infrastructure

The seismic resiliency of the Burnside Bridge is impacted by the adjacent major transportation facilities and buildings. The Project design team considered the following existing facilities during the conceptual design process:

1. TriMet light rail lines run on 5th Avenue and under the west approach of the bridge at 1st Avenue on the west side.
2. The City of Portland roadway facilities: Naito Parkway runs under the west approach of the bridge, 2nd and 3rd Avenues run under the east approach spans, and Martin Luther King Jr. (MLK) Boulevard and Grand Avenue are adjacent to the east approach.
3. The City of Portland large diameter combined sewer overflow (CSO) pipes run under both the west approach and east approach bridge spans.
4. Interstate 5 (I-5) south and northbound main lines and the ramps to and from Interstate 84 (I-84) run under the east approach of the Bridge.
5. Union Pacific Railroad (UPRR) lines run under the east approach of the bridge.
6. River navigation channel for U.S. Coast Guard (USCG) and other river users.
7. The Portland Streetcar runs just east of the bridge on MLK Boulevard and Grand Avenue.

8. The west and east approaches of the bridge are within close proximity to adjacent buildings, some having sidewalk access from Burnside Street.

Figure 2. Adjacent Major Transportation Facilities and Buildings of Burnside Bridge

2 Design Criteria and Other Considerations

At a minimum, the bridge replacement alternatives will be designed to current City, County, State, and national standards as applicable for the features and components of the alternative. Bridges and structures will be designed for a minimum 100-year design life.

Subsequent sections describe the project-specific technical reports and applicable criteria and design considerations documented within those reports.

2.1 Bridge Design Criteria

The relevant design specifications and guidelines that are the basis of the bridge replacement alternatives can be found in the *EQRB Bridge Design Criteria* (Multnomah County 2021a) (Appendix A). The criteria provide design loading and specific clearance requirements for the proposed alignments and detailed considerations for the three bridge replacement alternatives being studied during the NEPA Phase. The following unique loading criteria have would be taken into consideration:

- Removal of load restrictions across the Burnside Bridge by including Emergency Vehicle (EVs) into the design criteria.
- Able to accommodate Portland Streetcar.

2.2 Seismic Design Criteria

The relevant seismic design and guidelines that are the basis of the bridge replacement alternatives can be found in the *EQRB Seismic Design Criteria (SDC)* (Multnomah County 2021h) (Appendix A). The purpose of the SDC is to identify the minimum requirements for seismic design for the NEPA Phase design assessment.

Seismic performance goals defined for this project are as follows:

Full Operation – Damage sustained is negligible. Only minimal, superficial repairs and maintenance activities will be required post-earthquake without interruption to traffic. All traffic modes are able to use the bridge immediately after the earthquake. Full operation of movable span will be possible within weeks of the CSZ seismic event.

Limited Operation – Damage sustained is minimal. The bridge allows for emergency vehicles (after inspection and removal of debris). Movable components may not be operable without repairs. Damage is repairable but may have short-term traffic impacts.

2.3 Roadway Geometrics

Roadway design standards are developed to support safety and mobility goals. Roadway deficiencies have a critical impact on the safe and efficient use of the road by all travelers. The deficiencies of existing Burnside Bridge and approach roadway have been identified in the *EQRB Existing Roadway Deficiency Memo* (Multnomah County 2021c) (Appendix A). The proposed roadway geometrics for each replacement alternative have been defined in the *EQRB Facilities Standards List* (Multnomah County 2021d) (Appendix A) by using applicable AASHTO, Oregon Department of Transportation (ODOT), and County design standards.

For roadway layout and profile sheets developed for the replacement alternatives, see Appendix C.

2.4 Geotechnical Conditions

The results of the geotechnical research, field explorations, laboratory testing, analyses, and design recommendations for the bridge replacement alternatives can be found in the *EQRB Geotechnical Report* (Multnomah County 2021e) (Appendix A). Geotechnical analyses and recommendations presented in that report expand on the preliminary geotechnical work performed during the EQRB Feasibility Study. Foundation recommendations as well as seismic hazard mitigation have been identified for each bridge replacement alternative. These findings have also been discussed and summarized in Section 4.

2.5 Multi-Modal/Transit Considerations

As a part of the preparation of the EIS for the Project, the *EQRB Transportation Technical Report* (Multnomah County 2021i) was prepared to identify and evaluate Transportation within the Project's Area of Potential Impact (API). Transportation modes evaluated are automobiles, bus, light rail, streetcar, freight, bicycles, and pedestrians. Direct effects caused by proposed alternatives were evaluated within the direct impact area, whereas the indirect impact area was used to evaluate broader transportation implications for all modes during construction.

2.6 Navigation Clearances

The commercial, recreational, and government vessel traffic that transit the Willamette River under the Burnside Bridge has been summarized in the *EQRB Preliminary Navigation Study* (Multnomah County 2021f) (Appendix A). River user impacts, if any, have been identified for each of the bridge replacement alternatives. Furthermore, elevation and horizontal clearance requirements are discussed; these have been identified as Elevation 167.1 (NAVD 88), 147-foot vertical clearance (above ordinary high water Elevation 20.1) and 205-foot wide horizontal clearance. Ultimately, USCG requirement is to enable 100 percent of vessel traffic to safely transit the bridge.

2.7 Railroad Considerations

The Project site is located over UPRR tracks. At the time of this report, railroad coordination and input has not been initiated. Once coordination begins, items to discuss include, but are not limited to:

- Temporary access to facilitate demolition of the existing bridge adjacent to and over the UPRR tracks.
- Temporary track crossings to facilitate construction of the proposed replacement bridge.
- UPRR flagging requirements and third party inspector at Project site.

2.8 Right-Of-Way

Per preliminary right-of-way (ROW) investigations, it has been determined that in addition to the County's current easements and resolutions, additional ROW acquisitions are anticipated from parcels on both the west and east approaches of the proposed replacement bridge alternatives. Additionally, temporary construction easements would need to be secured to construct the proposed bridge and road improvements. As the design for this project progresses, HDR will work closely with the County to determine the extents of the permanent and temporary ROW needs. Preliminary ROW impact maps have been identified and detailed within the *EQRB Right-of-Way Technical Report* (Multnomah County 2021g).

2.9 Utilities

Reasonable attempts have been made to avoid utility infrastructure with proposed bridge layouts where practical. Foundation elements have been located to avoid the large diameter CSO pipes. Smaller utilities that are near the surface have been avoided where practical, but some temporary utility relocations would be required.

Expected temporary impacts include:

- Temporary relocation of sewer lines running along the sea wall behind and adjacent to the existing Pier 1.

- Temporary disruption to TriMet's overhead catenary lines attached to existing Bent 3.
- Abandonment or temporary relocation of all other utilities directly attached to the existing bridge structure.

For further discussion about these impacts and their need, see the *EQRB Construction Approach Technical Report* (Multnomah County 2021b) and the *EQRB Utilities Technical Report* (Multnomah County 2021j).

2.10 Hydraulic Considerations

At the time of this report, a design hydraulic study has not been conducted. Preliminary analysis and water surface elevations will need to be determined for the design flood events. Freeboard for the proposed structure will need to meet Federal Highway Administration and ODOT criteria for both the 50-year and 100-year flood events. Analysis will be done to determine the preferred alternative's impact on the base flood elevation. The Project is expected to have only minor flood elevation increases for the final condition, though temporary conditions during construction may have impacts that would require mitigation. If the new bridge contributes to a net increase in the 100-year base flood elevation, the Project may require conveyance offsets or may request revision to the base flood elevation to accommodate the new bridge piers. A Letter of Map Revision or Conditional Letter of Map Revision would be required for Federal Emergency Management Agency flood insurance maps.

2.11 Constructability

The anticipated approach to construct for the replacement bridge alternatives can be found in the *EQRB Construction Approach Technical Report* (Multnomah County 2021b) (Appendix A). The purpose of this report is to identify the potential phasing and staged construction considerations for the duration of the bridge construction. Project specific construction activities have been investigated for the replacement bridge alternatives being studied for the EIS.

2.12 Aesthetics and Urban Design

Although not specifically identified at the time of this report, it is anticipated that architectural aesthetics for this project will be of significant importance. Additionally, design features that would fit the urban context will be developed. As the design for this project progresses, HDR will work closely with the County and City of Portland to define the extents of the aesthetic and urban design needs and incorporate them into the design of the Project.

3 Alternative Development

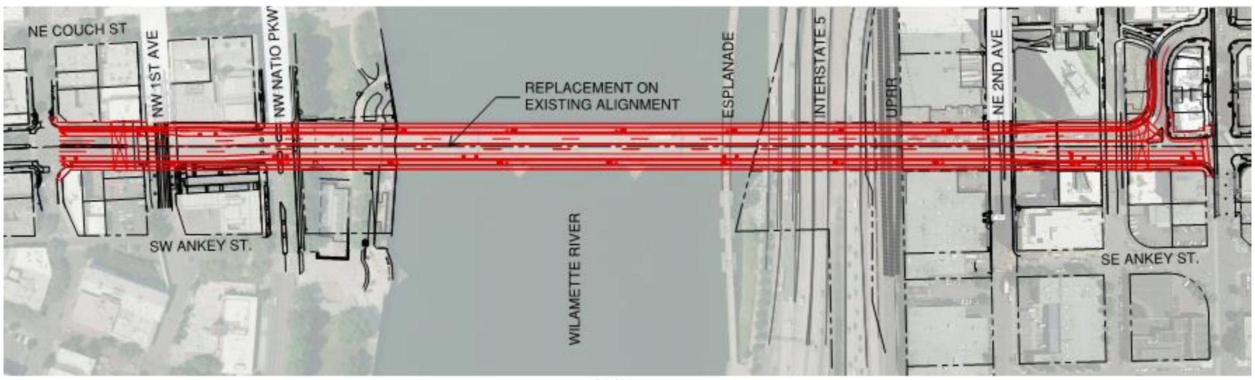
Numerous horizontal and vertical alignments were considered to satisfy the replacement bridge design criteria. After initial assessments during the Feasibility Study, two horizontal alignments and three vertical profiles were selected for further study.

3.1 Horizontal Alignment

3.1.1 Existing Alignment

The existing alignment is used for the Fixed, Short-span, and Long-span bridge replacement alternatives that will be discussed in Section 4.1 and 4.2. As the name implies, this alignment maintains the existing horizontal geometry of Burnside Street. The existing one-way couplet of NE Couch Street for westbound traffic and E Burnside Street for eastbound traffic is maintained.

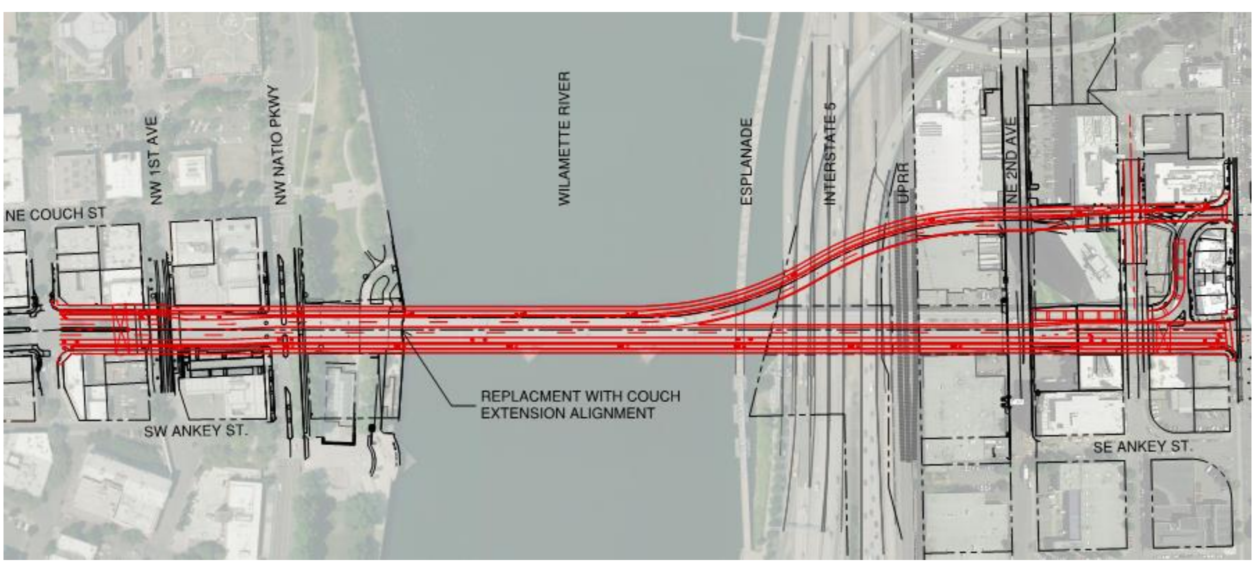
Figure 3. Replacement on Existing Alignment



3.1.2 Northeast Couplet Alignment

The northeast couplet alignment is used for the Couch Extension that will be discussed in Section 4.3. This alignment maintains the existing horizontal geometry of Burnside Street on the west approach and through the main river spans. At the east end of the movable span the east approach alignment splits into a one-way couplet of NE Couch Street (westbound) and E Burnside Street (eastbound); this eliminates the tight reversing curves of the existing Couch Street connection.

Figure 4. Replacement with Couch Extension Alignment



3.2 Vertical Profile

3.2.1 High Profile on Existing Alignment

A profile was developed for a high fixed bridge alternative (Fixed Replacement), located on the existing alignment. This vertical profile is set to provide sufficient vertical clearance over the primary river navigation channel without use of a movable span system. Based on the recently completed River User Survey and coordination with the USCG, the *EQRB Preliminary Navigation Study* (Multnomah County 2021f) (Appendix A) requires a minimum vertical clearance of 147 feet to comply with USCG navigation requirements (33 CFR §33.114-118).

High vertical profiles were previously evaluated in the Feasibility Phase; however, profile with vertical clearance higher than 97 feet were dismissed due to the significant impacts it caused to existing buildings, City roads, public transit, and public services at the approaches. Therefore, complying with the 147-foot clearance required by the USCG is impractical. It is recommended that a high fixed bridge replacement alternative be removed from consideration. Please reference the *EQRB Recommendation to Remove the Fixed Bridge Alternative from Further Consideration Memo* (Multnomah County 2019) (Appendix A) for additional explanation of the background and rationale for these recommendations.

3.2.2 Low Profile on Existing Alignment

A profile was developed for a low movable bridge alternative located on the existing alignment. This vertical profile is used for both the Short-span and Long-span Alternatives, and is set to maintain the existing closed bascule span clearance over the navigation channel, and satisfy other land transportation mode clearances. The east and west roadway approach conforms to the existing roadway near NE Couch Street and NW 2nd Avenue, respectively. The profile has a maximum grade of 4.20 percent, which balances the desire to minimize grade for bicycle and pedestrian bridge users and maximize the grade to increase river navigational clearance. The profile of the approach bridges were set to maintain sidewalk access to adjacent buildings between NW 2nd Avenue and NW 1st Avenue, and between SE 3rd Avenue and SE MLK Boulevard.

3.2.3 Low Profile on NE Couch Couplet Alignment

A profile was developed for a low movable bridge alternative located on the NE Couch couplet alignment. This vertical profile is used for the Couch Extension. The west approach and river span profile is similar to the profile discussed in Section 3.2.2, it is set to maintain the existing closed bascule span clearance over the navigation channel, and satisfy other land transportation mode clearances. The profile then splits at the east approach; the eastbound and westbound sections of the east approach profile climbs higher than the existing Burnside Bridge. This is necessary in order to maintain vertical clearances over the I-84 and I-5 structures below. The profile adheres to the 4.75 percent maximum allowable grade for pedestrian accessibility. The profile maintains connectivity of NE 3rd Avenue and SE 3rd Avenue by a combination of lowering 3rd Avenue, maximizing NE Couch Street grade, and minimizing NE Couch Street vertical curvature.

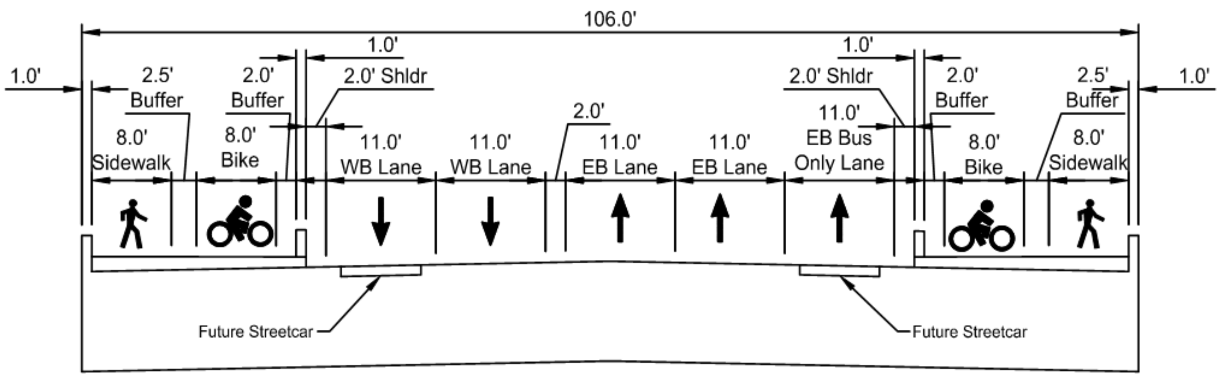
3.3 Structural Typical Sections

The typical sections developed herein, represent a possibility for bridge width, lane configuration and mode allocation. They do not represent a final decision, but rather a basis-for-design. These parameters are expected to change and evolve during the design phase. See the roadway plans (Appendix C) for structure sections not shown below.

3.3.1 Full Width Typical Section (Short-span Alternative)

This bridge section provides three eastbound lanes and two westbound lanes for vehicles and 8-foot sidewalks and 8-foot bike lanes on each side, separated from vehicular traffic by concrete barriers and buffers, for an overall width of 106 feet.

Figure 5. Full Width Typical Section (Short-span Alternative)

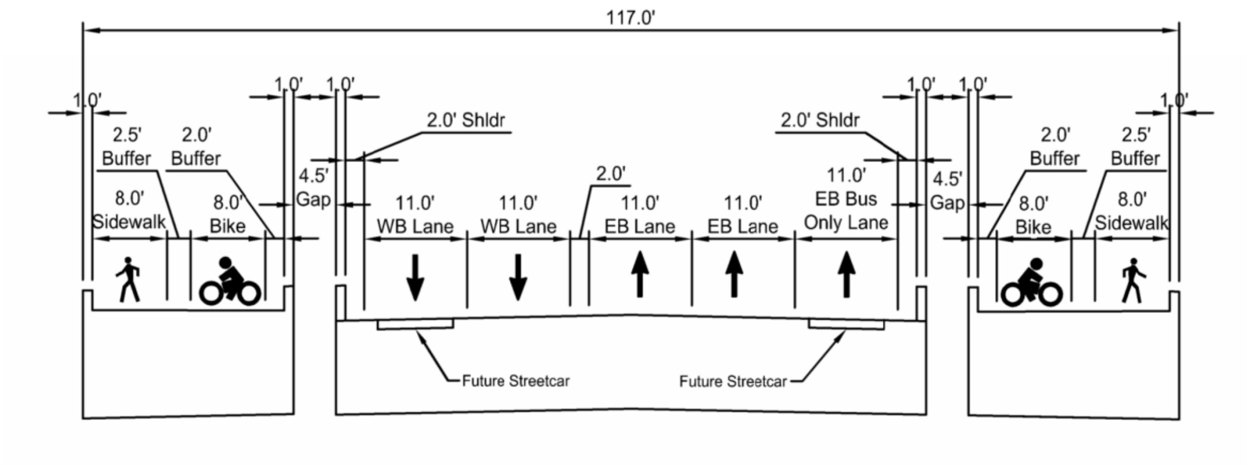


Note: EB (eastbound), WB (westbound)

3.3.2 Full Width Typical Section (Long-span Alternative)

Although this bridge section provides the same pedestrian, bike, and vehicle travel lanes as described in the Full Width Typical Section (Short-span Alternative) section above, the overall width is expected to be wider to accommodate structural components that must pass through the bridge deck. For the tied-arch option shown, the overall width would be up to 117 feet. This width is maintained across the main river spans, and would taper back to the typical width of the Short-span Alternative in order to avoid impacts with existing buildings on the east and west approaches.

Figure 6. Full Width Typical Section (Long-span Alternative)

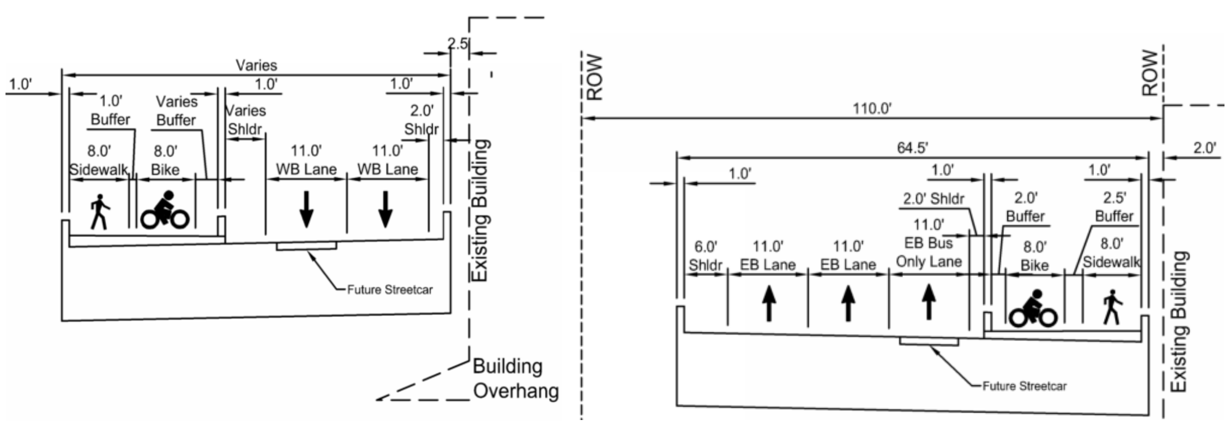


Note: EB (eastbound), WB (westbound)

3.3.3 Couplet Section

The Couch Extension has the same traffic features as the full width section, but with eastbound and westbound directions carried on separate structures. The northern split alignment carries westbound traffic along a variable width structure. Structure width has been defined by sight distance requirements through the horizontal curves and reduces in order to fit between existing buildings on NE Couch Street. The southern split alignment carries westbound traffic along a variable structure width. Structure width is variable between NE 2nd Avenue and NE MLK Boulevard in order to minimize permanent impacts with the adjacent buildings.

Figure 7. Couplet Section (at East Approach)



Westbound Section **Eastbound Section**

Note: EB (eastbound), WB (westbound)

4 Alternative Descriptions

As noted previously, a wide range of alternatives were developed and evaluated in previous project phases. Three bridge replacement alternatives were carried forward and further investigated in support of the EQRB EIS. The subsequent sections discuss key features, benefits, risks, and impacts for these replacement alternatives, but do not represent a final decision on structure type.

4.1 Fixed Bridge on Existing Alignment (Fixed Replacement)

This alternative proposes to replace the existing structure with a fixed bridge on an elevated vertical profile, along the existing Burnside Street alignment. If the bridge were to provide sufficient vertical clearance over the primary river navigation channel for all river users, then the profile would need to be raised approximately 110 feet above the existing bridge deck. However, bridges with vertical clearance higher than 97 feet were previously dismissed during the EQRB Feasibility Study due to the significant impacts resulting from an extreme profile raise.

Therefore, it is recommended that all alternatives to be evaluated in the EIS be low profile movable span alternatives. See the *EQRB Recommendation to Remove the Fixed Bridge Alternative from Further Consideration Memo* (Multnomah County 2019) (Appendix A) for additional explanation of the background and rationale of these recommendations.

4.2 Replacement Alternative with Short-span Approach (Short-span Alternative)

This alternative proposes to replace the existing structure on the existing alignment with a movable bridge span over the primary navigation channel and conventional slab-on-girder fixed bridge spans for the east and west approaches. Movable span systems consisting of vertical lift and bascule span types have been evaluated and are discussed in Section 4.2.4.

For bridge Plan and Elevation sheets for the Short-span Alternative, see Appendix B. For roadway layout plan sheets, see Appendix C. As previously noted, these layout and bridge type options are conceptual assumptions used as a basis-of-design to assess cost, benefits, and impacts.

4.2.1 Layout Considerations

As part of the bridge alternatives analysis, multiple span configurations were considered. Bridge substructures and foundations were kept clear of the existing roads and railways and the vertical profile set to maintain the vertical clearance envelopes while maintaining the sidewalk accesses on approaches. Attempts were made to balance the span lengths of the structure, while maintaining reasonable distances between intermediate supports.

During the preliminary design evaluation process it was determined that the Burnside Skatepark, located beneath the bridge just east of E 2nd Avenue, was being designated as an official park property and therefore protected by Section 4(f) of the US DOT Act of

1966. Proposed bents that would fall within the skatepark were eliminated from all replacement alternative layouts.

Another layout refinement made during the preliminary design evaluation process was to eliminate the end span at the west abutment. In order to help minimize access and operation impacts to the Portland Rescue Mission, the end bent was moved from behind the existing abutment to in front of it and the first intermediate bent was eliminated. The space between the existing abutment and the new end bent would be filled with mechanically stabilized earth (mse) backfill.

The Short-span Alternative would measure 2,292 feet in total length, and is comprised of three separate segments of bridge: west approach spans, movable span, and east approach spans.

West Approach Span Configuration

The west approach encompasses Span 1 to Span 6. A preliminary layout, span configuration and conceptual superstructure type is shown in Table 1.

Table 1. West Approach – Short-span Alternative

Span Number	Span Length [feet]	Potential Structure Type
1	70	Prestressed Concrete Voided Slab
2	44	Prestressed Concrete Voided Slab
3	126	Prestressed Concrete Girder
4	126	Prestressed Concrete Girder
5	150	Steel Plate Girder
6	295	Steel Plate Girder

The west approach spans near the TriMet Light Rail (LRT) Station span both the eastbound and westbound tracks, which is an improvement to the existing condition. Spanning both tracks and eliminating an intermediate support between the tracks, allows for easier construction and less obstructions to the LRT. Additionally, the adjacent bents are located at the back of sidewalks in order to increase the width of the LRT platform. In doing so, this would provide larger clearance between transit trains and proposed substructure as well as providing a safer LRT user platform due to the added visibility.

Bent 6 was placed within Tom McCall Waterfront Park, in the location of existing Bent 19. This placement would provide approximately 10-feet of clearance from the existing harbor wall and the existing large diameter sewage lines that are attached. This is advantageous for construction, and would potentially eliminate the need to reconstruct the harbor wall for purposes of constructing the proposed bent. However, this has pushed the limits of this span (Span 6) to 295 feet in length. Spans beyond a threshold of approximately 300 feet would require special superstructure considerations.

Movable Span Configuration

The movable span is identified as Span 7 between Bents 7 and 8. The span length was set to exceed the minimum 205 feet of horizontal clearance, the width required by river users identified in the *EQRB Preliminary Navigation Study* (Multnomah County 2021f) (Appendix A).

Both Bascule and Lift bridges were investigated as movable systems. Bents 7 and 8 would likely differ between the two types of movable bridges. The bascule bent will require a much larger footprint than a lift tower (Figure 8, Figure 9). Therefore, the adjacent flanking spans (Spans 6 and 8) could vary depending on which movable system is chosen. One way to avoid this is by use of a "jump span," or "back span," between the fixed approach span and the movable bent for the lift bridge (Figure 9).

Figure 8. Bascule Bridge Detail

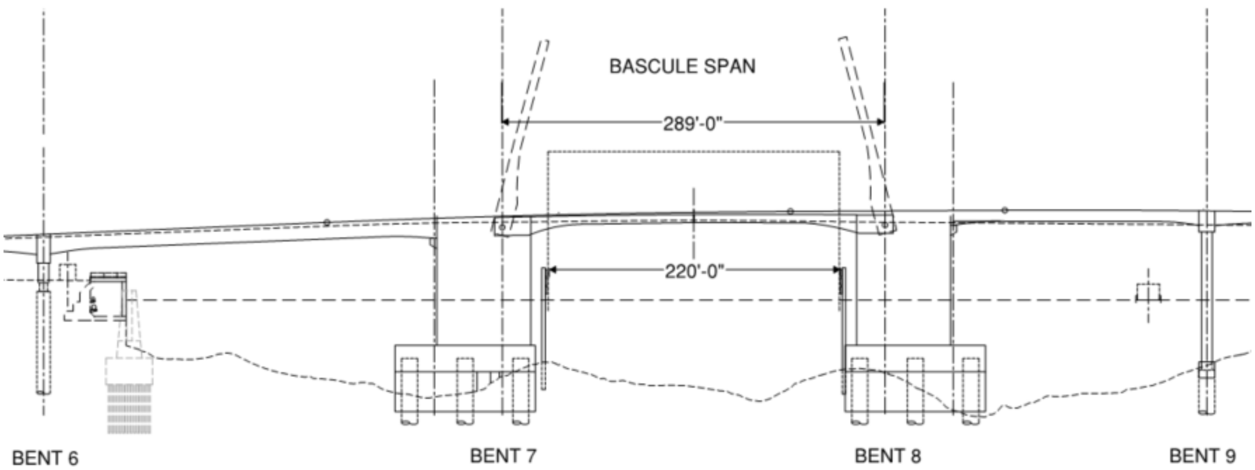
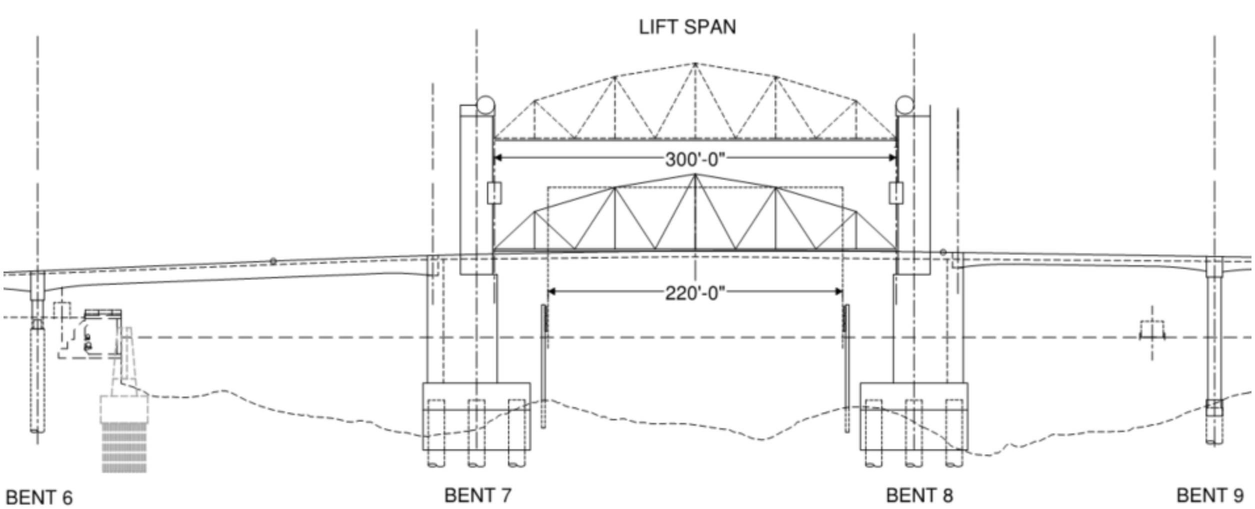


Figure 9. Lift Bridge Detail



The movable span configuration for both a bascule and lift bridge is shown in Table 2. More information on each of these movable systems is located in Section 4.2.4.

Table 2. Movable Span Lengths (Per Type)

Span Number	Span Length [feet]	Potential Structure Type
7	289[1]	Double Leaf Bascule Span
7	300[2]	Through-Truss Lift Span

[1] Measured from CL of Trunnion to CL of Trunnion
[2] Measured from CL of Lifting girder to CL of Lifting Girder

East Approach Span Configuration

The east approach encompasses Span 8 to Span 13. A preliminary layout, span configuration and conceptual superstructure type is shown in Table 3.

Table 3. East Approach – Short-span Alternative

Span Number	Span Length [feet]	Potential Structure Type
8	191.5	Steel Plate Girder
9	221	Steel Plate Girder
10	191.5	Steel Plate Girder
11	135	Steel Plate Girder
12	270	Steel Plate Girder
13	80	Prestressed Concrete Box Beam

Multiple considerations were given to Bent 9 and Bent 10 placement in regards to the existing and potential future improvements for I-5 and I-84. Attempts were made to coordinate with appropriate agencies to determine the most practical location to limit impacts to the surrounding I-5 and I-84 structures. Additionally, Bent 9 was placed to the east of the Eastbank Esplanade in order to maintain the existing river navigation channel free of obstructions.

Bent 11 was placed to remain outside of UPRR ROW.

Multiple constraints within the vicinity of Bents 12 and 13 were taken into consideration. Burnside Skatepark is located underneath the existing Burnside Bridge at the cross street of 2nd Avenue. Permanent impacts to the existing skatepark are understood to be unacceptable due to permitting considerations. Additionally, an underground large diameter CSO pipe is located immediately east of the skatepark crossing underneath Burnside Bridge. Proposed bridge foundations must remain clear of the 53-foot wide permanent easement that straddles this east side CSO pipe. Lastly, proposed bents were placed outside of City streets. Avoiding these impacts resulted in a 270-foot long span that clears 2nd Avenue, the skatepark, and the CSO pipe.

Bent 14 was specifically placed behind the existing bridge abutment. The existing bridge abutment is a tiered concrete gravity retaining wall system, which could serve as shoring and facilitate the construction of the proposed Bent 14.

4.2.2 Substructure/Foundations

The geotechnical subsurface investigations have determined that the soil profile near the surface is comprised with fill and fine-grained alluvium materials that are highly susceptible to liquefaction. These conditions suggest that the presence of competent material may not be reached until depths beyond 50 feet below ground level. Therefore, this site may not be eligible for shallow foundations such as spread footings but rather better suited for deep foundations such as drilled shafts. It is suggested that drilled shafts be embedded into the Troutdale Formation subsurface layer in order to provide sufficient support for the replacement bridge.

The approach spans could all be supported on multi-column concrete bents founded on oversized drilled shafts. Each of the intermediate bents for the west and east approach could be supported on a four column/shaft configuration. Link beams between columns are proposed at the top of shaft elevation for select bents in order to reduce displacements and moments in the bents. Due to the height of its columns, Bent 9 is significantly more flexible than adjacent bents. Increased section size for Bent 9 in addition to lateral cross bracing is suggested in order to increase the stiffness of this bent and balance the stiffness of the east approach bridge frame. Increasing the column section size would require a pile cap in order to accommodate the proposed 4-shaft configuration for the foundation.

The movable spans would be supported on a group of large diameter shafts encased in a large footing cap. Additionally, the use of a seal course for cofferdam dewatering is needed for these bents. Analysis indicates that the bascule bridge could require eighteen 12-foot diameter shafts spaced at a minimum of three shaft diameters. This results in a 106-foot by 175-foot footing cap size for the bascule bents. The movable lift bridge is slightly lighter than the bascule spans and therefore, could have a slight decrease in the foundation size. The lift bridge foundation could require fourteen 12-foot diameter shafts and approximately an 80-foot by 140-foot footing cap. Table 4 contains conceptual shaft and column sizes for the Short-span Alternative:

Table 4. Bent Foundations – Short-span Alternative

Support Location	Number of Shafts	Shaft Diameter [feet]	Column Diameter [feet]
Bent 1	10	3	--
Bent 2	4	7	5
Bent 3	4	7	5
Bent 4	4	8	6
Bent 5	4	10	8
Bent 6	4	10	8
Bent 7	18 (Bascule Bridge) 14 (Lift Bridge)	12	--

Table 4. Bent Foundations – Short-span Alternative

Support Location	Number of Shafts	Shaft Diameter [feet]	Column Diameter [feet]
Bent 8	18 (Bascule Bridge) 14 (Lift Bridge)	12	--
Bent 9	4	12	10x16
Bent 10	4	10	8
Bent 11	4	10	8
Bent 12	4	10	8
Bent 13	4	7	5
Bent 14	13	3	--

4.2.3 Geotechnical Considerations and Seismic Hazard Mitigation

Shannon & Wilson, Inc. have conducted geotechnical investigations and analysis, and an *EQRB Geotechnical Report* (Multnomah County 2021e) prepared (Appendix A). This is a summary of their findings.

The subsurface conditions were determined by historical geotechnical data and recent geotechnical field explorations performed in the previous phase of this project. Through field explorations, in situ testing, and laboratory testing a subsurface profile was determined for the Project site.

Dynamic soil-structure interaction (DSSI) analysis was performed to develop site-specific design ground motions and evaluate seismic ground hazards from seismic shaking. A suite of seven earthquake time histories for the Full Operation performance level and a suite of nine earthquake time histories for the Limited Operation performance level were used in the DSSI analysis. Seismic hazards considered in the evaluation include ground shaking, liquefaction and associated effects (e.g., flow failure, lateral spreading, and settlement), ground surface fault rupture, tsunami, and seiche. It was determined that the potential for fault rupture is low and the potential for seismically induced tsunami and seiche is very low. However, the potential for liquefaction and liquefaction-related effects is high for the Project site.

The DSSI analysis indicated that liquefaction and liquefaction-induced permanent ground deformations would occur at the west and east approach embankments. Additionally, ground failures such as embankment landslides on the order of 25-feet and permanent lateral spreading displacements of approximately 3-feet or more are anticipated at the east riverbank. Likewise, the west riverbank is expected to see up to 14 feet of ground surface movements and permanent lateral displacements greater than one foot. Flow failures and large permanent ground displacements of this magnitude could cause significant damage to drilled shafts of any practical dimension. Therefore, hazard mitigation through ground improvements is recommended for this project.

Ground improvement methods include excavation and replacement, soil densification, (e.g., vibro-compaction, deep dynamic compaction), drainage (e.g., EQ Drain), soil cementation (e.g., jet grouting, deep soil mixing), or a combination of these methods.

The selection of an appropriate mitigation method(s) for a particular site depends on factors such as soil type, site access, ROW constraints, cost, environmental concerns, and vibration impacts on existing facilities, among others. Based on the project site conditions, soil cementation by the methods of jet grouting and deep soil mixing is the anticipated ground improvement method.

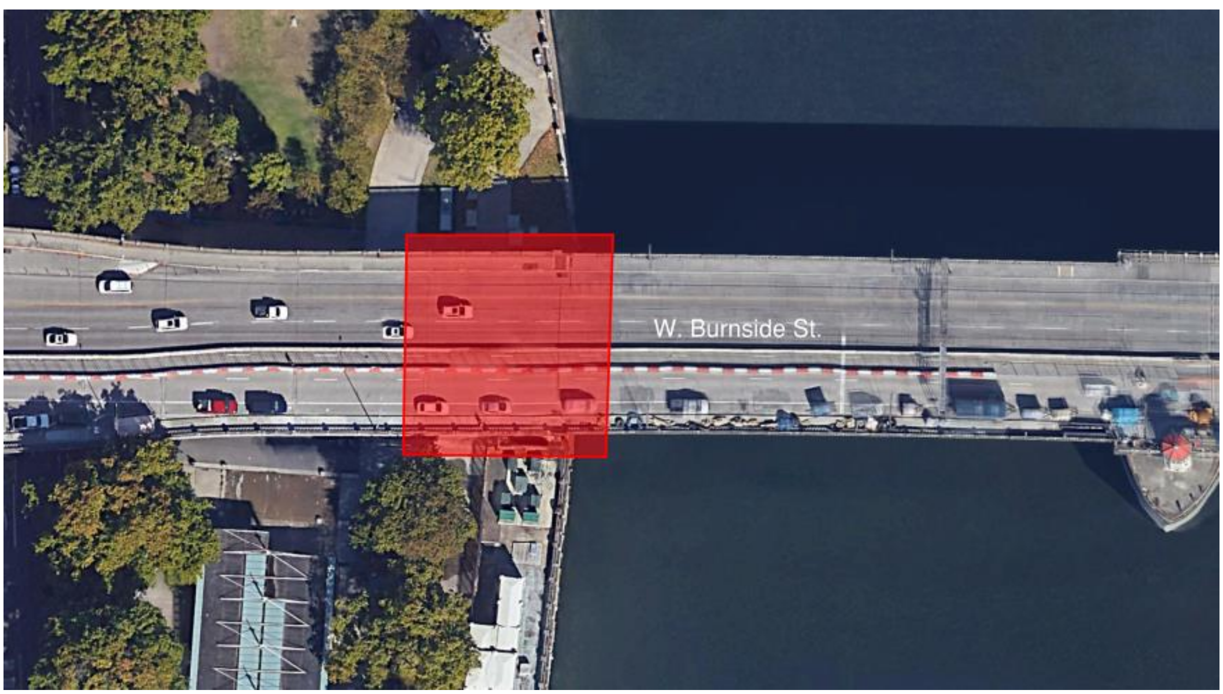
West Approach Improvements

It is recommended that the west approach be founded on drilled shafts that extend through the liquefiable soil layers and be embedded into the competent Troutdale Formation subsurface layer.

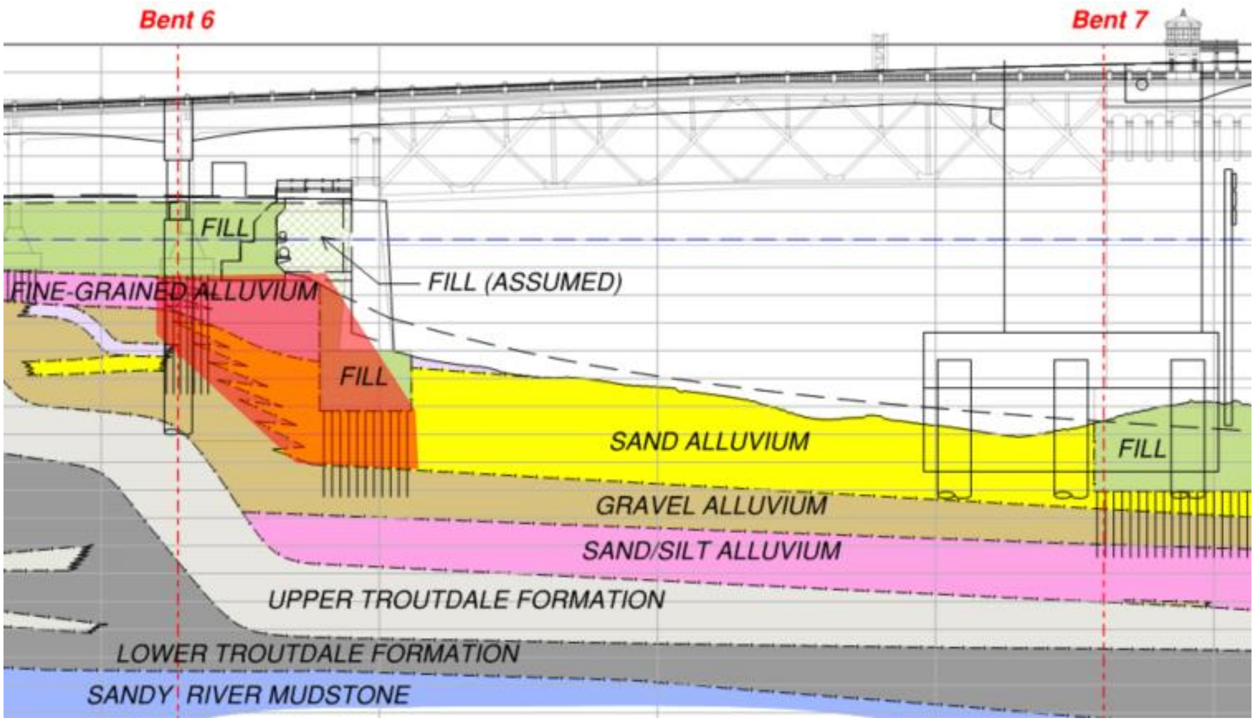
Due to lateral spreading, seismic hazard mitigation is required at one location for the west approach along the west riverbank from Bent 6 to the east side of existing Pier 1 (Figure 10). The ground improvements encompass Bent 6 and extend in front of existing Pier 1 and under the harbor wall. The recommended improvement method for this site is jet grouting. This method is expected to damage existing timber pile foundations that will require replacement of the harbor wall in this area. However, there are no recent borings at this area to determine an accurate subsurface condition. During the design phase, it is anticipated that borings will take at this location in order to better evaluate the soil conditions. A benefit of this could be that the ground improvements at Bent 6 could be moved to the other side of the bent, which eliminates the impacts to the harbor wall, sewage pipes, and Pier 1.

Bents 1 through 5 would be designed to accommodate anticipated downdrag loads caused by liquefaction-induced settlements and to provide adequate uplift resistance. There is no horizontal displacement on the west approach due to soil stratification at Bents 1 through 5; therefore, no seismic mitigation is recommended at these bents.

Figure 10. Ground Improvement Concept - West Approach Location



a. Plan View



b. Elevation View

Movable Span Improvements

Lateral spreading displacements at Bents 7 and 8 are significant, with greater than 36 inches of soil movement expected. However, due to the group shaft configuration proposed, it is anticipated that the group of shafts would be designed to accommodate the soil displacement and downdrag effects. Therefore, ground improvements are not recommended at these bents, nor does the DSSI analysis include any improvements at these locations.

East Approach Improvements

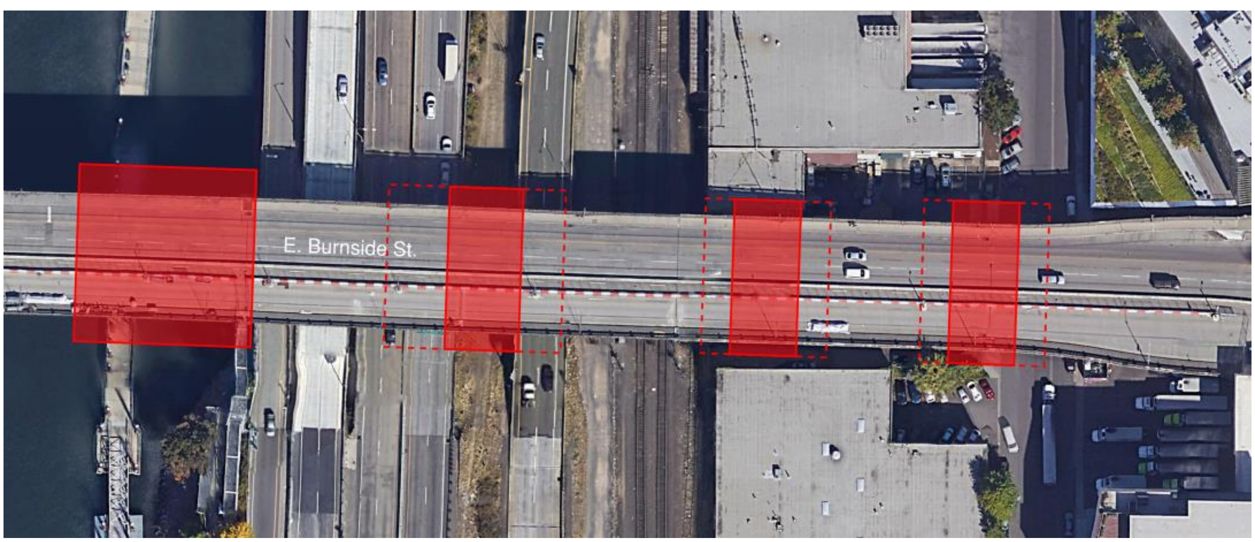
The east approach seismic hazard mitigation analysis has gone through multiple iterations in order to determine the best approach to limiting soil displacements.

Concept #1 - Two locations of improvements located in the vicinity of proposed Bent 9 and 10, between the Eastbank Esplanade and the I-5/I-84 structures. The improvements at these two locations would include a volume of cementitious grouting that would extend well beyond the bridge width, thereby creating a “dam” to hold back the eastbank flow failures during a seismic event (Figure 11). However, further analysis showed that this approach did not limit the magnitude of lateral spreading for practical design at proposed Bents 10 and 11. Therefore, the ground improvement approach was revised and the DSSI reiterated until lateral soil displacements were limited to the degree feasible.

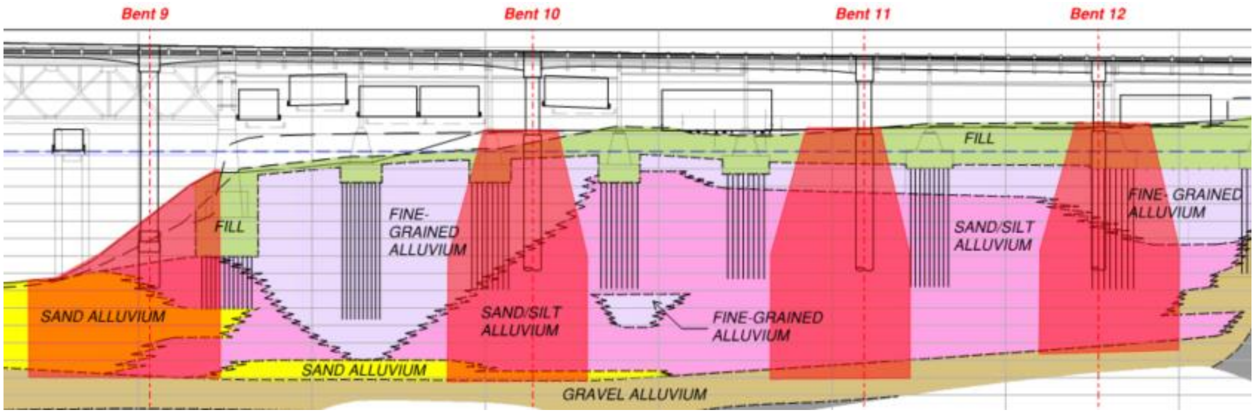
Figure 11. Ground Improvement Concept #1 - East Approach Locations

Concept #2 - Ground improvements are proposed at Bents 9 through 12 as shown in Figure 12. It is anticipated that the ground improvements extend down to the Troutdale Formation subsurface layer. Additionally, the improvement sites have been sized to increase stability and withstand the large-scale soil displacements that will occur during a seismic event at each bent.

Figure 12. Ground Improvement Concept #2 - East Approach Locations



a. Plan View



b. Elevation View

With the knowledge of the subsurface conditions at the time of this phase, Concept #2 is assumed to have to greatest positive impact to soil improvement. As a basis-of-design, Concept #2 has been used for analysis, cost, and impacts. During the design phase, it is anticipated that borings could be taken at multiple locations along the east approach spans in order to better evaluate the soil conditions. A benefit of this could be a reduction in mitigation needed than what is shown in Figure 11 and Figure 12.

4.2.4 Movable Span Systems

Bascule span and vertical lift span options have been considered for replacement of the existing movable span. The proposed span layouts satisfy the navigational requirements recommended in the *EQRB Preliminary Navigational Study* (Multnomah County 2021f) (Appendix A). Additionally, the movable span system would need to be designed to adhere to the seismic performance requirements outlined in the project SDC. Seismic response for the movable span systems considered is discussed in Section 5.

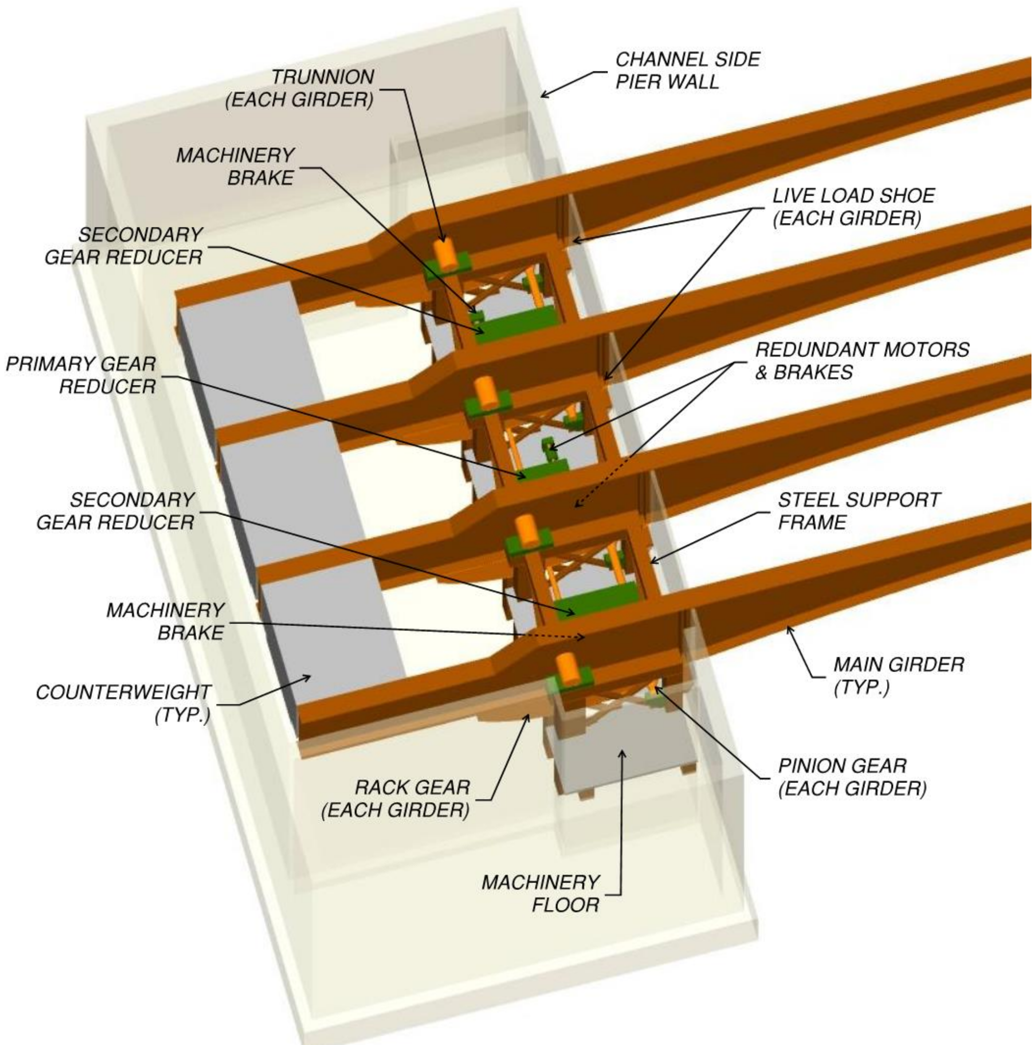
Bascule Span

The conceptual bascule span considered in this report is a double-leaf trunnion style bascule. See Figure 13 for a general configuration of the main structural and mechanical features at one end of the span. For each leaf, a solid lightweight deck system would be supported by a stringer-floorbeam framing system. Solid decks, though generally heavier than open deck systems, offer relative benefits such as an improved riding surface, noise reduction, and environmental protection for structural and mechanical elements. The main load-carrying elements would be four deck girders.

Each bascule girder would be supported by, and rotate about, a forged steel trunnion, resting on low-friction bearings inside the bascule pier. The bearings would be supported either on steel framing braced by the pier walls or on a free-standing braced steel frame, independent of the pier walls. Counterweights at the back would be designed to balance the weight of each leaf about its axis of rotation when not subjected to live load. Live load bearings on the bascule girders would support the leaf at the channel side pier walls.

Lateral restraint during a seismic event would be provided primarily by the structure supporting the trunnion bearings. Secondary restraint at the live load supports and counterweights may prove beneficial for satisfying seismic performance objectives and should be considered during preliminary and final design. Examples of secondary restraint include tapered alignment devices at the live load bearings and full-range-of-motion lateral guides at the counterweight. Secondary restraint features, if used, also have potential to incorporate energy-dissipating mechanisms (e.g., hydraulic dampers) that should be considered.

Figure 13. Bascule Span Concept



Longitudinal and lateral deck joints between the movable span and approach spans would be located to avoid placement over the operating machinery and bascule support steel. At the leaf tips, special joints will be necessary to limit the maximum joint width for normal use while simultaneously accommodating large-scale relative deflections between the bascule leaves anticipated during a seismic event. An example of such a system includes overlapping elements between the leaf tips that would engage as the leaves are seated. Sacrificial and/or energy-dissipating features may also be included to minimize or eliminate contact between the leaves during an earthquake. The overlap may require a sequence of operation with one leaf seating ahead of the other (similar to rolling lift bridges with jaw-and-diaphragm span locks), but it would be effective in reducing or eliminating a potential gap in the roadway, sidewalk and bikeway areas. Rail joints would have miter rails at the road breaks that may also require sequenced operation. Spare miter rails and special joint hardware should be included in the construction contract to allow for quick replacement if damaged during a seismic event.

Below deck would be steel-supported walkways that extend from the counterweights to the leaf tips. This walkway system would be used to access counterweight pockets, span locks, and navigation lights, as well as to facilitate routine inspections. All walkways and platforms on the span, in electrical rooms, and around drive machinery in the pier would be sized and equipped with adequate lighting to satisfy all local, state, and federal safety standards.

The drive system would consist of redundant main motors that drive a primary reducer at the centerline of the bridge. The drive system would be sized to complete an opening or closing cycle within a reasonable timeframe—generally within 90 seconds—under normal operating conditions. In addition to redundant main motors, the drive system would also be equipped with an auxiliary motor that can operate the span at half speed in the event neither main motor is available. The primary reducer would drive two secondary reducers centrally located between the outer two bascule girders for each leaf. Each secondary reducer, in turn, would drive two rack and pinion gear sets, one at each bascule girder. Each motor of the redundant pair would be equipped with a motor brake, and each side of the drive train would include a machinery brake. The entire system of drive machinery for each leaf, including the structural supports, would be designed to remain elastic during a seismic event, minimizing potential for permanent misalignment between elements within each drive train and ensuring span operability following an earthquake. Torque-limiting couplings that allow gear slippage to protect mechanical components from overstress during a seismic event should also be considered.

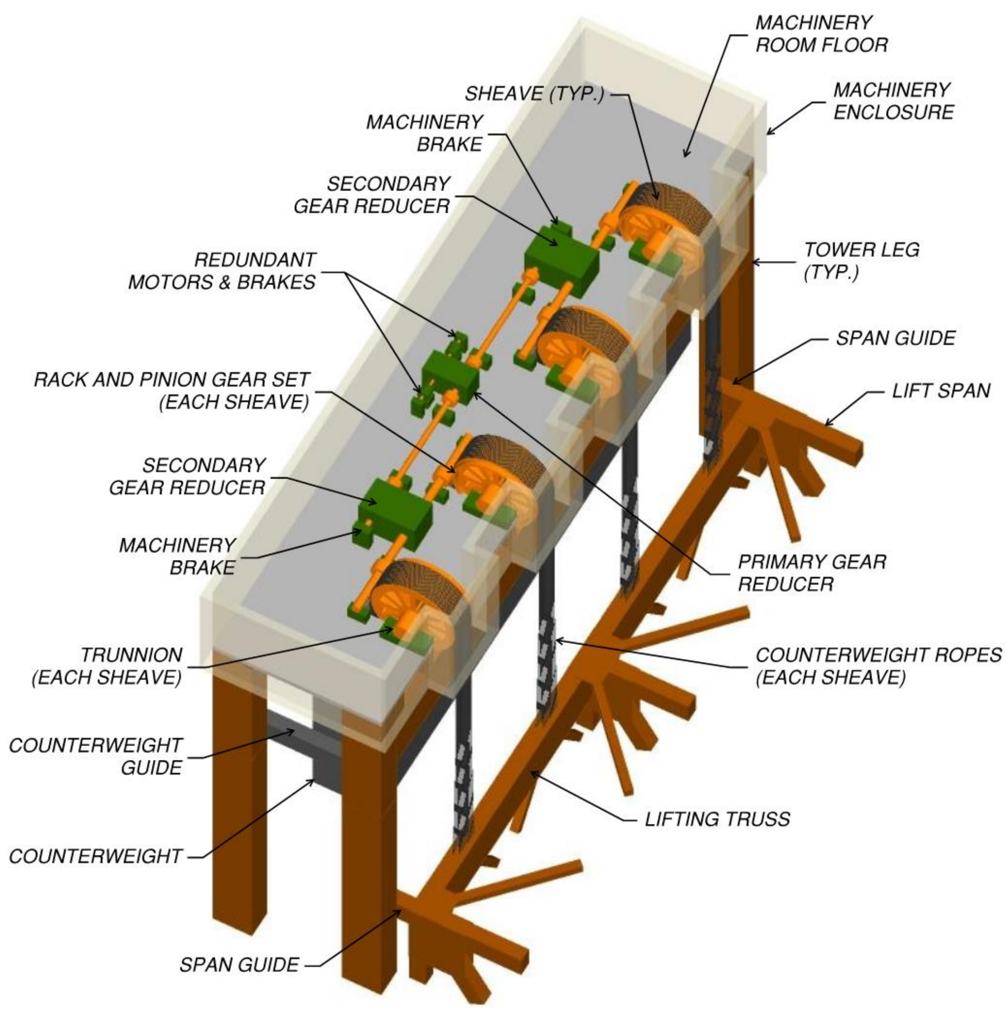
Vertical Lift Span Option

The conceptual vertical lift span considered in this report is based on a tower drive system. Similar to the bascule span concept, a solid lightweight deck would be supported by a floorbeam-stringer system. Unlike the deck-girder bascule span concept, the main load-carrying system for the lift span would be a multi-plane truss or arch system. The main span would be suspended from towers at each end by groups of streel ropes attached to a transverse floorbeam or overhead lifting truss, draped over large-diameter sheaves at the top of each tower, and anchored into a counterweight. The counterweights at both ends together would equal the weight of the lift span. Due to the anticipated vertical travel distance, auxiliary counterweights or balance chains would also be provided to offset rope weight that transfers from one side of the sheaves to the other during operation. See Figure 14 for a general configuration of the main structural and mechanical features at one end of the span.

Characteristic of a tower-driven lift span, the drive machinery would be located at the tops of the towers at both ends of the span. The sheaves that rotate to raise and lower the span would be supported by forged steel trunnions resting on low-friction bearings. The bearings would be mounted on steel frames or machinery floor framing resting on the sheave girder spanning between the tower legs. Trunnion supports would include features that allow for longitudinal and transverse realignment, if necessary, following a seismic event. The towers would also include hangers for independently supporting the counterweights to unload the ropes for future rope replacement and trunnion support realignment.

Lateral restraint would be provided primarily by a system of lateral and longitudinal guides for both the lift span and the counterweights. In addition, the lift span would be laterally restrained by centering/alignment devices at the bottom when the span is fully seated. Span locks at the ends of the lift span would provide uplift restraint when fully seated. These alignment and locking features are required for normal operation and typically have narrow operating clearances. As a result, the lift span and counterweight are likely to come into contact with the tower during an earthquake. Preliminary design efforts should include strategies that limit, attenuate, and or eliminate excessive impact forces between the lift span and the tower. For example, span and counterweight guides could either be designed as fusible elements that fail at a predetermined force to capacity-protect the tower, or they could incorporate hydraulic dampers to permit lateral movement of the lift span and counterweight while dissipating energy.

Figure 14. Vertical Lift Span Concept



The operating machinery and controls would be contained within water-tight, climate-controlled enclosures. Operator houses would be located at one or both ends of the span, positioned horizontally and vertically to maximize the bridge operator's views of the roadway, sidewalks, and navigation channel from the control desk. Lift span tower construction can take on several forms. Common tower configurations include single structures spanning the roadway with either two or four legs, as well as independent towers on either side of the roadway with independent drive systems. Conventional materials for tower construction include post-tensioned concrete and structural steel. Seismic performance and aesthetic requirements will likely dictate the recommended structural system of the towers. Preliminary design efforts should identify structural systems and materials that satisfy the project-specific design and performance objectives while also optimizing economy, constructability, serviceability, and long-term operation and maintenance costs.

Elevators would be provided for access to the machinery rooms. In addition, stairs would be provided with at least two independent egress paths from the machinery room to the ground for alternate maintenance access or emergency egress. Features that provide access to lift span at any position of travel would also be provided.

If desired for maintenance and access purposes, the lift span option could include a walkway below the deck that extends the entire length of the lift span, providing access between the towers without having to go to deck level. It could also provide access to navigation lights and facilitate routine inspections. All walkways and platforms on the span, in electrical rooms, and around drive machinery in the tower would be sized and equipped with adequate lighting to satisfy all local, state, and federal safety standards.

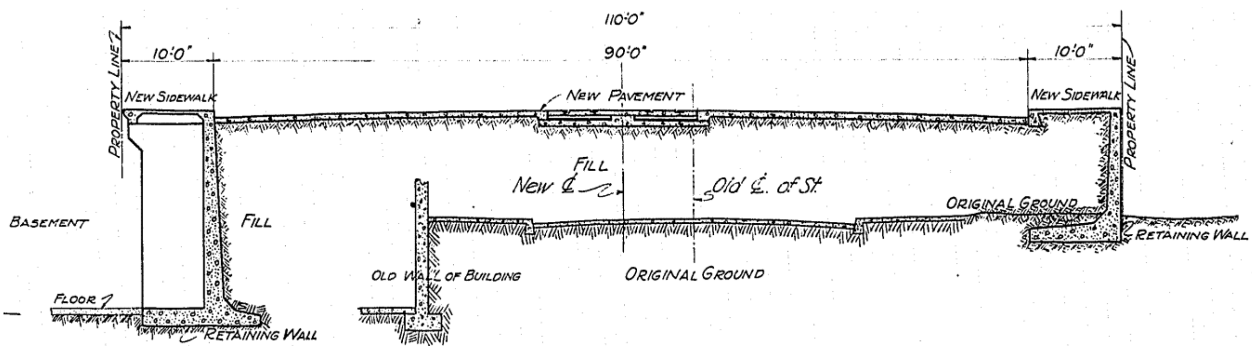
For a single-tower configuration (assumed for this discussion), the drive system would be similar to the configuration discussed previously for the bascule span option, comprised of redundant main motors that drive a primary reducer at the centerline of the bridge. The drive system would be sized to complete an opening or closing cycle within a timeframe that represents a reasonable speed for the length of vertical travel under normal operating conditions. In addition to redundant main motors, the drive system would also be equipped with an auxiliary motor that can operate the span at half speed in the event neither main motor is available. The primary reducer would drive two secondary reducers centrally located between the outer sheaves on each side of the span. Each secondary reducer, in turn, would drive two rack and pinion gear sets, one at each sheave. Each motor of the redundant pair would be equipped with a motor brake, and each side of the drive train would include a machinery brake. The entire system of drive machinery for each tower, including the structural supports, would be designed to remain elastic during a seismic event, minimizing potential for permanent misalignment between elements within each drive train and ensuring span operability following an earthquake. Torque-limiting couplings that allow gear slippage to protect mechanical components from overstress during a seismic event should also be considered.

4.2.5 Retaining Walls

For the Short-span Alternative, End Bent 14 (east approach) would be constructed as shallow pile cap behind the existing abutment. The top of the existing abutment wall would need to be removed to provide room for the adjacent span superstructure, but the remainder of the wall could be left in place to retain the roadway embankment. As discussed previously, End Bent 1 (west approach) would be constructed as a concrete pier wall founded on a row of small diameter drilled shafts and backfilled with MSE wall reinforced soil. MSE wall panels would close in the open south side of the area between the existing abutment and Bent 1. The top of existing abutment wall would be removed as needed to allow the end panel to span over it on compacted base.

There are existing cantilever retaining walls at both west and east roadway approaches. The north side of Burnside (between NW 1st Avenue and NW 2nd Avenue) has concrete cantilever walls abutting the existing buildings and the sidewalks are built on retained fill (Figure 15). The south side of Burnside (between SW 1st Avenue and SW 2nd Avenue) has buttressed walls, with openings into the existing buildings' basements and the sidewalk is supported by these buttresses (Figure 16).

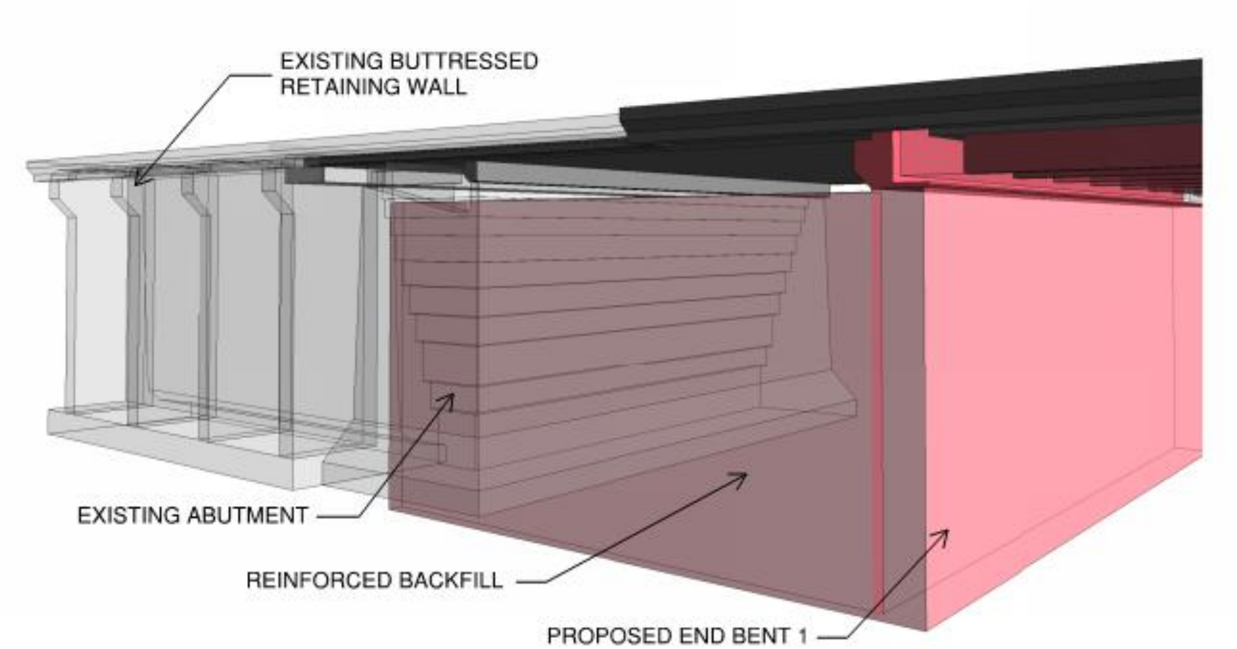
Figure 15. Cross Section of West Approach Embankment, Looking West



Source: As-built Bridge plans, 1924

These buttressed walls are immediately adjacent (and open to) to existing buildings. Refer to the *EQRB Construction Approach Technical Report* (Multnomah County 2021b) (Appendix A) for more information. A new retaining wall is assumed and would be installed directly south of the buttressed wall, allowing those voids to be backfilled and new sidewalk to be built on retained fill. The existing wall could be left in place except in discrete locations where it conflicts with new substructure elements. Figure 16 shows the interaction between existing and new elements, revealing locations where existing abutment and wall would need to be removed.

Figure 16. Isometric View of Existing West Abutment and Buttress Walls with New Substructure Elements



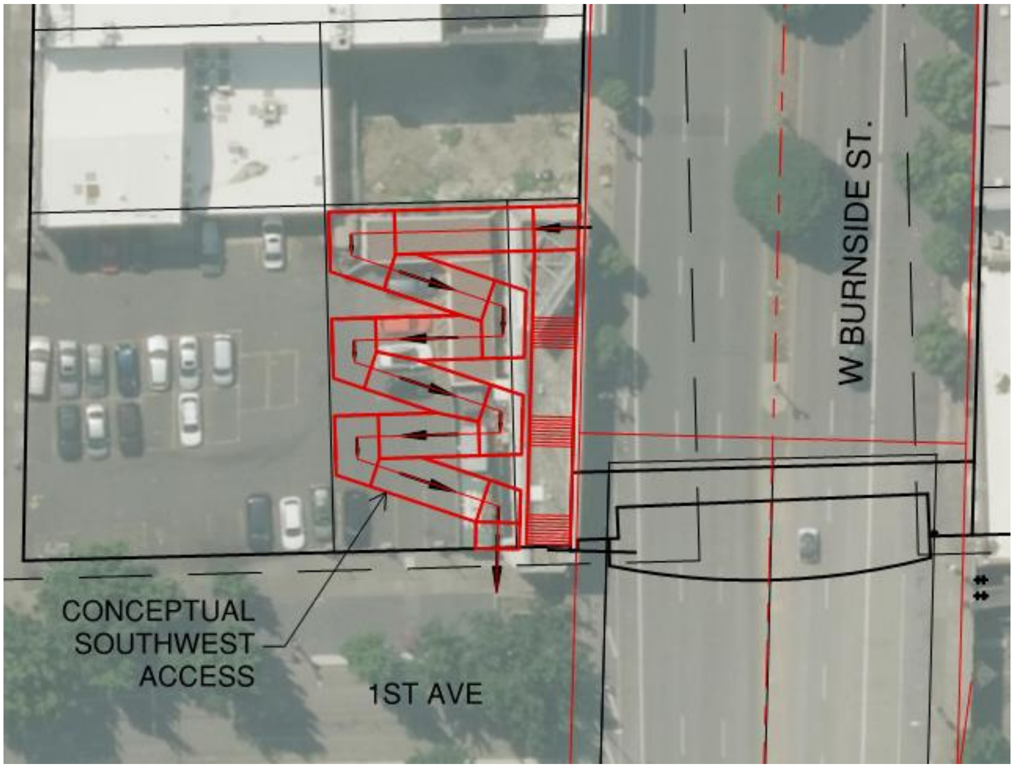
The east approach embankment similarly has both cantilever and buttressed walls past the abutment, however these have already been exposed and backfilled as part of new building construction. It is assumed that these walls would be left in place and the sidewalks would be supported by the embankment.

4.2.6 Miscellaneous Structures

It is assumed that all existing access points be maintained in the final condition; this must be confirmed during the final design phase. This would require constructing new access structures at the Skidmore Fountain MAX Station from the west approach and the Eastbank Esplanade from the east approach.

A new south side, west approach bridge access point is expected for bike, pedestrian and Americans with Disabilities Act (ADA) access (Figure 17). Additionally, a new north side, west approach bridge stair access is expected to be maintained at the Skidmore Fountain MAX station (Figure 17). Several layouts have been considered and a final selection has not yet been chosen. It is expected that refinement of structure type and location would continue in the future design phase.

Figure 17. Bike and Pedestrian South Access Concept (West Approach at Skidmore Fountain MAX Station)

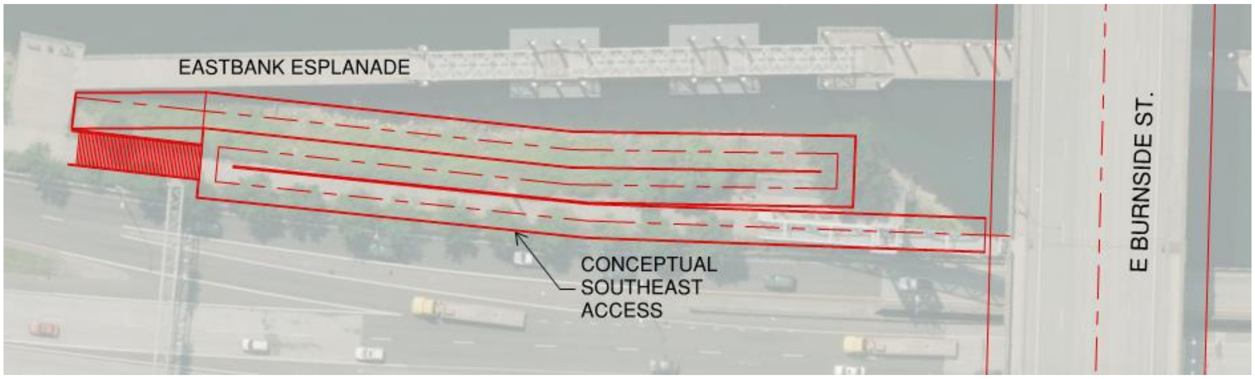


a. South Access

b. North Access

A new south side, east approach bridge access point is expected for bike, pedestrian, and ADA access connecting to the Eastbank Esplanade. One of the concepts being considered is shown in Figure 18.

Figure 18. Eastbank Esplanade Bike and Pedestrian Access Bridge (East Approach on the south side of the Burnside Bridge)



4.3 Replacement Alternative with Long-span Approach (Long-span Alternative)

This alternative proposes to replace the existing structure on the existing alignment with a movable bridge span over the primary navigation channel and a combination of conventional slab-on-girder and long-span fixed bridge spans for the east and west approaches. Movable span systems consisting of vertical lift and bascule span types have been evaluated in Section 4.2.4.

Longer fixed bridge spans were utilized in this alternative in both the east and west approach spans. The principal advantage of the Long-span Alternative is the reduced number of required intermediate bents, thereby reducing risk and cost associated with constructing foundations within areas of complex subsurface conditions. Steel tied-arch spans are presented for the Long-span Alternative. While other structure types such as cable-stayed or steel truss are technically viable options, a steel-tied arch is a common and cost effective structure type for the required span lengths and is generally representative of the considerations that other long-span structure types would require at this project site.

Conceptual layouts for other long-span options, such as a cable-stayed bridge (which may identify other potential visual impacts of the typical large tower bents), are not otherwise further addressed in this report.

For bridge layout sheets for the Long-span Alternative, see Appendix B. For roadway layout plan sheets, see Appendix C. As previously noted, these layout and bridge type options are conceptual assumptions used as a basis-of-design to assess cost, benefits, and impacts.

4.3.1 Layout Considerations

As part of the bridge alternatives analysis, multiple span configurations were considered. Bridge substructures and foundations were generally kept clear of the existing roads and railways and the vertical profile set to maintain the vertical clearance envelopes while maintaining the sidewalk accesses on approaches. Approach spans were increased to reduce the number of spans and intermediate supports, thereby reducing the amount of seismic soil mitigation anticipated at the east and west approach embankments. The Long-span Alternative would eliminate the need for four intermediate bents in comparison to the Short-span Alternative.

This alternative would involve a temporary impact to northbound Naito Parkway for foundation construction and would require moving the adjacent sidewalk to route behind the substructure of Bent 5.

The Long-span Alternative would measure 2,292 feet in total length, and is comprised of three separate segments of bridge: west approach spans, movable span, and east approach spans.

West Approach Span Configuration

The west approach encompasses Span 1 to Span 5. A preliminary layout, span configuration and conceptual superstructure type is shown in Table 1.

Table 5. West Approach – Long-span Alternative

Span Number	Span Length [feet]	Potential Structure Type
1	70	Prestressed Concrete Voided Slab
2	44	Prestressed Concrete Voided Slab
3	126	Prestressed Concrete Girder
4	122	Prestressed Concrete Girder
5	450	Steel Tied-Arch

The first four spans of the west approach are nearly identical for the Long-span Alternative and Short-span Alternative; see Section 4.2.1 for span arrangement considerations.

The Long-span Alternative utilizes a steel tied-arch to span 450 feet from Bent 5, located in Tom McCall Waterfront Park immediately east of Naito Parkway, to the movable span Bent 6 in the river. The benefit of using a longer span in this location is the elimination of the bent construction within Tom McCall Waterfront Park near the harbor wall. This reduces construction impacts to the existing harbor wall and the attached sewage lines by eliminating the need for ground improvements at the west approach.

Movable Span Configuration

The movable span is identified as Span 6 between Bents 6 and 7 for this alternative. The movable span configuration for the Long-span Alternative is the same as the Short-span Alternative; refer to Section 4.2.1.

East Approach Span Configuration

The east approach encompasses Span 7 to Span 9. A preliminary layout, span configuration and conceptual superstructure type is shown in Table 6.

Table 6. East Approach – Long-span Alternative

Span Number	Span Length [feet]	Potential Structure Type
7	740	Steel Tied-Arch
8	270	Steel Plate Girder
9	80	Prestressed Concrete Box Beam

Although the numbering differs due to the elimination of intermediate bents elsewhere in the bridge, the last two spans of the east approach are similar between the Long-span Alternative and Short-span Alternative. Refer to Section 4.2.1 for discussion on placement of these spans.

The Long-span Alternative utilizes a steel tied-arch to span 740 feet from the movable span Bent 7 in the river to proposed Bent 8 located east of UPRR tracks and west of 2nd Avenue. The benefit of using a longer span in this location is the elimination of one intermediate bent support within the waterway and two within the I-5 and I-84 structures in comparison to the Short-span Alternative, all of which require ground improvements due to seismic hazards. Spanning the waterway and existing I-5 and I-84 structures would eliminate in-water construction for one bent and eliminate impacts to any potential future freeway improvements.

4.3.2 Substructure/Foundations

Subsurface conditions and common bent foundations for Short-span Alternative approach spans and movable spans are discussed in Section 4.2.2.

The steel tied-arch long-spans in both west and east approach would be supported by the movable span bents in the river and multi-shaft pier wall bents at land locations. Base isolation bearings would be proposed at the ends of each arch span, in order to limit seismic demands on the substructure and foundations. Preliminary analysis indicates that the bascule bent foundations could maintain the same configuration of eighteen 12-foot diameter shafts spaced at a minimum of three shaft diameters. The footprint of the movable bascule bent walls would increase to accommodate the wider superstructure. The approach side bent wall would need to be locally thickened to 12 feet at each bearing location to accommodate the isolation bearings. Similarly, a 12-foot wide bent cap would be provided at the land side bents. The land side bents could be supported by eight 10-foot diameter drilled shafts configured in two rows that extend into a common footing cap.

Table 7 contains conceptual shaft and column sizes for the Long-span Alternative:

Table 7. Bent Foundations – Long-span Alternative

Support Location	Number of Shafts	Shaft Diameter [feet]	Column Diameter [feet]
Bent 1	10	3	--
Bent 2	4	7	5
Bent 3	4	7	5
Bent 4	4	8	6
Bent 5	8	10	Pier Wall
Bent 6	18 (Bascule Bridge) 14 (Lift Bridge)	12	--
Bent 7	18 (Bascule Bridge) 14 (Lift Bridge)	12	--
Bent 8	8	10	Pier Wall
Bent 9	4	7	5
Bent 10	13	3	--

4.3.3 Geotechnical Considerations and Seismic Hazard Mitigation

The geotechnical investigations, analysis, subsurface conditions and ground improvement methods are the same as discussed in Section 4.2.3 for the Short-span Alternative.

Due to the slight variation of span configuration and intermediate bent layout, the seismic hazard mitigation approach would differ as discussed below. With the knowledge of the subsurface conditions at the time of this phase, this concept is assumed to have the greatest positive impact to soil improvement. During the design phase, it is anticipated that borings would be taken at multiple locations along the east and west approach spans in order to better evaluate the soil conditions.

West Approach Improvements

Seismic mitigation concepts for the west approach supports have changed in comparison to the Short-span Alternative, as discussed in Section 4.2.3, due to the elimination of the intermediate bent near the harbor wall.

Geotechnical investigations have indicated liquefaction and liquefaction-induced lateral spreading along the west riverbank near the existing harbor wall and existing Pier 1 is anticipated. This Long-span Alternative proposes to span over the anticipated ground hazard zone and place the first land bent immediately east of Naito Parkway. This would eliminate the need for ground improvements on the west approach. Additionally, unlike other alternatives, this eliminates permanent and temporary impacts to the existing harbor wall and existing large diameter sewage utilities in this location.

Movable Span Improvements

Seismic mitigation concepts for the movable Bents 6 and 7 are the same as the Short-span Alternative, Bents 7 and 8, as discussed in Section 4.2.3.

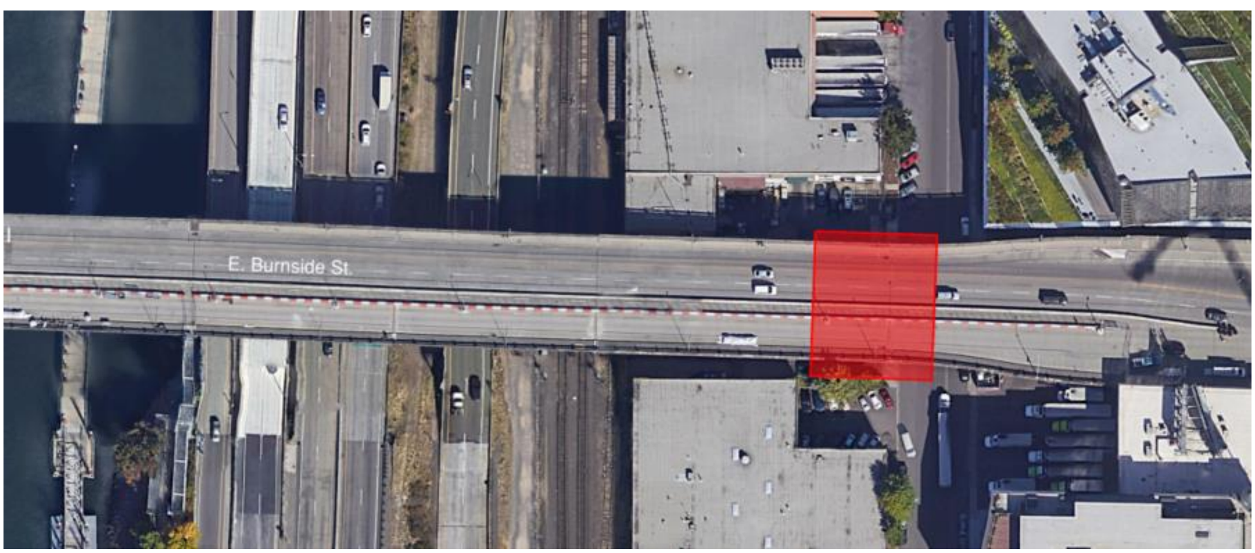
East Approach Improvements

Seismic mitigation concepts for the east approach supports have changed in comparison to the Short-span Alternative, as discussed in Section 4.2.3, due to the elimination of intermediate bents near the Eastbank Esplanade, I-5 and I-84 structures and 2nd Avenue.

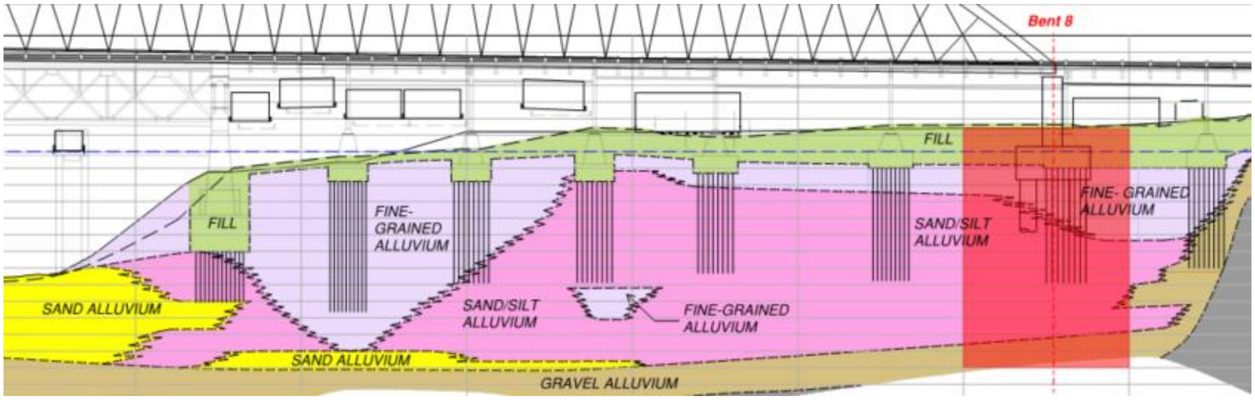
Geotechnical investigations have indicated large zones of liquefaction and liquefaction-induced lateral spreading within the east embankment from the riverbank to approximately 2nd Avenue. This Long-span Alternative proposes to span over a majority of the anticipated ground hazard zone and place the first land bent immediately west of 2nd Avenue. Therefore, the ground improvements would be limited to a single location at proposed Bent 8 (Figure 19). This would significantly reduce the number of zones of ground improvement, in comparison to the Short-span Alternative, thereby significantly reducing construction cost and impacts of the ground improvements. It is anticipated that the ground improvements would extend down to the Troutdale Formation subsurface layer. Additionally, the improvement site would be sized to increase stability and withstand the large-scale soil displacements that will occur during a seismic event at each bent.

Additional analysis specific to these foundation changes have not been performed. Engineering judgment has been applied based on the analysis performed for the Short-span Alternative.

Figure 19. Ground Improvement - East Approach Location



Plan View



Elevation View

4.3.4 Movable Span Systems

The movable span systems for the Long-span Alternative are the same as the Short-span Alternative; refer to Section 4.2.4.

4.3.5 Retaining Walls

The retaining wall systems for the Long-span Alternative are the same as the Short-span Alternative; refer to Section 4.2.5.

4.3.6 Miscellaneous Structures and Considerations

The miscellaneous structures and other miscellaneous considerations for the Long-span Alternative are the same as the Short-span Alternative; refer to Section 4.2.4.

4.4 Replacement Alternative with Couch Extension (Couch Extension)

This Couch Extension proposes to replace the existing structure on the NE Couch Extension alignment discussed in Section 3.1.2. The west approach and movable spans follow the existing Burnside Street alignment, the east approach spans then split into a couplet with the eastbound lanes remaining on the existing Burnside Street alignment and the westbound lanes diverting one block northward to align with NE Couch Street. Vertical lift and bascule span types have been evaluated in Section 4.4.4.

For bridge Plan and Elevation sheets for the Couch Extension options, see Appendix B. For roadway Layout plan sheets, see Appendix C. As previously noted, these layout and bridge type options are conceptual assumptions used as a basis-of-design to assess cost, benefits, and impacts.

4.4.1 Layout Considerations

As part of the bridge alternatives analysis, multiple span configurations were considered. Bridge substructures and foundations were kept clear of the existing roads and railways and the vertical profile set to maintain the vertical clearance envelopes. Attempts were made to balance the span lengths of the structure, while maintaining reasonable distances between intermediate supports.

The Couch Extension would measure 2,292 feet in total length measured along Burnside Street and 911 feet along the NE Couch Street couplet. It is comprised of four separate segments of bridge: west approach spans, movable spans, northeast approach spans, and southeast approach spans.

West Approach Span Configuration

The west approach configuration for the Couch Extension is the same as the Short-span Alternative; refer to Section 4.2.1.

Movable Span Configuration

The movable span configuration for the Couch Extension is the same as the Short-span Alternative; refer to Section 4.2.1.

East Approach Span Configuration

The east approach is comprised of two separate bridge structures to the east of Bent 9, with bents and spans denoted as north (N) and south (S). The structure flares across Span 8 to accommodate the diverging horizontal alignments. The westbound/northeast structure begins at span N9 and terminates at span N15. The eastbound/southeast structure begins at span S9 and terminates at span S14. A preliminary layout, span configuration and conceptual superstructure type is shown in Table 8 and Table 9.

Table 8. Northeast Approach – Couch Extension

Span Number	Span Length [feet]	Potential Structure Type
N9	250	Steel Plate Girder
N10	196	Steel Plate Girder
N11	133	Prestressed Concrete Girder
N12	133	Prestressed Concrete Girder
N13	133	Prestressed Concrete Girder
N14	66	Prestressed Cast-in-place Slab

Table 9. Southeast Approach – Couch Extension

Span Number	Span Length [feet]	Potential Structure Type
Span 8	189.75	Steel Plate Girder
S9	222.75	Steel Plate Girder
S10	191.5	Steel Plate Girder
S11	135	Steel Plate Girder

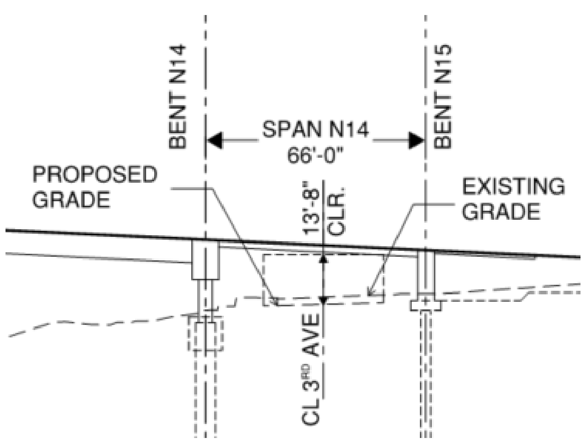
Table 9. Southeast Approach – Couch Extension

Span Number	Span Length [feet]	Potential Structure Type
S12	270	Steel Plate Girder
S13	80	Prestressed Concrete Box Beam

The southeast structure configuration follows the same logic as the Short-span Alternative as discussed in Section 4.2.2. The northeast structure is on a new alignment that does not exist today. Attempts were made to establish an alignment and bridge width that minimized property impacts. The structure width is variable from Bents N15 to N12 in order to avoid permanent impacts with the adjacent buildings and varies from Bent N11 to common Bent 9 to accommodate minimum site distance criteria. Bents N11 and N12 avoid conflicts with the ODOT Interstate structures and UPRR ROW, however, ROW acquisition will be required from the properties the bents are located in to construct the bridge.

The profile grade for the northeast alignment was set at 4.75 percent maximum to maintain pedestrian accessibility and maintain connection with NE Couch Street and NE MLK Jr. Boulevard. This alternative requires the alteration of NE 3rd Avenue to maintain vertical clearance below the bridge (Figure 20). At the location of the Couch Extension, the profile of NE 3rd Avenue will be lowered to provide the same vertical clearance provided under Burnside Street.

Figure 20. Elevation View - NE 3rd Avenue at Couch Extension



4.4.2 Substructure/Foundations

As discussed for the Short-span Alternative, the subsurface investigations have determined that the project site is well suited for deep foundations such as drilled shafts.

The approach spans could be supported on multi-column concrete bents founded on oversized drilled shafts. Each of the intermediate bents for the west approach could be supported on a four column/shaft configuration. The east approach would be supported on a reduced column configuration due to the reduced widths of the bridge. The northeast approach could be supported on a two column/shaft configuration, and the southeast approach on a three column/shaft configuration. Link beams between columns are proposed at the top of shaft elevation for select bents in order to reduce displacements and moments in the bents. Additionally cross bracing for the columns of Bents 9 are suggested in order to increase stiffness and brace the significantly tall columns at these bents.

The movable spans for the Couch Extension Replacement are similar to the Short-span Alternative. Bents 7 and 8 would be supported on a large footing cap and a group of large diameter shafts. Additionally, the use of a seal course for cofferdam dewatering is needed for these bent locations. Analysis indicates that for the bascule bridge, eighteen 12-foot diameter shafts spaced at a minimum of three shaft diameters are needed. This has resulted in a 106-foot by 175-foot footing size for the bascule bents. The movable lift bridge is slightly lighter than the bascule spans and therefore could have a slight decrease in the size of foundations. The lift bridge foundation could have fourteen 12-foot diameter shafts and approximately 80-foot by 140-foot footing cap. Table 10 contains conceptual shaft and column sizes for the Couch Extension:

Table 10. Bent Foundations – Couch Extension

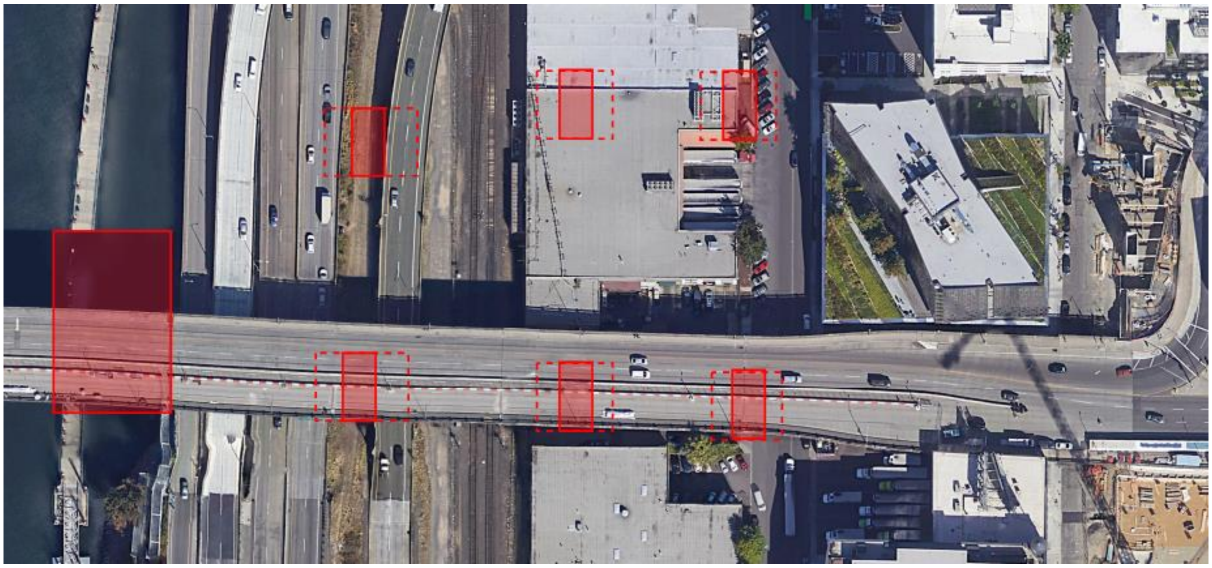
Support Location	Number of Shafts	Shaft Diameter [feet]	Column Diameter [feet]
Bent 1	10	3	--
Bent 2	4	7	5
Bent 3	4	7	5
Bent 4	4	8	6
Bent 5	4	10	8
Bent 6	4	10	8
Bent 7	18 (Bascule Bridge) 14 (Lift Bridge)	12	--
Bent 8	18 (Bascule Bridge) 14 (Lift Bridge)	12	--
Bent 9	4	12	10x16
Bent N10	2	10	8
Bent N11	2	10	8
Bent N12	2	8	6
Bent N13	2	8	6
Bent N14	2	6	4
Bent N15	6	3	--
Bent S10	3	10	8
Bent S11	3	10	8
Bent S12	3	10	8
Bent S13	3	7	5
Bent S14	8	3	--

4.4.3 Geotechnical Considerations and Seismic Hazard Mitigation

The seismic hazard mitigation approach for the Couch Extension is the same as the Short-span Alternative (Section 4.2.3), except as noted below.

Due to the alignment split and the additional northern bents, additional locations of ground improvements are anticipated. Ground improvement zones are needed at all bent locations located in inadequate soil conditions. Figure 21 below shows the proposed ground improvement locations for both the southeast and northeast legs of the Couch Extension.

Figure 21. Ground Improvement Concept - East Approach Locations (Couch Extension)



4.4.4 Movable Span Systems

The movable span systems for the Couch Extension are the same as the Short-span Alternative; refer to Section 4.2.4.

4.4.5 Retaining Walls

The retaining walls for the Couch Extension are the same as the Short-span Alternative (Section 4.2.5), except as noted below.

A new abutment would be constructed at NE Couch Street and NE 3rd Avenue. Unlike the southeast abutment location, this would need to be an abutment wall because there is no existing abutment to retain the roadway fill. Similarly, this alternative involves raising the profile grade of NE Couch Street between NE 3rd Avenue and NE MLK Boulevard several feet, which would require retaining walls on both the north and south sides of the roadway to support the fill. Lastly, because NE 3rd Avenue would need to be lowered, a series of retaining structures parallel to NE 3rd Avenue below the bridge would likely be needed to maintain pedestrian access and existing building access points.

4.4.6 Miscellaneous Structures

The miscellaneous structures for the Couch Extension are the same as the Short-span; refer to Section 4.2.6.

4.4.7 Dismissed Long-span Alternative Assessment

As an exploratory exercise, a long-span option for the Couch Extension Alternative was assessed, leading to the dismissal of the concept. The principal advantage of the long-span concept is the reduced number of required intermediate bents, thereby reducing risk and cost associated with constructing foundations within areas of complex subsurface conditions. It would also allow for more open spaces beneath the bridge.

For this assessment with the Couch Extension Alternative, the west approach and movable bridge spans would mimic the layouts of the Long Span Alternative. The unique feature of the Couch Extension Alternative, however, is its dual legs to the Couch / Burnside Street couplet. For the long-span concept to be viable, it would need to support the curved alignment for the Couch Street leg, and the tangent alignment for the Burnside Street leg. Given this twin cable stayed bridges would be constructed - one for each bridge leg to Couch Street and Burnside Street, respectively (Appendix D). On their west ends, the long-span bridge portions must converge and be supported by a combined bent cap and set of columns at Bent 9. On their east ends, the long-span bridge portions, in order to transition between the existing buildings for each leg, would need to terminate just to the east of 3rd Avenue.

Initially, both a tied arch and cable-stayed bridge type was considered. But because of the roadway geometry of Couch Street, the tied arch was found to need a much wider bridge deck than the cable stayed option to account for the street curvature. This would have resulted in the placement of the arch ribs on the outside of the bridge's multi-use paths on either side. Because of this, the tied arch option was dismissed and the cable-stayed type was deemed the most feasible option for the assessment.

Based on the conceptual design provided in Appendix D, there are a number of draw-backs with this option, including:

- High cost: A preliminary cost evaluation has determined that this option is approximately $50 million more than the baseline Couch Extension Alternative, making it the most expensive option of all alternatives studied. Further, it does not possess a unique benefit that isn't already embedded into one of the other alternatives.
- Seismic Risk: Because the cable stayed bridges require an in-water bent between the Eastbank Esplanade and the I-5 freeway, similar to the Short-span Alternative, the benefit of a reduced number of foundations in the east side geologic hazard zone is lost. This benefit is fundamental to selecting a long-span bridge configuration.
- Building Proximity and Visual Clutter: The two cable stays would create a visual spider-web for nearby residents and users. This is especially true for the tenants of The Yard building, that would be located between the two cable stayed spans. For some building floors, in fact, both north and south views could be impeded due to the cable stays and towers.

For the reasons stated above, the long-span option for the Couch Extension Alternative was dismissed from further consideration.

5 Seismic Performance and Modelling

As discussed in previous sections, the need for seismic resiliency for the Burnside Bridge is of extreme importance. The structure will be designed for two levels of performance: Full Operation (FO) design event and Limited Operation (LO) design event.

FO Event Performance Requirements – Damage sustained is negligible. Primary structural components remain "essentially elastic." Movable spans remain operable. All traffic modes are able to use the bridge.

LO Event Performance Requirements – Damage sustained is minimal. Inelastic behavior in substructure components is limited to strain limits identified in *EQRB SDC* (Multnomah County 2021h) (Appendix A). Movable components may not be operable without repairs. Damage is repairable but may impact traffic.

5.1 Modelling Approach

Multi-modal Response Spectrum Analysis (RSA) was used to determine elastic demands and peak global displacements on the structural components, particularly the bent columns and end bents.

- As detailed in the *EQRB SDC*, cracked section properties for the substructure elements were used and confirmed from moment-curvature analysis.
- Boundary conditions effecting the longitudinal and transverse response of the structure were considered; passive backfill pressure behind the end bents, bearing stiffness at simply supported spans and foundation fixity.
- Vertical, transverse and longitudinal seismic force effects from adjacent frames were considered when applicable.
- Out of phase and in-phase structural responses were examined in order to envelope the elastic demands and global displacements of the structure.
- Displacement capacities were determined from established equations based on moment-curvature properties, elastic and inelastic displacement, and plastic hinge properties. The longitudinal and transverse displacement capacities for all bents during the LO event were based on strain limitations as defined in the *EQRB SDC* (Multnomah County 2021h) (Appendix A).
- Critical elements such as crossbeams, footings and shafts would be capacity protected based on column overstrength demands.

Individual baseline RSA models were developed to capture the global behavior of the conceptual bridge structures for each alternative presented in Section 4. Regions of the structure were modeled as applicable, as noted below:

- West Approach Model (Short-span Alternative) – Bents 1 through 6, Spans 1 through 6.
  - Modeling was performed on the 7-span configuration originally considered prior to the abutment changes described in Section 4.2.1. The result differences are expected to be relatively minor.
- Movable Span Model (Short-span Alternative) – Isolated Bent 8 bascule pier with single leaf.
- Movable Span Model (Long-span Alternative) – Isolated Bent 7 bascule pier with single leaf.
- East Approach Model (Short-span Alternative) – Bents 9 through current Bent 14, Spans 8 through current span 13.
  - Modeling was performed on an alternate east approach span arrangement that considered two 135-foot spans in lieu of the 270-foot span currently proposed.

This span layout revision was due to the late determination to avoid impacts to the Burnside Skatepark. Timing did not allow the seismic analysis to be reanalyzed and the general assessment is that while there may be changes to the preliminary base loads, the nature of the design evaluations are not significantly altered. Analysis was not revised to incorporate this revision.

- East and West Approach Model (Long-span Alternative) – Isolated Bent 8.

5.1.1 Modelling Results and Refinements

In order to design for full operability, multiple iterations of the RSA models were developed. Attempts were made to reduce the seismic force effects and displacement demands seen in the structure. The following are key aspects of the conducted modeling and resultant findings determined through the RSA of the conceptual bridge structure.

West Approach Modeling (Short-span Alternative)

- Lateral spreading associated with liquefaction near Bent 6 requires ground improvements in this vicinity.
- The approach superstructure is free to move in the longitudinal direction at Bent 7 to avoid force transfer and pinned in the transverse direction to reduce transverse movement. This connectivity can be reevaluated further in the final design phase if needed.
- The superstructure and end bent (Bent 1) has pinned connection allowing thermal expansion longitudinally and utilizing the Bent 1 stiffness as a part of earthquake resisting system (ERS) thereby reducing the longitudinal displacement demands. This connectivity can be reevaluated further in the design phase if needed.
- Spans 1 through 2, 3 through 4 and 5 through 6 have been modeled with a continuous superstructure, to take advantage of superstructure stiffness thereby reducing the transverse displacement demands. This connectivity can be reevaluated further in the design phase if needed.
- The shafts are sized to remain elastic during both FO and LO design events, and would be capacity protected against potential hinging in the column.

Movable Bent Modeling (Short-span Alternative)

- The movable Bents 7 and 8 could be designed so as not to see force transfer in the longitudinal direction associated with the adjacent conventional approach spans. This could be accomplished by sizing the joint between spans to allow longitudinal movement without impact. The benefit of this design approach would be to reduce the force the movable bents would see. Therefore, this bent model does not account for the full longitudinal force transfer from the adjacent fixed spans.
- The movable bents could see force transfer in the transverse and vertical direction, due to the need for restraining and supporting the approach spans. These forces have been accounted for in the analysis of this model.
- Lateral spreading associated with liquefaction at Bents 7 and 8 is significantly large. Per SDC, lateral spreading combined with 50 percent of seismic inertial loads was

investigated. However, this load case did not control the foundation size but rather limiting the foundation displacement by increasing its stiffness did. Therefore, ground improvements at these bents are not anticipated.

- The movable bent foundations are sized to remain essentially elastic for both the FO and LO design events. Furthermore, in order to maintain the operability of the mechanical systems, it is vital to reduce the displacements of these bents. This has resulted in significantly large and stiff foundations for these bents.
- Initial iterations of the foundation determined that 10-foot diameter shafts did not provide enough axial and uplift capacity for the elastic forces. Additionally, footing cap displacements with 10-foot diameter shafts were unacceptably large. Shaft sizes were increased to 12-foot diameter to stiffen the foundation.

Movable Bent Modeling (Long-span Alternative)

- If adjacent Long-span Alternative approaches are used, it is expected that the movable bents would be required to support these adjacent spans. Due to the mass and length of the long-span approach, attempts were made to minimize force transfer between the adjacent long-span and bascule bent. Therefore, this Bent 7 model assumed base isolation bearings would be used at these locations, thereby significantly reducing the seismic demands to the movable bent. Force transfer in all three directions, longitudinal, transverse and vertical, were accounted for in this model.
- Lateral spreading associated with liquefaction at the movable bents is significantly large. Per SDC, lateral spreading combined with 50 percent of seismic inertial loads was investigated. However, this load case did not control the foundation size but rather limiting the foundation displacement by increasing its stiffness did. Therefore, ground improvements at these bents are not anticipated.
- The movable bent foundations are sized to remain essentially elastic for both the FO and LO design events. Furthermore, in order to maintain the operability of the mechanical systems, it is vital to reduce the displacements of these bents. This has resulted in significantly large and stiff foundations for these bents.
- 12-foot diameter shafts were needed for axial resistance.

East Approach Modeling (Short-span Alternative)

- Lateral spreading associated with liquefaction near Bents 9 through 12 requires ground improvements in this vicinity.
- The approach superstructure is free to move in the longitudinal direction at Bent 8 to avoid impact and reduce force transfer, and restrained in the transverse direction to reduce transverse movement. This connectivity should be reevaluated further in the design phase; base isolation bearings at this connection could be beneficial to reduce seismic demands.
- The superstructure and end bent have been modeled integrally; utilizing the end bent stiffness as a part of ERS thereby reducing the longitudinal displacement demands. This connectivity can be reevaluated further in the design phase if needed.

- Spans 8 through 10 and 11 through current span 13 have been modeled with a continuous superstructure, to take the advantage of superstructure stiffness thereby reducing the transverse displacement demands. This connectivity can be reevaluated further in the final design phase if needed.
- Attempts were made to adjust the geometry of the intermediate bents in order to reduce the stiffness of the east approach. By reducing the stiffness of the structure, the period increases which reduces the acceleration and associated force effects.
- Due to the length of the approach bridge spans and geometry of the river embankments, frame stiffness is extremely unbalanced. For example, Bent 9 is one of the tallest bents for the structure, measuring approximately 90 feet tall. Whereas, Bents 11 through current Bent 13 are on the range of 10 to 30 feet tall. The disparity in stiffness has caused unequal force distribution throughout the frame. To better balance the frame stiffness, column isolation through corrugated metal pipe is suggested at select locations.
- The columns are sized to remain essentially elastic during the FO design event. Due to significant elastic force demands, consideration for use of high strength reinforcing steel such as grade 80 bars should be evaluated further in the design phase.
- The shafts are sized to remain elastic during both FO and LO design events, and are capacity protected against potential hinging in the column.

East and West Approach Modeling (Long-span Alternative)

- An isolated bent model was created for the long-span fixed approach support located at proposed Bent 8. This location was taken into consideration due to the controlling forces of the longer 740-foot tied-arch span.
- Due to the mass and length of the long-span approach, attempts were made to minimize seismic forces in the foundations through use of base isolation bearings.
- Lateral spreading associated with liquefaction near Bent 8 would require ground improvements in this vicinity.
- The shafts are sized to remain elastic during both FO and LO design events, and would be capacity protected against potential hinging in the pier wall column.

Modelling Limitations and Conclusions

Ultimately, the project-specific performance requirements and design RSA go beyond standard code based requirements. This added level of performance expectation results in significant seismic demands on the structure. Designing the structure for these demands has proven difficult and may require nonstandard solutions than typically seen for bridge structures within the region. It is recommended that base isolation be investigated in the final design phase in order to improve the global response of the bridge.

5.2 Movable Span Seismic Considerations

The following considerations apply to the mechanical systems:

- Machinery will be designed to be replaceable.
- Machinery supports and mounting will be designed to be fully elastic for both FO and LO events.
- Significant damage requiring removal or replacement of span locks will be allowed. The span locks will be designed to be replaceable. However, design would limit permanent displacements at the joint in order to maintain traffic.
- Spare lock bars will be provided.

Bascule Specific:

- The design of trunnions, rack pinions, and drive machinery should take into account additional seismic loading due to vertical ground motion.
- The design of trunnions, rack pinions, and drive machinery should take into account additional unbalanced load due to seismic loading.
- The operating machinery will be supported by the trunnion frame to limit the differential movement between the trunnions and the pinions during a seismic event.
- Sizing of the trunnion tower connections to the pier to be elastic for all loading levels, and provisions for jacking the trunnion frame to reset it after a seismic event.
- Provide longitudinal restraint to the bascule span or design clearance at the roadway joints and pier walls, with the span in the closed position.
- Provide lateral support for the bascule leaf counterweight when the bridge is in the fully open or closed position.

Vertical Lift Specific:

- Counterweight guide connections to be design to minimize loads upon the towers during a seismic event.
- Spacing and clearance between counterweight ropes (and any other vertical hanging features) and tower structure to accommodate maximum expected horizontal movement of the tower at the top.
- Strengthen tower columns to avoid soft story effects and consider passive energy dissipaters at the tower base.
- Vertical lift bridge machinery may be able to be designed to lesser loading conditions since it may only really see the unbalanced vertical loads due to seismic loading.

6 Construction Impacts and Staging

Given the multitude of stakeholders impacted by the project and the complexity of the design and construction, constructability has been a prime focus to try to identify and limit impacts to users and mitigate risks during construction. These considerations are discussed in detail in the *EQRB Construction Approach Technical Report* (Multnomah County 2021b) (Appendix A).

6.1 Constraints and Impacts

The Burnside Bridge is in the core of downtown Portland, surrounded by other stakeholders and their facilities. Attempts would be made to minimize impacts to adjacent facilities, these constraints will need to be identified and investigated throughout the design phases.

6.1.1 West Approach

- There are existing buildings immediately adjacent to the north and south of the bridge between W 2nd Avenue and W 1st Avenue and the north block between W 1st Avenue and W Naito Parkway. The secure entrance for the Portland Rescue Mission is on the north sidewalk and in front of the existing abutment. The end spans of the west approach were modified to help minimize impacts to this operation as described in Section 4.2.1.
- An existing classroom building for the University of Oregon is located underneath the bridge, blocking access to the west abutment. The west approach changes mentioned above would eliminate the space that the classroom currently occupies.
- There is a parking lot under the bridge between W 1st Avenue and W Naito Parkway.
- East of W Naito Parkway, Tom McCall Waterfront Park runs beneath the bridge. Part of this space is used weekly by the Saturday Market, including a steel canopy structure immediately south of the bridge and in the path of the potential temporary bridge. It is assumed that this structure will be removed and stored during construction.
- The Japanese American Historical Plaza is located in Tom McCall Waterfront Park just north of the bridge. It is anticipated that a portion of the Tom McCall Waterfront Park property would be required to provide construction access for the duration of construction.

6.1.2 Within the River

- Work bridges could be needed to demolish and construct the proposed in water bents. It is anticipated that cofferdams would be needed for this work.
- Work bridges located near the east bank of the river may need to extend north, running parallel to the Eastbank Esplanade, to a location with enough vertical clearance under I-5. Construction equipment and materials will need to traverse underneath the I-5 and I-84 facilities to access the east work bridge. Alternatively, this work platform could be accessed by barge alone, but could negatively impact the construction schedule.

6.1.3 East Approach

- Access to the in water work bridges would need to be provided along the existing ODOT access road.
- Temporary crossings over UPRR tracks would be needed to access the in water work bridges as well as access replacement bents located in the vicinity of the I-5

and I-84 structures. Likewise, this temporary crossing would provide access to proposed construction staging areas located on the east side.

- Impacts to adjacent facilities can also be expected during bridge demolition and girder erection. There are businesses north and south of the bridge between the UPRR tracks and E 2nd Avenue, one of which also utilizes the space directly under the bridge.
- One of these parcels is a prime location for a contractor staging area, and given that the temporary bridge cuts through the lot to the south, it is expected that this property will be acquired for construction.
- Under the bridge between E 2nd Avenue and E 3rd Avenue is the Burnside Skatepark, which would need to be closed during construction. Permanent impacts to the skatepark are being avoided for the replacement alternatives.
- New residential and commercial buildings have been built north of the bridge between E 2nd Avenue and E 3rd Avenue. Existing building access points are located on the south side of this block.

6.2 Construction Staging

Two methods for construction and traffic staging are being investigated.

- Divert traffic to an onsite temporary bridge.
- Close the Burnside Bridge river crossing for the duration of construction, and reroute all traffic to adjacent river crossings.

6.2.1 Replacement Bridge with Temporary Bridge

This approach would divert multi-modal traffic around the existing bridge through use of a temporary bridge located immediately adjacent to the south of the existing bridge alignment. The temporary bridge would be located sufficiently south to allow for construction access of the replacement bents for the Short-span Alternative (Figure 22) or for the Long-span Alternative (Figure 23).

Figure 22. Temporary Bridge Alignment Short-span Alternative Concept

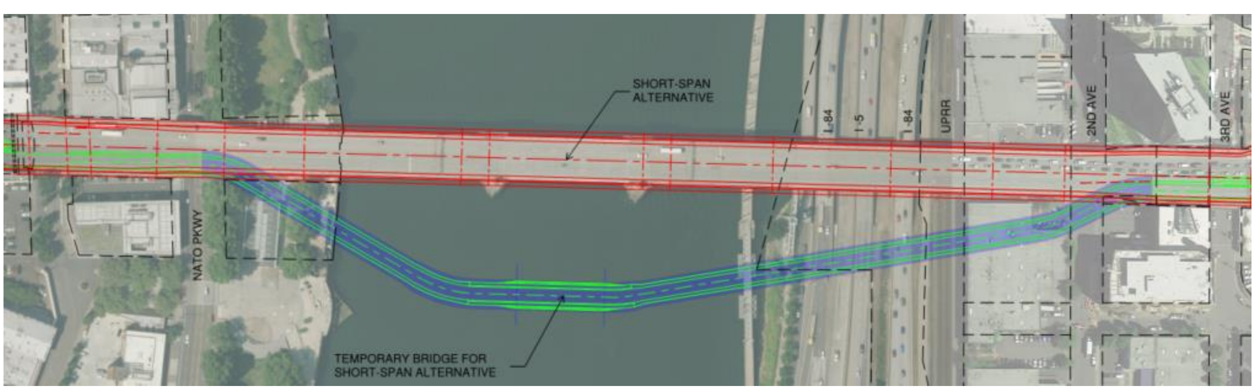
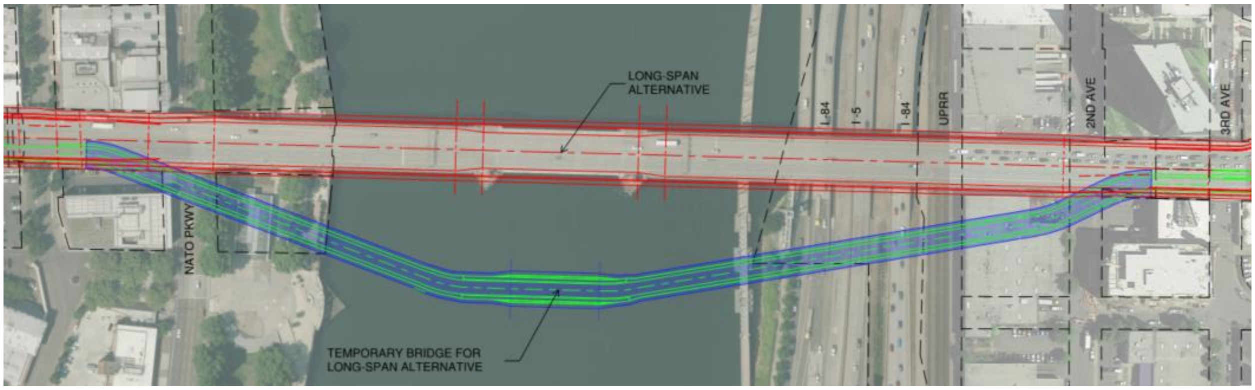


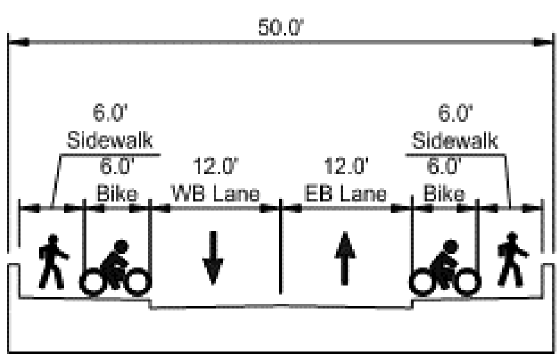
Figure 23. Temporary Bridge Alignment Long-span Alternative Concept



The temporary bridge could consist of fixed spans along the east and west approach, and a movable lift span within the river navigation channel. This would allow for demolition of the majority of the existing bridge spans and construction of the replacement spans to occur. However, because the temporary bridge cannot tie in past the existing bridge tie in without large ROW impacts, a portion of both the east and west approach spans would need to be constructed in stages.

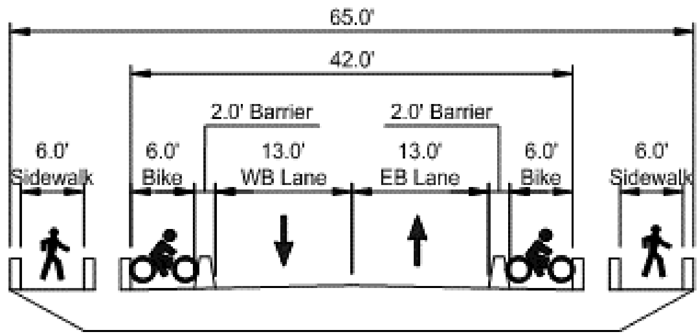
The temporary bridge could provide one vehicular lane, one bike lane, and one sidewalk in each direction. This would result in an out-to-out width of approximately 50 feet (Figure 24). This width would allow for staged construction at the tie in at the east and west approach. Due to the configuration of the truss support system that supports the temporary movable lift span, the section at midspan of the river would require approximately 65 feet in order to accommodate the same multi-modal traffic section as the approaches (Figure 25).

Figure 24. Temporary Bridge – Typical Section (At East and West Approaches)



Note: EB (eastbound), WB (westbound)

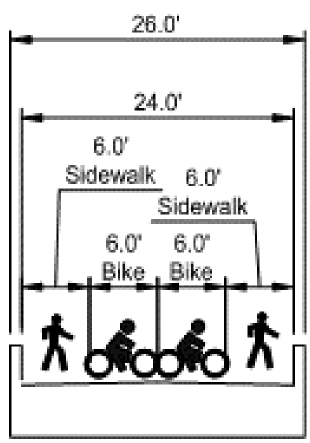
Figure 25. Temporary Bridge – Typical Section (At Midspan of Willamette River)



Note: EB (eastbound), WB (westbound)

Alternatively, the vehicular lanes in the cross-sections above could be limited to transit vehicles. Another cross-section has been developed restricting the temporary bridge to only bikes and pedestrians (Figure 26). This configuration would follow the same alignments for the Short-span Alternative or Long-span Alternative but would have a narrower width, reducing cost and construction impacts.

Figure 26. Temporary Bike/Ped Bridge – Typical Section (At East and West Approaches)



6.2.2 Replacement Bridge without Temporary Bridge

This approach would close the Burnside Bridge crossing (from E MLK Boulevard to W 3rd Avenue) to all modes of transportation for the duration of construction. Detour routes would be established to route multi-modal traffic to adjacent river crossings. This approach would allow the contractor to demolish the existing bridge and construct the new bridge without concerns for staging traffic. All other facilities crossed by Burnside Street (e.g. I-5, various city streets, and TriMet MAX lines) would have to be maintained and protected, except for short term closures for construction activities such as girder erection and deck placement.

7 References

Metro

1996 Regional Emergency Transportation Routes, Portland Metropolitan Area

Multnomah County

1924 Burnside Bridge As-Built Plans. https://multco.us/earthquake-ready-burnside-bridge/project-library.

2019 EQRB Recommendation to Remove the Fixed Bridge Alternative from Further Consideration Memo. https://multco.us/earthquake-ready-burnside-bridge/project-library.

2021a EQRB Bridge Design Criteria. https://multco.us/earthquake-ready-burnside-bridge/project-library.

2021b EQRB Construction Approach Technical Report. https://multco.us/earthquake-ready-burnside-bridge/project-library.

2021c EQRB Existing Roadway Deficiency Memo. https://multco.us/earthquake-ready-burnside-bridge/project-library.

2021d EQRB Facility Standards List. https://multco.us/earthquake-ready-burnside-bridge/project-library

2021e EQRB Geotechnical Report. https://multco.us/earthquake-ready-burnside-bridge/project-library.

2021f EQRB Preliminary Navigation Study. https://multco.us/earthquake-ready-burnside-bridge/project-library.

2021g EQRB Right-of-Way Technical Report. https://multco.us/earthquake-ready-burnside-bridge/project-library.

2021h EQRB Seismic Design Criteria. https://multco.us/earthquake-ready-burnside-bridge/project-library.

2021i EQRB Transportation Technical Report. https://multco.us/earthquake-ready-burnside-bridge/project-library.

2021j EQRB Utilities Technical Report. https://multco.us/earthquake-ready-burnside-bridge/project-library.

OSSPAC (Oregon Seismic Safety Policy Advisory Commission)

2013 The Oregon Resilience Plan. xiii, 105-159. https://www.oregon.gov/oem/Documents/Oregon_Resilience_Plan_Final.pdf

PBEM (City of Portland, Oregon, Bureau of Emergency Management)

2017 Annex D Evacuation Plans. https://www.portlandoregon.gov/pbem/article/668061

USCG (U.S. Coast Guard)

2019 Navigation and Navigable Waters. 33 Code of Federal Regulations J Bridges 114-118. https://www.govinfo.gov/content/pkg/CFR-2012-title33-vol1/pdf/CFR-2012-title33-vol1-chapI.pdf

Appendix A. Supporting Reports

Supporting Reports

EQRB Bridge Design Criteria

EQRB Seismic Design Criteria

EQRB Existing Roadway Deficiency Memo

EQRB Facility Standards List

EQRB Geotechnical Report

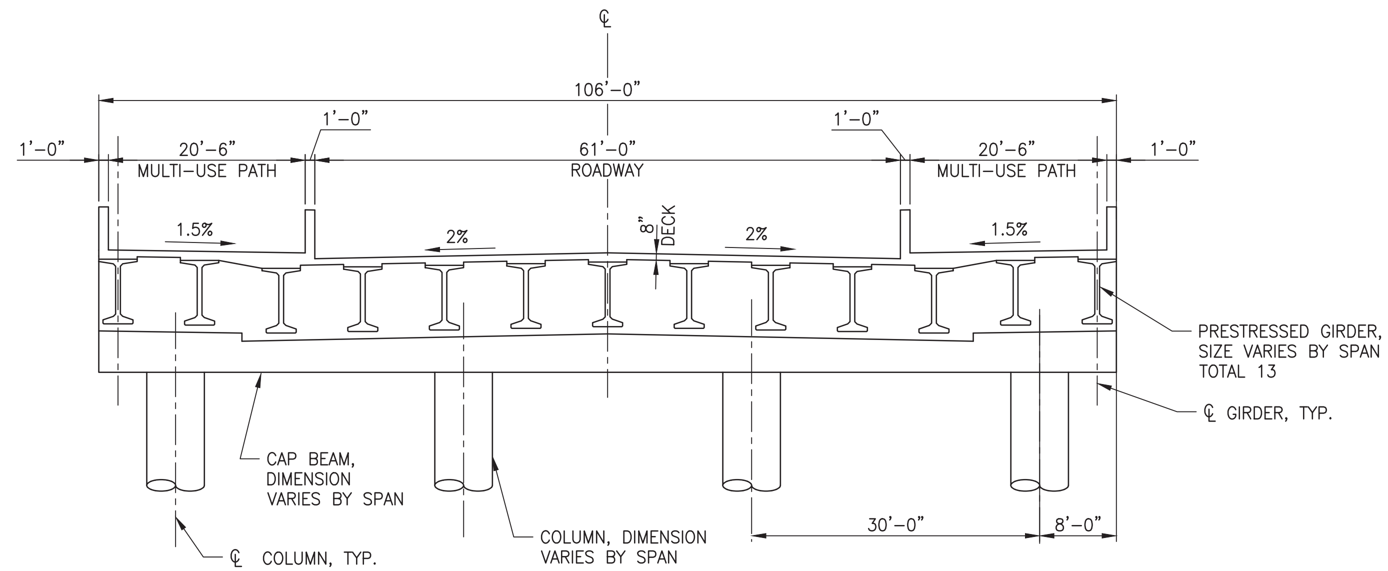
EQRB Preliminary Navigation Study

EQRB Construction Approach Technical Report

EQRB Recommendation to Remove the Fixed Bridge Alternative from Further Consideration Memo

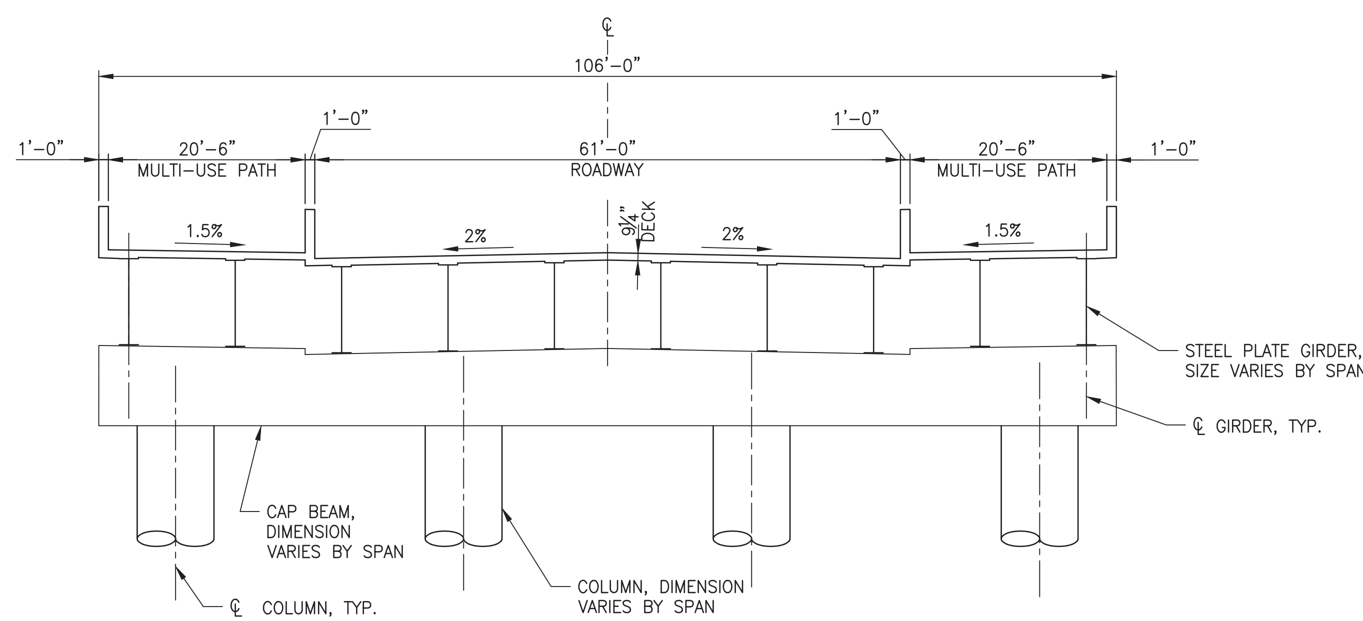
Supporting documents were developed to support the NEPA Environmental Impact Statement (EIS) are available in the project library (https://multco.us/earthquake-ready-burnside-bridge/project-library).

Appendix B. Replacement Bridge Site Plan Sheets



FULL WIDTH TYPICAL SECTION - PRESTRESSED CONCRETE GIRDER

SCALE: 1" = 10'-0"
(LOOKING EAST)



FULL WIDTH TYPICAL SECTION - STEEL PLATE GIRDER

SCALE: 1" = 10'-0"
(LOOKING EAST)

NOTES:

1. FOR LANE DESIGNATIONS, SEE ROADWAY SHEETS.
2. FOR BRIDGE PROFILE, SEE ROADWAY SHEETS.

CONCEPTUAL PLANS
JUNE 2020

Earthquake Ready Burnside Bridge

Replacement Alternative with Short-span Approach (Bascule)

MULTNOMAH COUNTY

PROJECT NO.:

DATE:

MULTNOMAH COUNTY
DEPARTMENT OF COMMUNITY SERVICES
TRANSPORTATION DIVISION
1620 S.E. 190th AVE. PORTLAND, ORE. 97233-5999

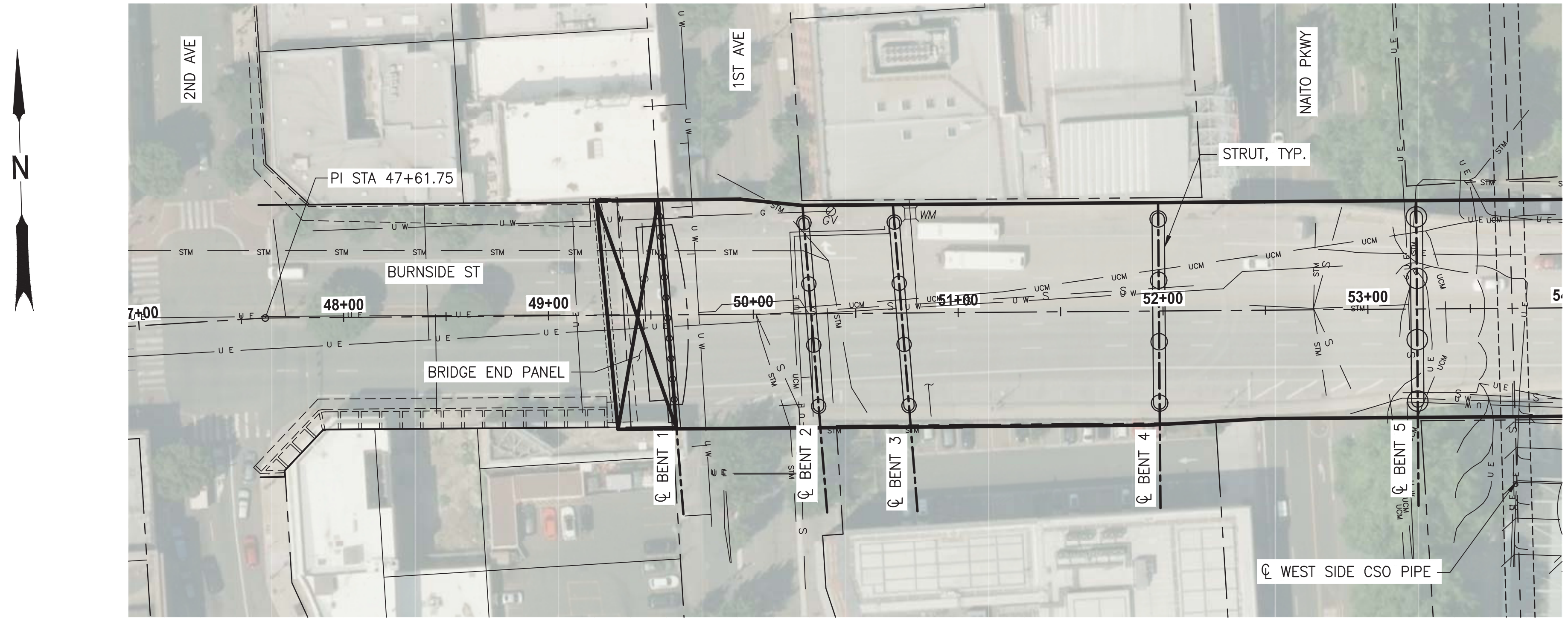
IAN B. CANNON P.E.
COUNTY ENGINEER

DESIGNED BY:
DRAFTED BY:
CHECKED BY:

REVISIONS

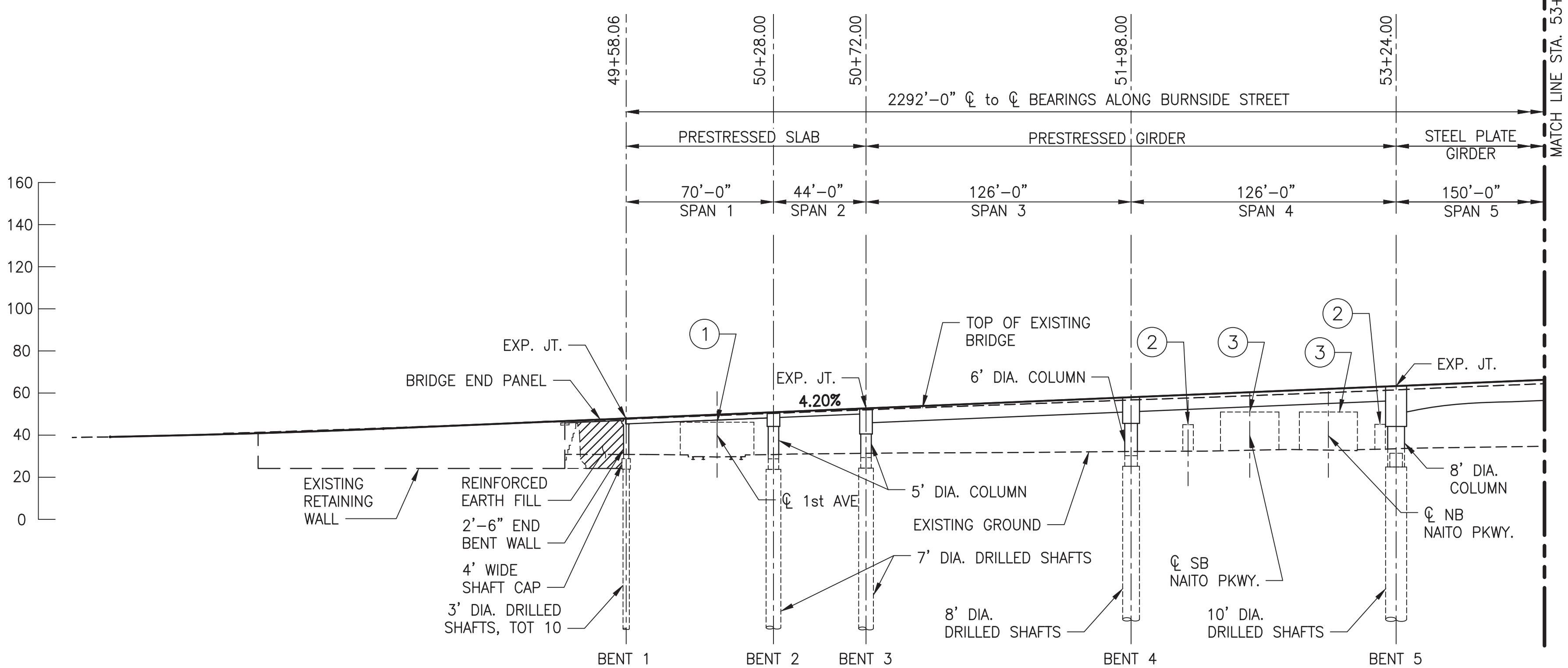
NO.	DATE:

Sheet No.
BR01



PLAN

SCALE: 1"=40'



ELEVATION

SCALE: 1"=40'

CLEARANCE ENVELOPE LEGEND

1	LRT	15'-6"
2	PEDESTRIAN	12'-0"
3	CITY STREET	18'-0"
4	NAVIGATION	220'-0" W x UNLIMITED H
5	HIGHWAY	17'-4"
6	UPRR	23'-6"
7	CITY STREET @ 3rd AVE	13'-8"

CONCEPTUAL PLANS
JUNE 2020

Earthquake Ready Burnside Bridge

Replacement Alternative with Short-span Approach (Bascule)

MULTNOMAH COUNTY

PROJECT NO.:

DATE:

MULTNOMAH COUNTY
DEPARTMENT OF COMMUNITY SERVICES
TRANSPORTATION DIVISION
1620 S.E. 190th AVE. PORTLAND, ORE. 97233-5999

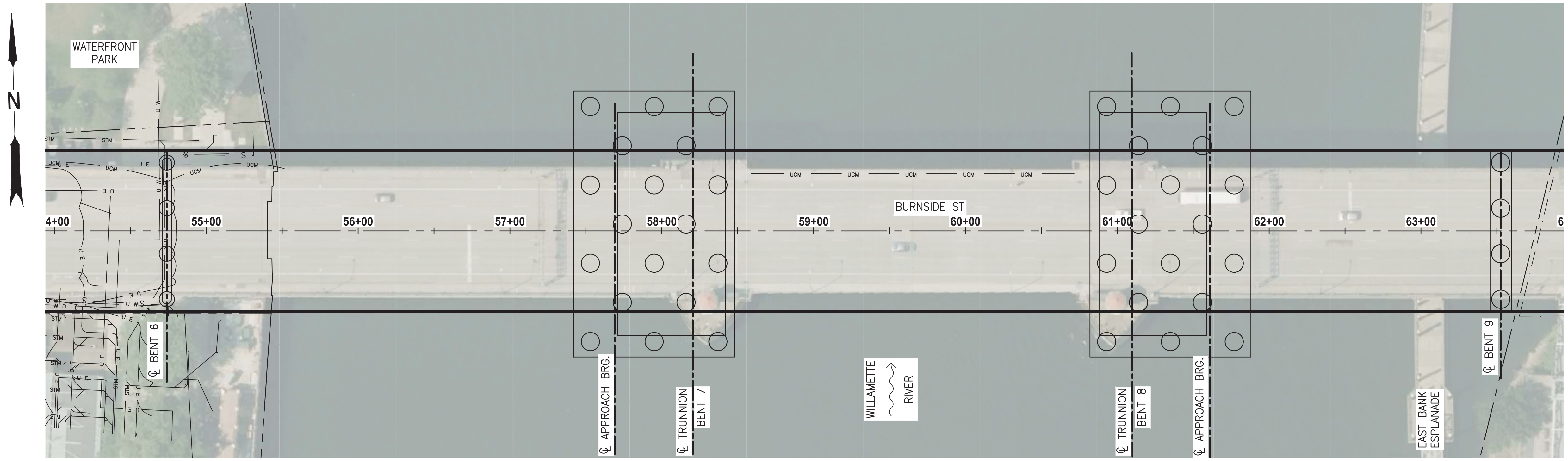
IAN B. CANNON P.E. COUNTY ENGINEER

DESIGNED BY:
DRAFTED BY:
CHECKED BY:

REVISIONS

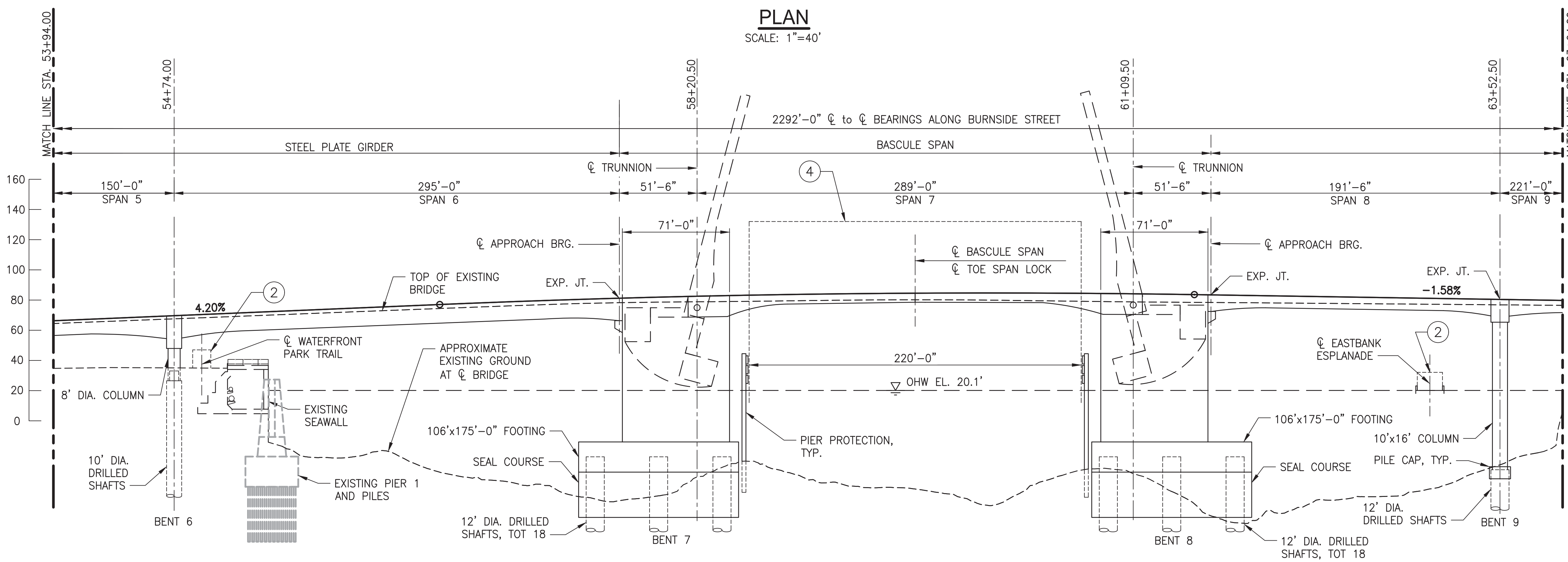
NO DATE:

Sheet No.
BR02



PLAN

SCALE: 1"=40'



ELEVATION

SCALE: 1"=40'

CLEARANCE ENVELOPE LEGEND

1	LRT	15'-6"	5	HIGHWAY	17'-4"
2	PEDESTRIAN	12'-0"	6	UPRR	23'-6"
3	CITY STREET	18'-0"	7	CITY STREET @ 3rd AVE	13'-8"
4	NAVIGATION	220'-0" W x UNLIMITED H			

CONCEPTUAL PLANS
JUNE 2020

Earthquake Ready Burnside Bridge

Replacement Alternative with Short-span Approach (Bascule)

MULTNOMAH COUNTY

PROJECT NO.:

DATE:

MULTNOMAH COUNTY
DEPARTMENT OF COMMUNITY SERVICES
TRANSPORTATION DIVISION
1620 S.E. 190th AVE. PORTLAND, ORE. 97233-5999

IAN B. CANNON P.E. COUNTY ENGINEER

DESIGNED BY:

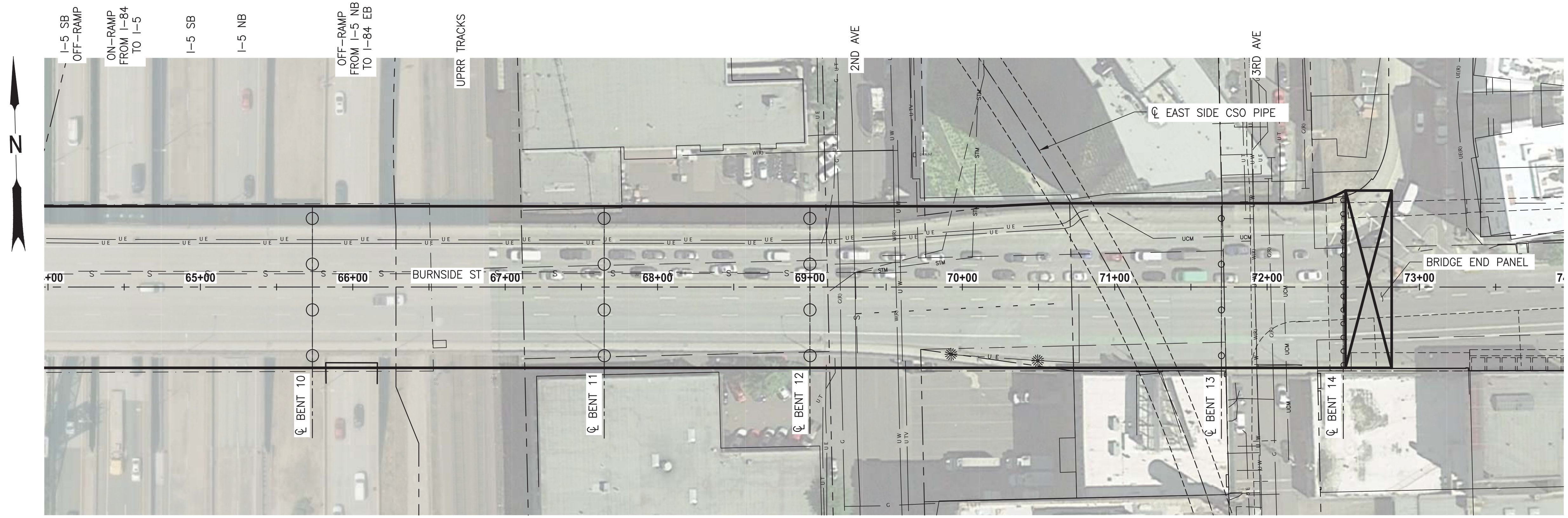
DRAFTED BY:

CHECKED BY:

REVISIONS

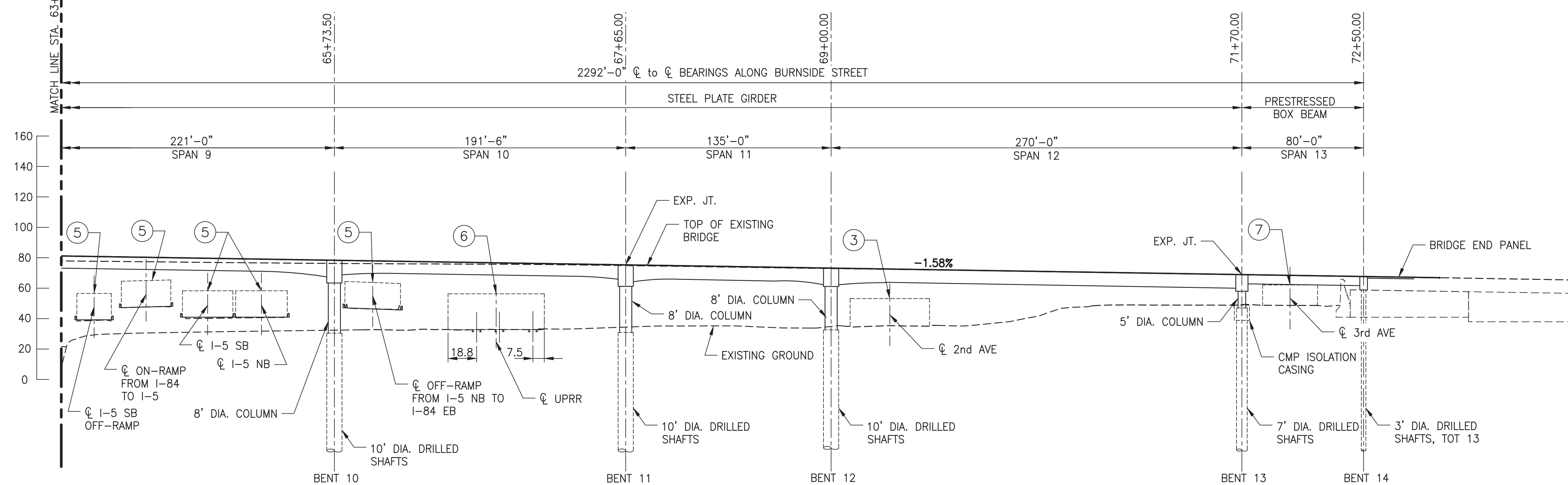
NO DATE:

Sheet No. *BR03*



PLAN

SCALE: 1"=40'



ELEVATION

SCALE: 1"=40'

CLEARANCE ENVELOPE LEGEND

1	LRT	15'-6"	5	HIGHWAY	17'-4"
2	PEDESTRIAN	12'-0"	6	UPRR	23'-6"
3	CITY STREET	18'-0"	7	CITY STREET @ 3rd AVE	13'-8"
4	NAVIGATION	220'-0" W x UNLIMITED H			

CONCEPTUAL PLANS
JUNE 2020

Earthquake Ready Burnside Bridge

Replacement Alternative with Short-span Approach (Bascule)

MULTNOMAH COUNTY

PROJECT NO.:

DATE:

MULTNOMAH COUNTY
DEPARTMENT OF COMMUNITY SERVICES
TRANSPORTATION DIVISION
1620 S.E. 190th AVE. PORTLAND, ORE. 97233-5999

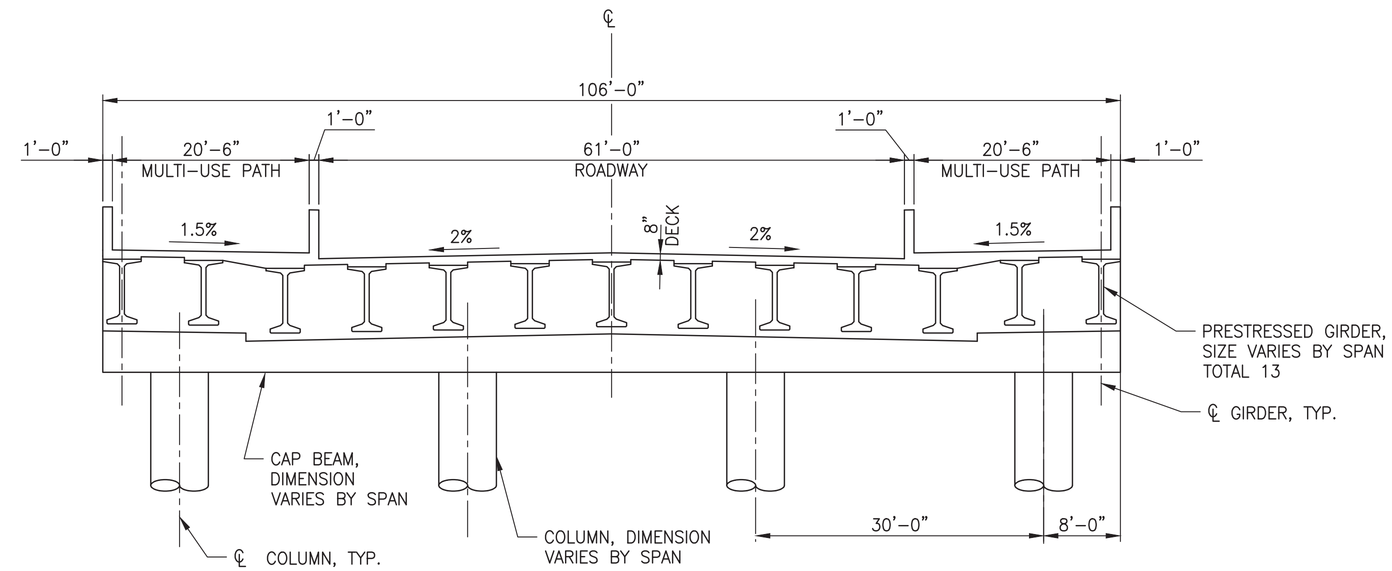
IAN B. CANNON P.E. COUNTY ENGINEER

DESIGNED BY: DRAFTED BY: CHECKED BY:

REVISIONS

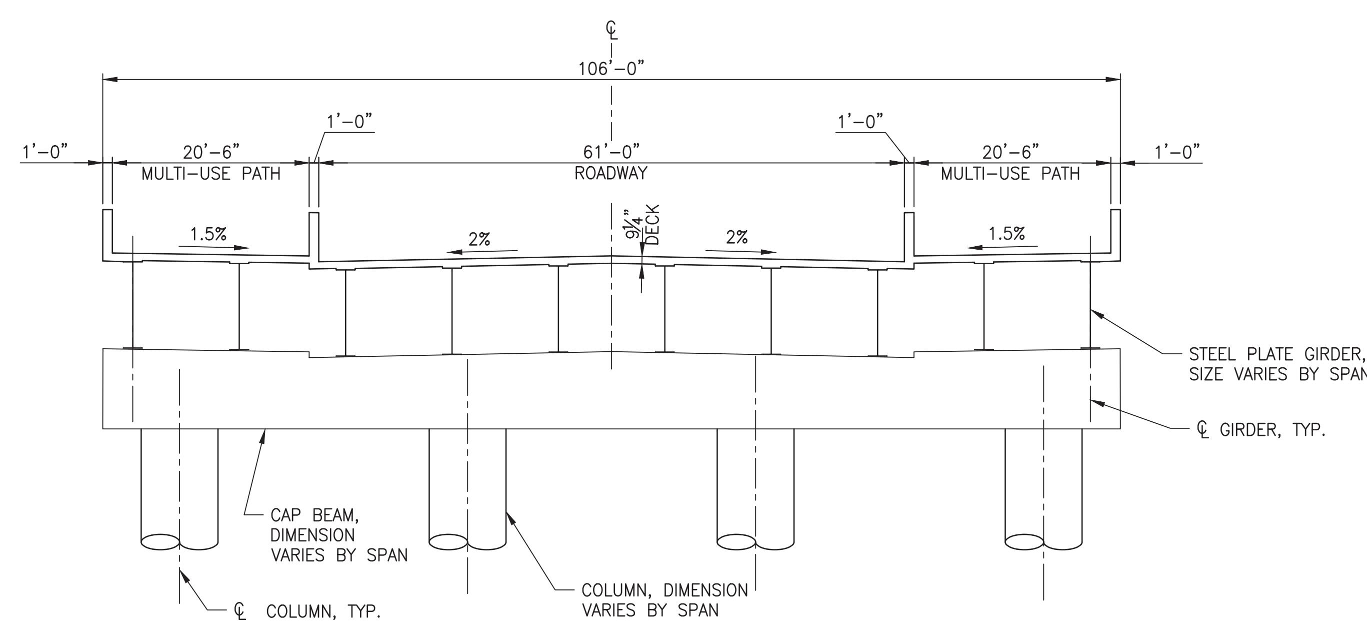
NO DATE:

Sheet No.
BR04



FULL WIDTH TYPICAL SECTION - PRESTRESSED CONCRETE GIRDER

SCALE: 1" = 10'-0"
(LOOKING EAST)



FULL WIDTH TYPICAL SECTION - STEEL PLATE GIRDER

SCALE: 1" = 10'-0"
(LOOKING EAST)

NOTES:

1. FOR LANE DESIGNATIONS, SEE ROADWAY SHEETS.
2. FOR BRIDGE PROFILE, SEE ROADWAY SHEETS.

CONCEPTUAL PLANS
JUNE 2020

Earthquake Ready Burnside Bridge

Replacement Alternative with Short-span Approach (Lift)

MULTNOMAH COUNTY

PROJECT NO.:

DATE:

MULTNOMAH COUNTY
DEPARTMENT OF COMMUNITY SERVICES
TRANSPORTATION DIVISION
1620 S.E. 190th AVE. PORTLAND, ORE. 97233-5999

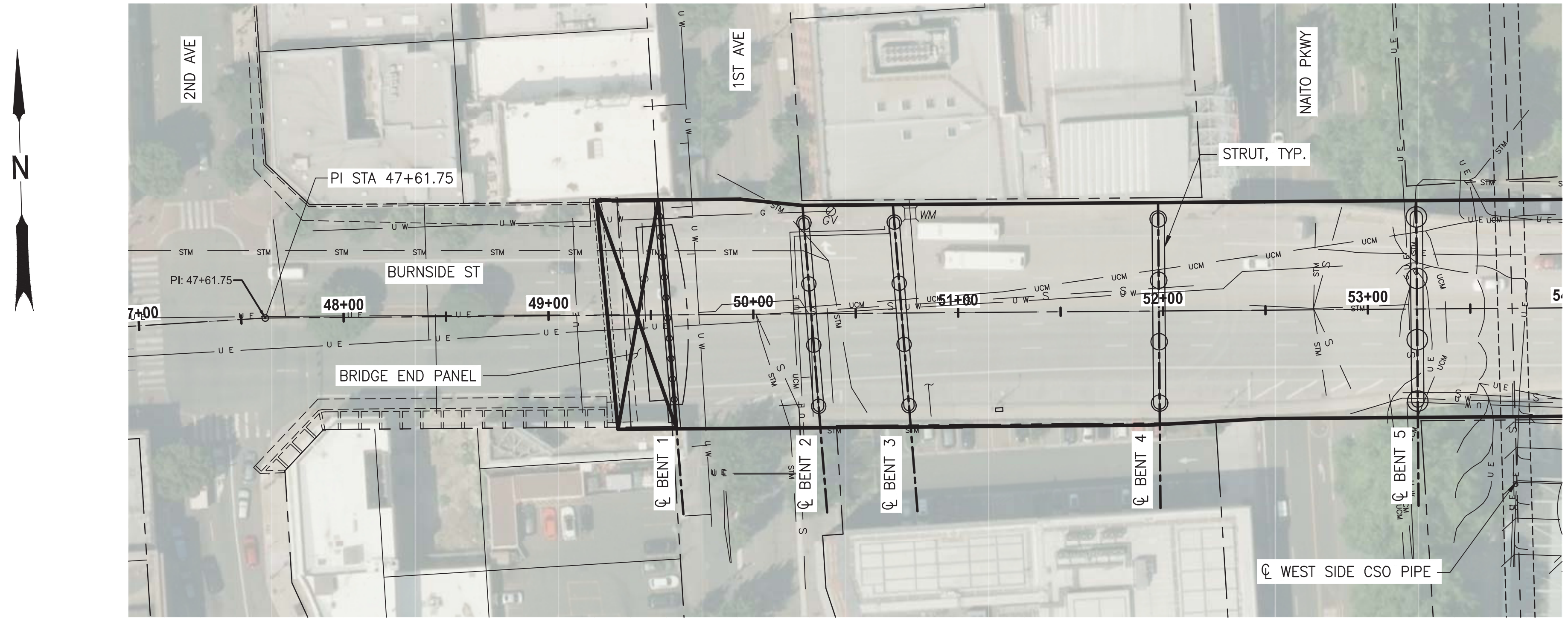
IAN B. CANNON P.E.
COUNTY ENGINEER

DESIGNED BY:
DRAFTED BY:
CHECKED BY:

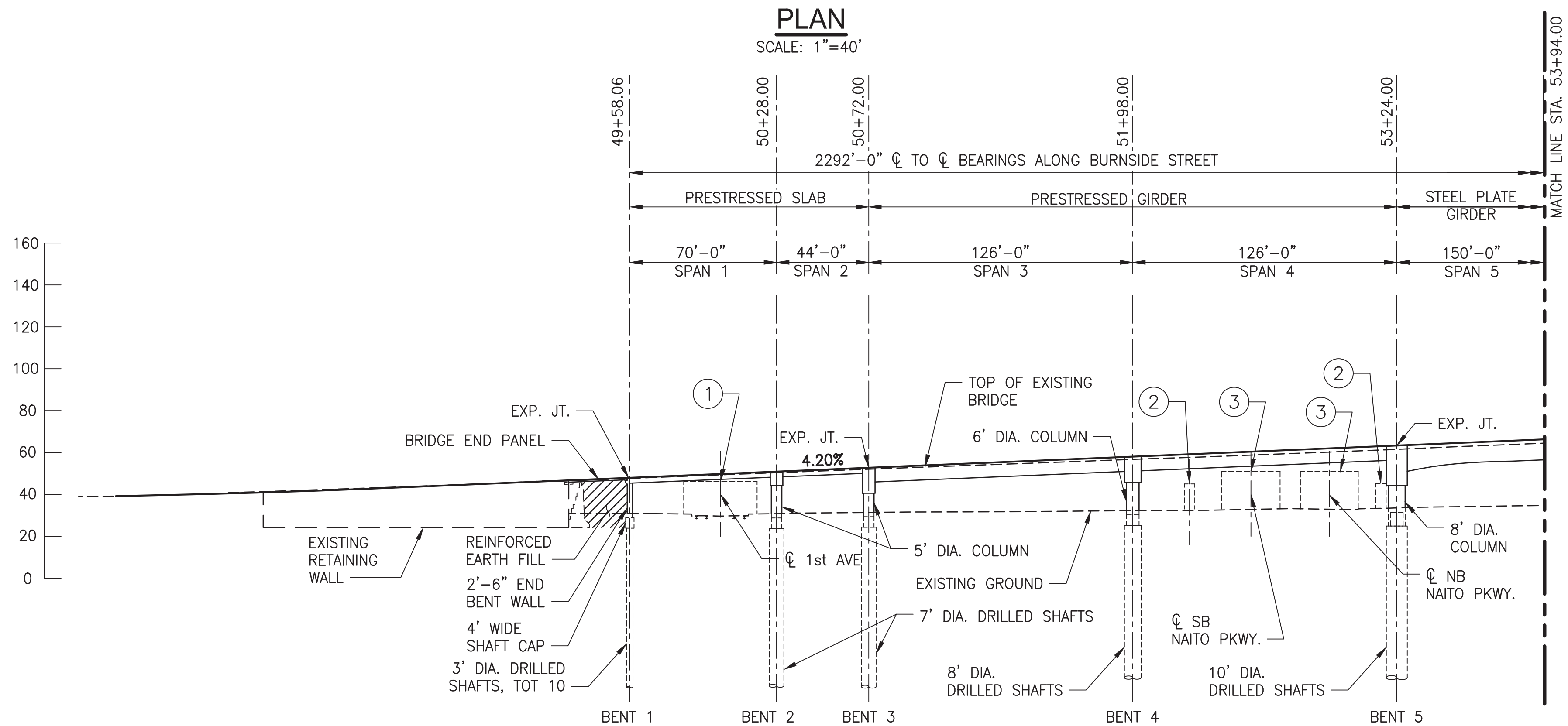
REVISIONS

NO. DATE:

Sheet No.
BR05



PLAN
SCALE: 1"=40'



ELEVATION
SCALE: 1"=40'

CLEARANCE ENVELOPE LEGEND

1	LRT	15'-6"
2	PEDESTRIAN	12'-0"
3	CITY STREET	18'-0"
4	NAVIGATION	220'-0" W x 147'-0" H
5	HIGHWAY	17'-4"
6	UPRR	23'-6"
7	CITY STREET @ 3rd AVE	13'-8"

CONCEPTUAL PLANS
JUNE 2020

Earthquake Ready Burnside Bridge

Replacement Alternative with Short-span Approach (Lift)

MULTNOMAH COUNTY

PROJECT NO.:

DATE:

MULTNOMAH COUNTY
DEPARTMENT OF COMMUNITY SERVICES
TRANSPORTATION DIVISION
1620 S.E. 190th AVE. PORTLAND, ORE. 97233-5999

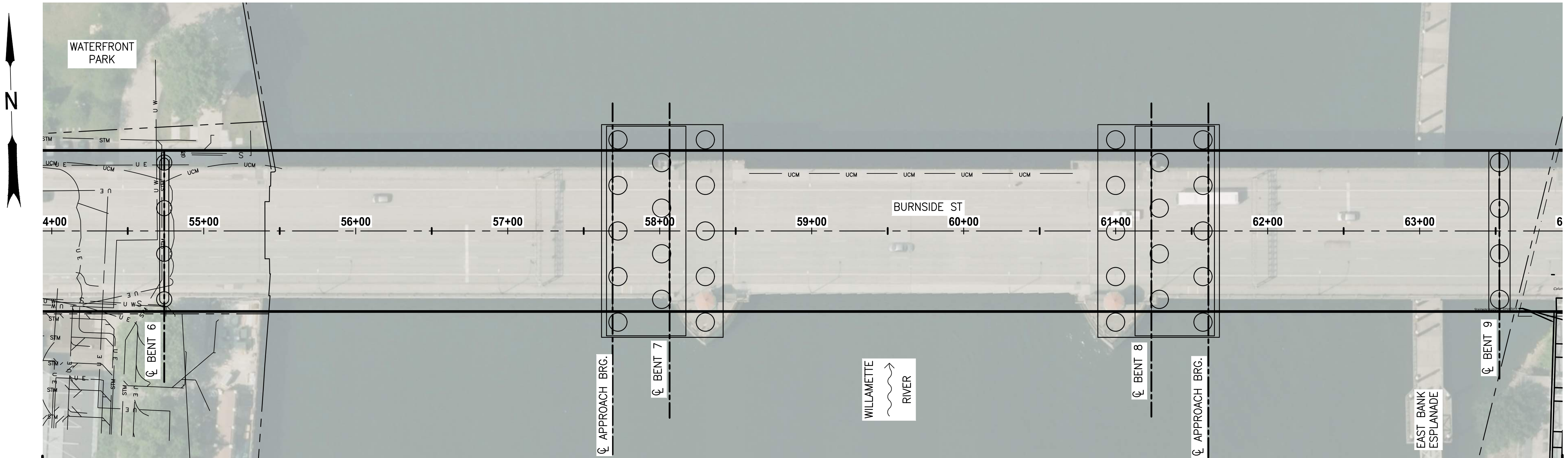
IAN B. CANNON P.E. COUNTY ENGINEER

DESIGNED BY:
DRAFTED BY:
CHECKED BY:

REVISIONS

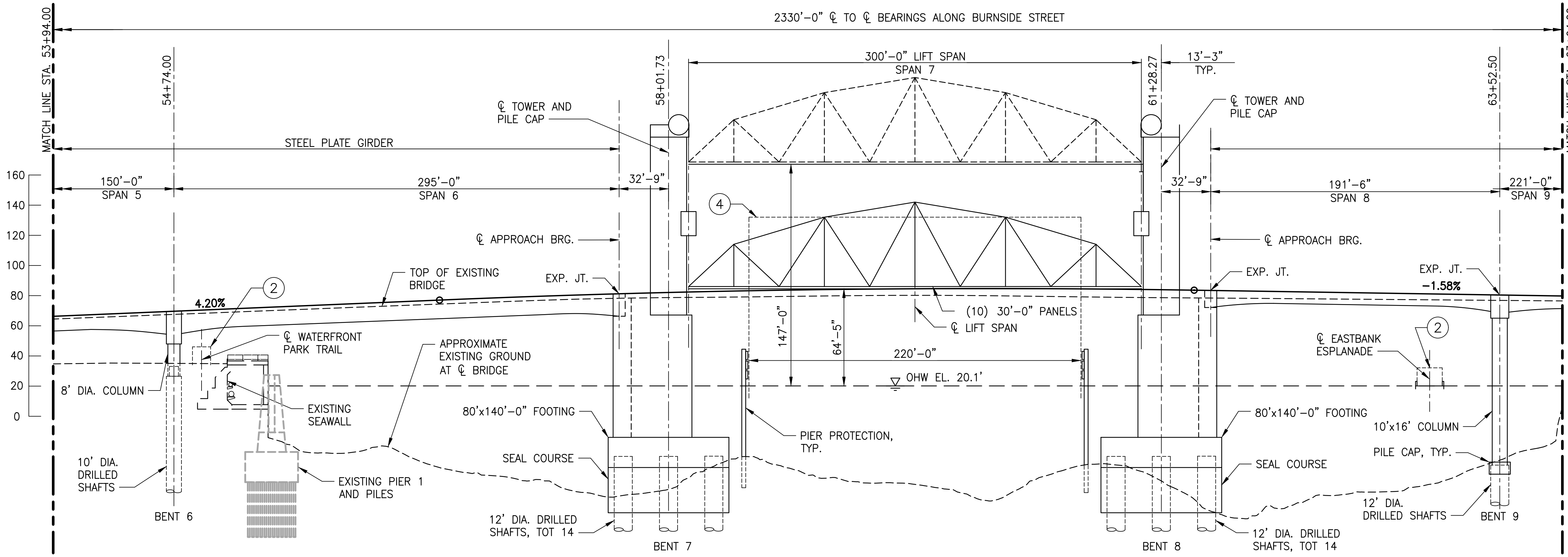
NO DATE:

Sheet No.
BR06



PLAN

SCALE: 1"=40'



ELEVATION

SCALE: 1"=40'

CLEARANCE ENVELOPE LEGEND

1	LRT	15'-6"	5	HIGHWAY	17'-4"
2	PEDESTRIAN	12'-0"	6	UPRR	23'-6"
3	CITY STREET	18'-0"	7	CITY STREET @ 3rd AVE	13'-8"
4	NAVIGATION	220'-0" W x 147'-0" H			

CONCEPTUAL PLANS
JUNE 2020

Earthquake Ready Burnside Bridge

Replacement Alternative with Short-span Approach (Lift)

MULTNOMAH COUNTY

PROJECT NO.:

DATE:

MULTNOMAH COUNTY
DEPARTMENT OF COMMUNITY SERVICES
TRANSPORTATION DIVISION
1620 S.E. 190th AVE. PORTLAND, ORE. 97233-5999

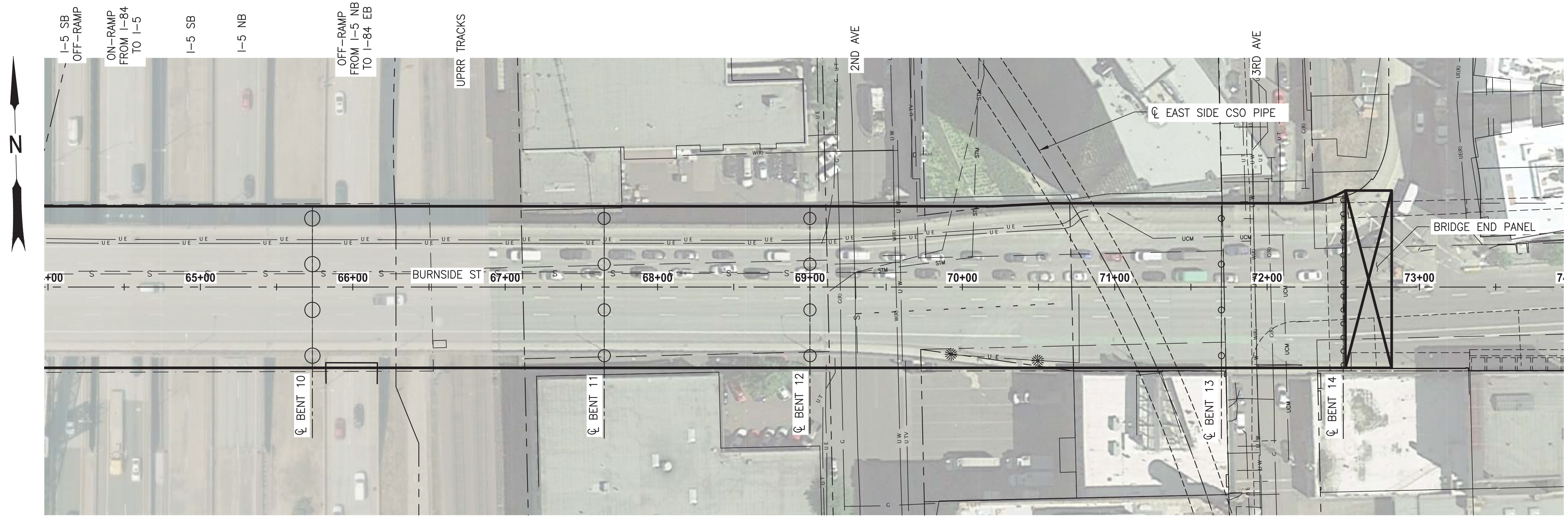
IAN B. CANNON P.E. COUNTY ENGINEER

DESIGNED BY:
DRAFTED BY:
CHECKED BY:

REVISIONS

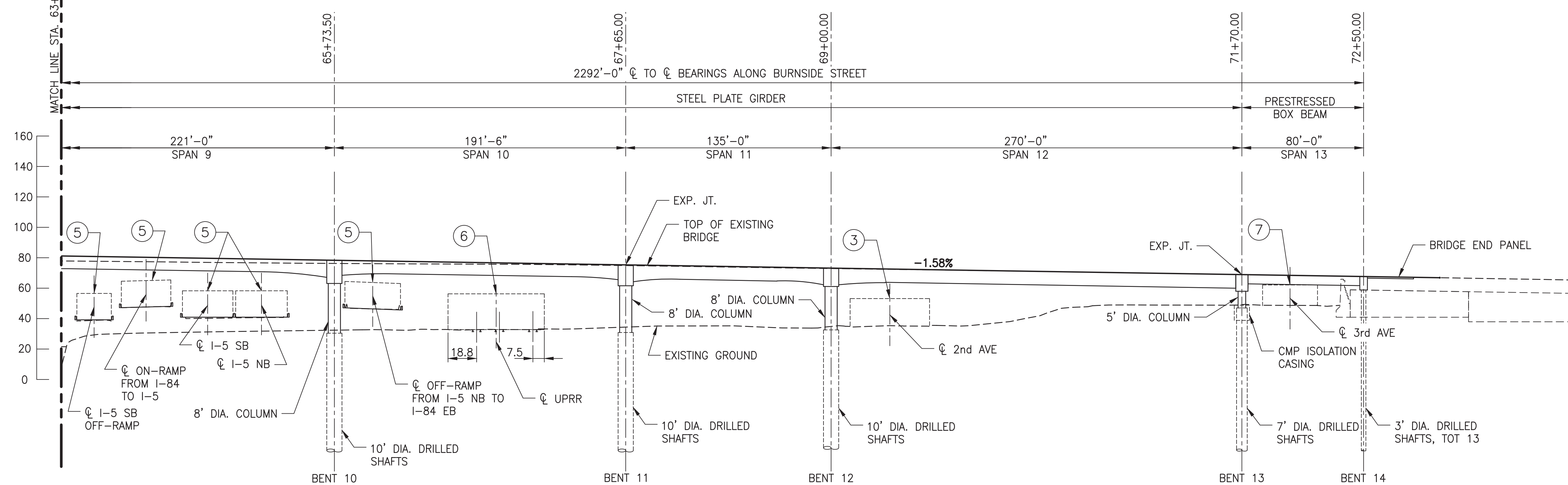
NO. DATE:

Sheet No.
BR07



PLAN

SCALE: 1"=40'



ELEVATION

SCALE: 1"=40'

CLEARANCE ENVELOPE LEGEND

1	LRT	15'-6"	5	HIGHWAY	17'-4"
2	PEDESTRIAN	12'-0"	6	UPRR	23'-6"
3	CITY STREET	18'-0"	7	CITY STREET @ 3rd AVE	13'-8"
4	NAVIGATION	220'-0" W x 147'-0" H			

CONCEPTUAL PLANS
JUNE 2020

Earthquake Ready Burnside Bridge

Replacement Alternative with Short-span Approach (Lift)

MULTNOMAH COUNTY

PROJECT NO.:

DATE:

MULTNOMAH COUNTY
DEPARTMENT OF COMMUNITY SERVICES
TRANSPORTATION DIVISION
1620 S.E. 190th AVE. PORTLAND, ORE. 97233-5999

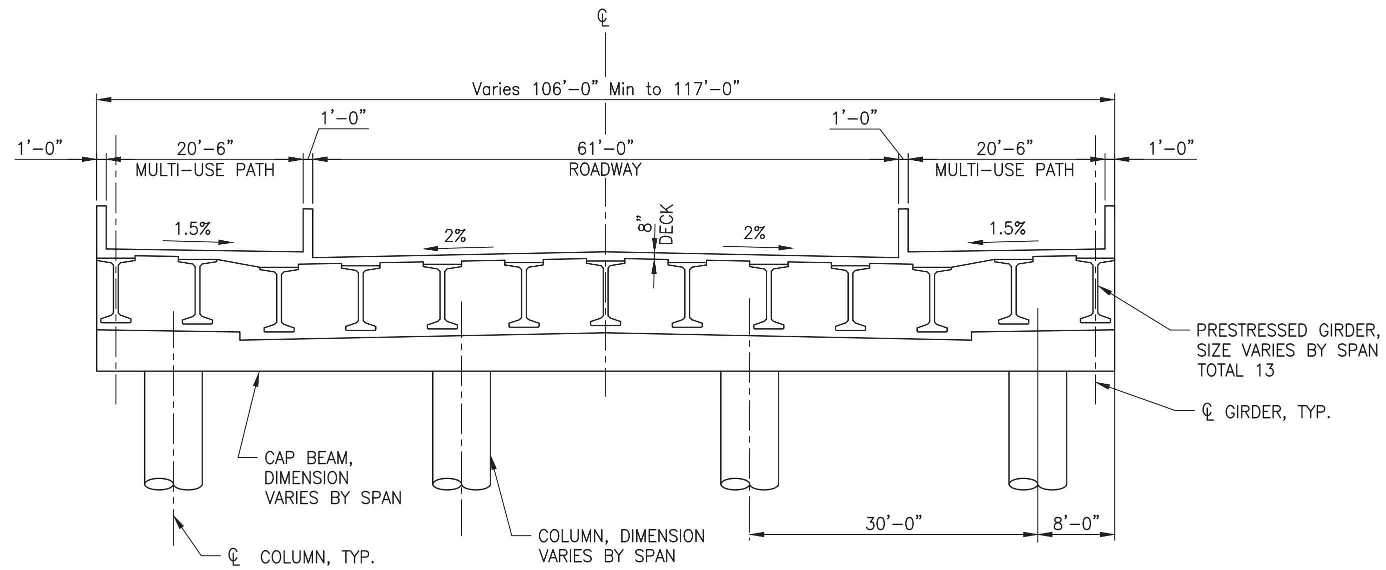
IAN B. CANNON P.E. COUNTY ENGINEER

DESIGNED BY:
DRAFTED BY:
CHECKED BY:

REVISIONS

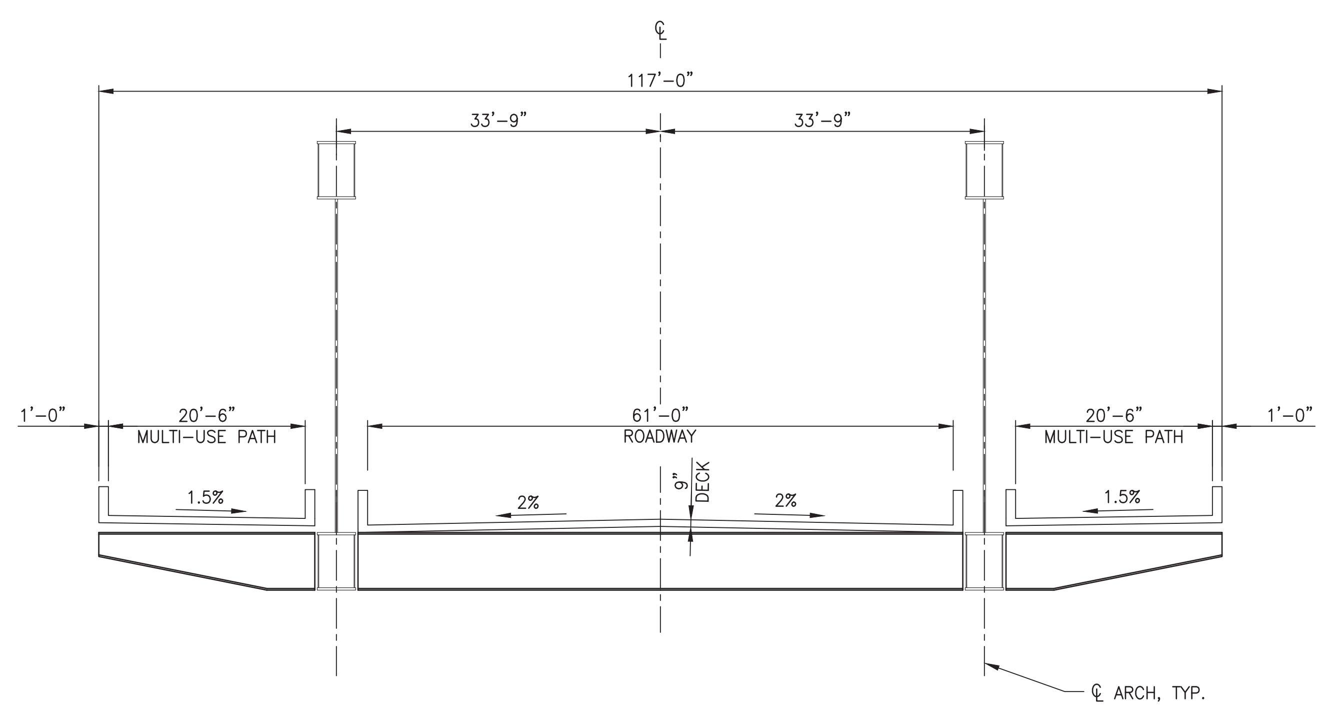
NO	DATE:	

Sheet No. BR08



FULL WIDTH TYPICAL SECTION - PRESTRESSED CONCRETE GIRDER

SCALE: 1" = 10'-0"
(LOOKING EAST)



FULL WIDTH TYPICAL SECTION - STEEL TIED ARCH

SCALE: 1" = 10'-0"
(LOOKING EAST)

NOTES:

1. FOR LANE DESIGNATIONS, SEE ROADWAY SHEETS.
2. FOR BRIDGE PROFILE, SEE ROADWAY SHEETS.

CONCEPTUAL PLANS
JUNE 2020

Earthquake Ready Burnside Bridge
Replacement Alternative with Long-span Approach (Bascule)
MULTNOMAH COUNTY

PROJECT NO.:

DATE:

MULTNOMAH COUNTY
DEPARTMENT OF COMMUNITY SERVICES
TRANSPORTATION DIVISION
1620 S.E. 190th AVE. PORTLAND, ORE. 97233-5999

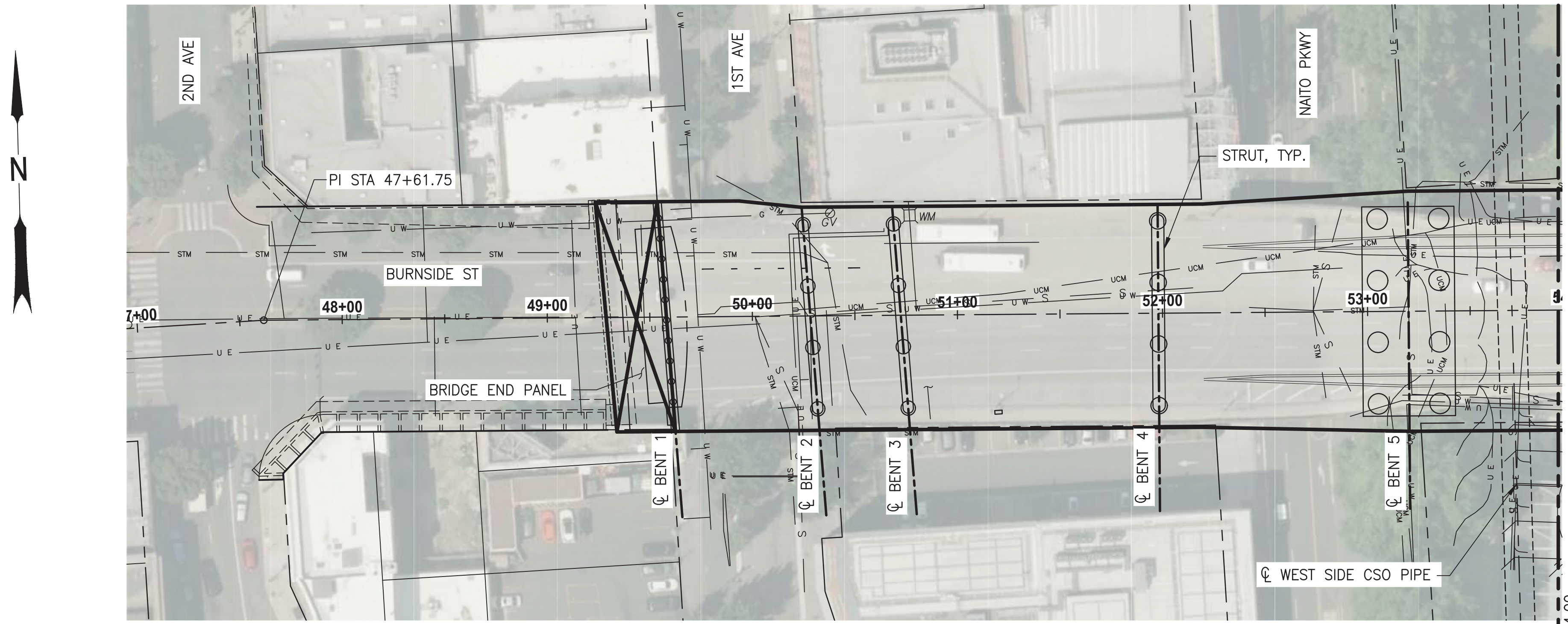
IAN B. CANNON P.E.
COUNTY ENGINEER

DESIGNED BY:
DRAFTED BY:
CHECKED BY:

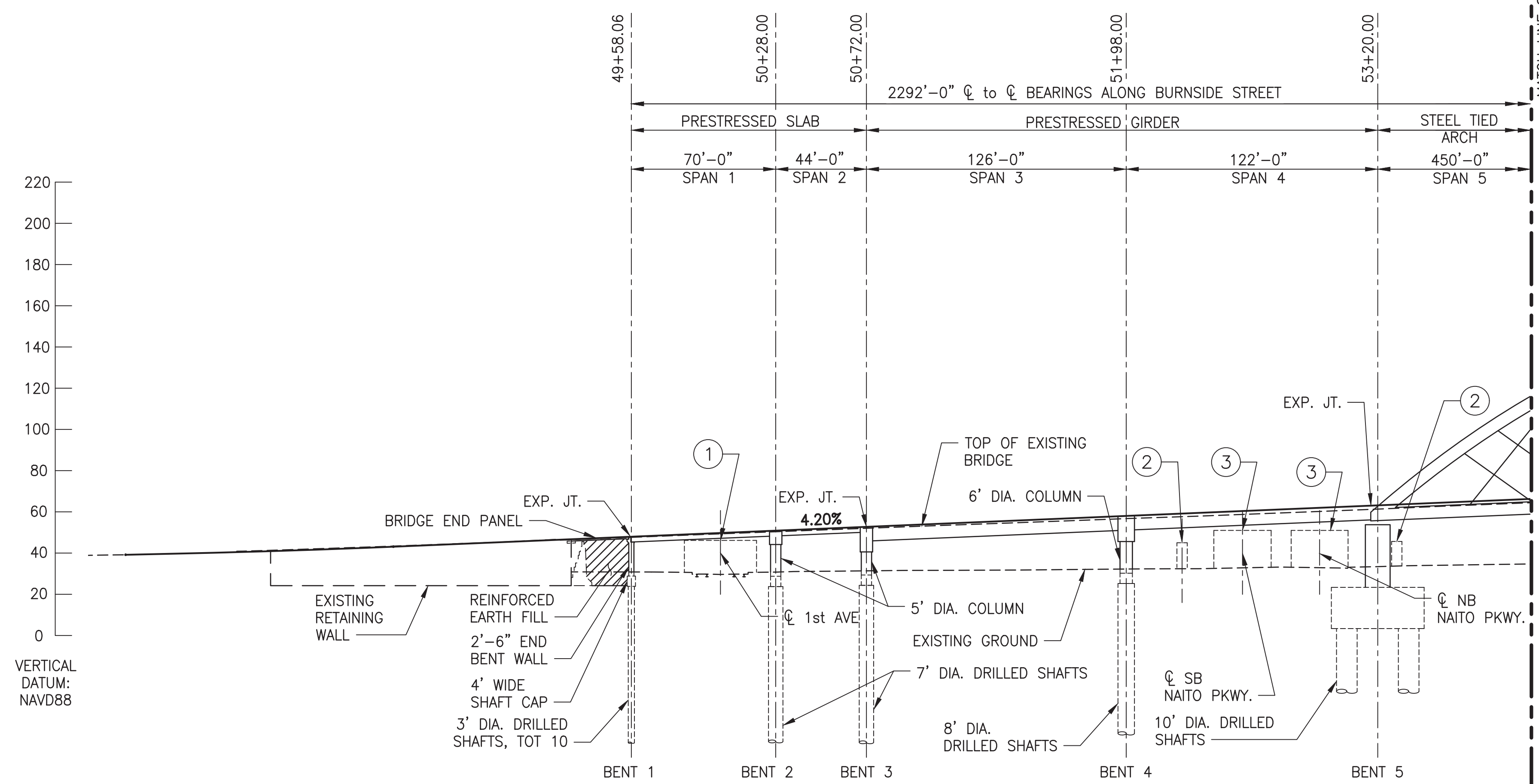
REVISIONS

NO	DATE:

Sheet No.
BR09



PLAN
SCALE: 1"=40'



ELEVATION
SCALE: 1"=40'

CLEARANCE ENVELOPE LEGEND

1	LRT	15'-6"
2	PEDESTRIAN	12'-0"
3	CITY STREET	18'-0"
4	NAVIGATION	220'-0" W x UNLIMITED H
5	HIGHWAY	17'-4"
6	UPRR	23'-6"
7	CITY STREET @ 3rd AVE	13'-8"

CONCEPTUAL PLANS
JUNE 2020

Earthquake Ready Burnside Bridge
Replacement Alternative with Long-span Approach (Bascule)
MULTNOMAH COUNTY

PROJECT NO.:
DATE:

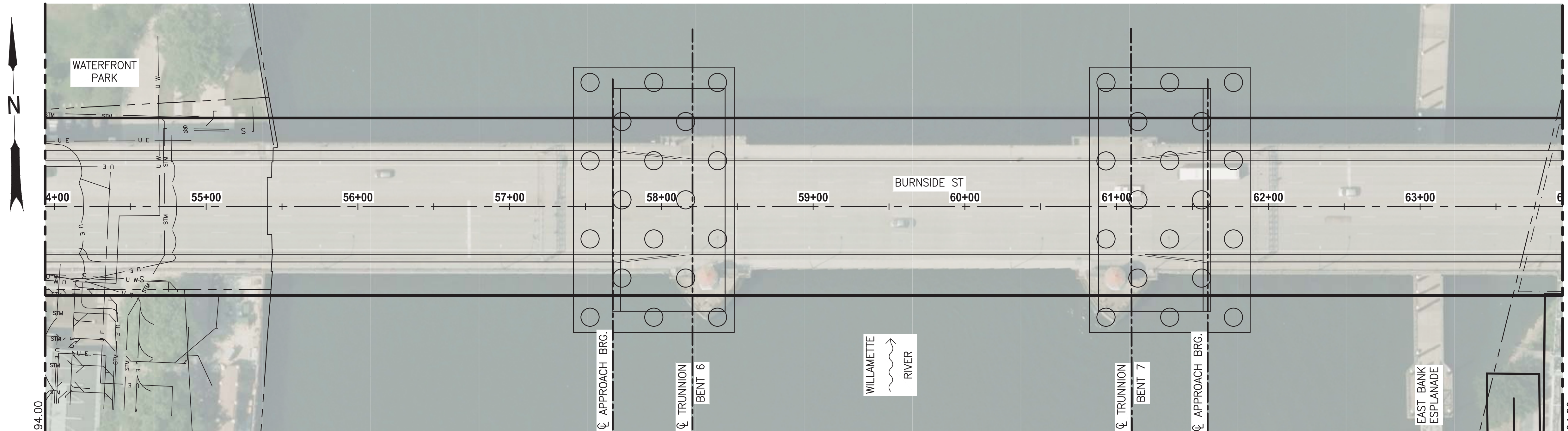
MULTNOMAH COUNTY
DEPARTMENT OF COMMUNITY SERVICES
TRANSPORTATION DIVISION
1620 S.E. 190th AVE. PORTLAND, ORE. 97233-5999

IAN B. CANNON P.E. COUNTY ENGINEER

DESIGNED BY:
DRAFTED BY:
CHECKED BY:

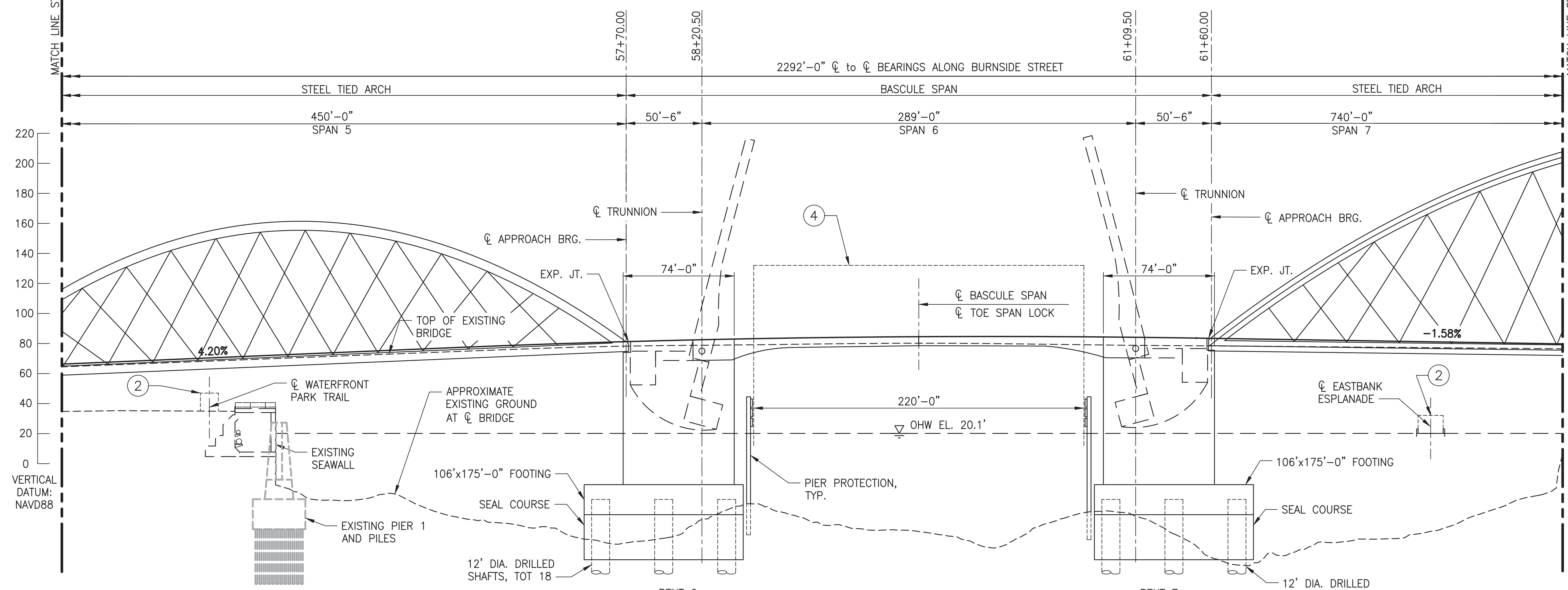
REVISIONS
NO | DATE:

Sheet No.
BR10



PLAN

SCALE: 1"=40'



ELEVATION

SCALE: 1"=40'

CLEARANCE ENVELOPE LEGEND

1	LRT	15'-6"	5	HIGHWAY	17'-4"
2	PEDESTRIAN	12'-0"	6	UPRR	23'-6"
3	CITY STREET	18'-0"	7	CITY STREET @ 3rd AVE	13'-8"
4	NAVIGATION	220'-0" W x UNLIMITED H			

CONCEPTUAL PLANS
JUNE 2020

Earthquake Ready Burnside Bridge
Replacement Alternative with Long-span Approach (Bascule)
MULTNOMAH COUNTY

PROJECT NO.:
DATE:

MULTNOMAH COUNTY
DEPARTMENT OF COMMUNITY SERVICES
TRANSPORTATION DIVISION
1620 S.E. 190th AVE. PORTLAND, ORE. 97233-5999

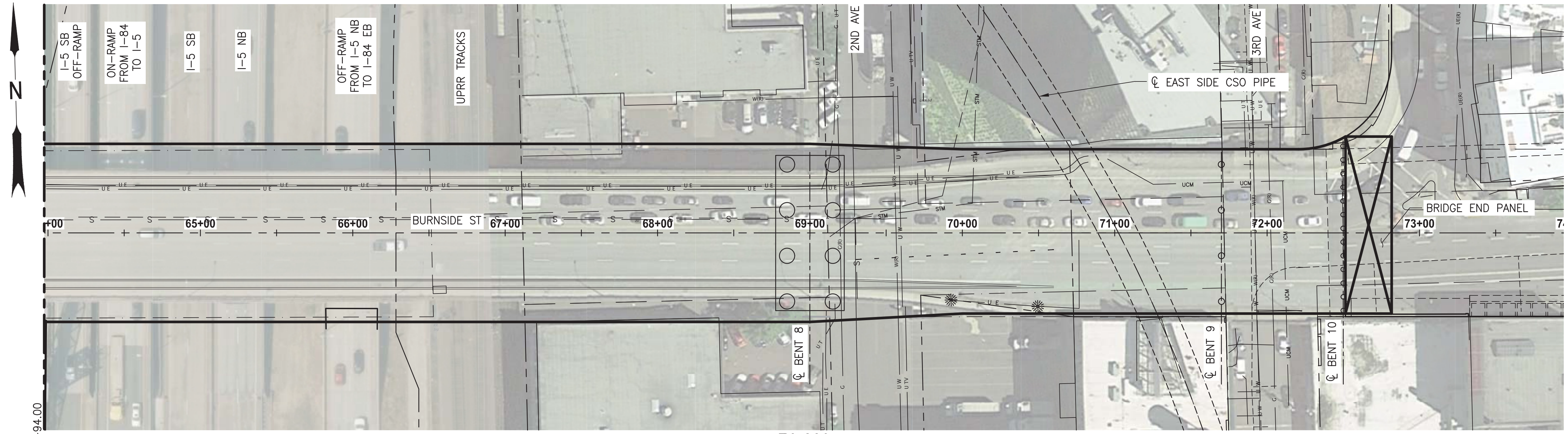
IAN B. CANNON P.E. COUNTY ENGINEER

DESIGNED BY:
DRAFTED BY:
CHECKED BY:

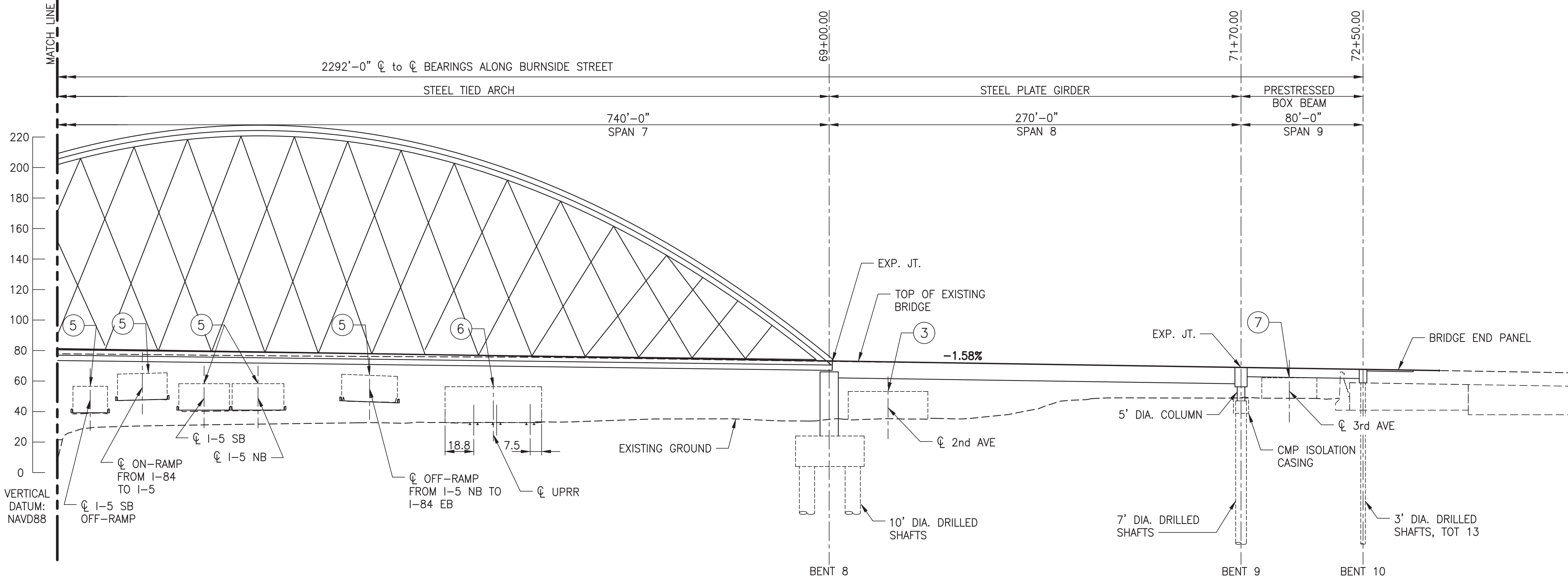
REVISIONS

NO | DATE:

Sheet No.
BR11



PLAN
SCALE: 1"=40'



ELEVATION
SCALE: 1"=40'

CLEARANCE ENVELOPE LEGEND

(1)	LRT	15'-6"
(2)	PEDESTRIAN	12'-0"
(3)	CITY STREET	18'-0"
(4)	NAVIGATION	220'-0" W x UNLIMITED H
(5)	HIGHWAY	17'-4"
(6)	UPRR	23'-6"
(7)	CITY STREET @ 3rd AVE	13'-8"

CONCEPTUAL PLANS
JUNE 2020

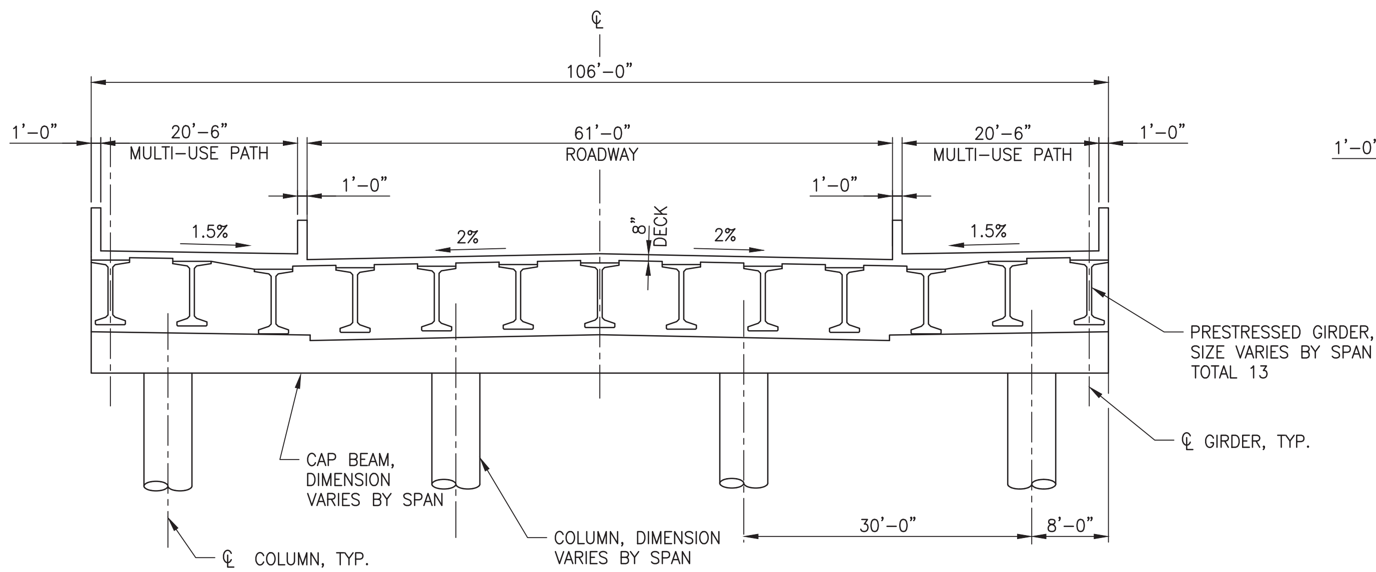
Earthquake Ready Burnside Bridge
Replacement Alternative with Long-span Approach (Bascule)
MULTNOMAH COUNTY
PROJECT NO.:
DATE:

MULTNOMAH COUNTY
DEPARTMENT OF COMMUNITY SERVICES
TRANSPORTATION DIVISION
1620 S.E. 190th AVE. PORTLAND, ORE. 97233-5999
IAN B. CANNON P.E. COUNTY ENGINEER

DESIGNED BY:
DRAFTED BY:
CHECKED BY:

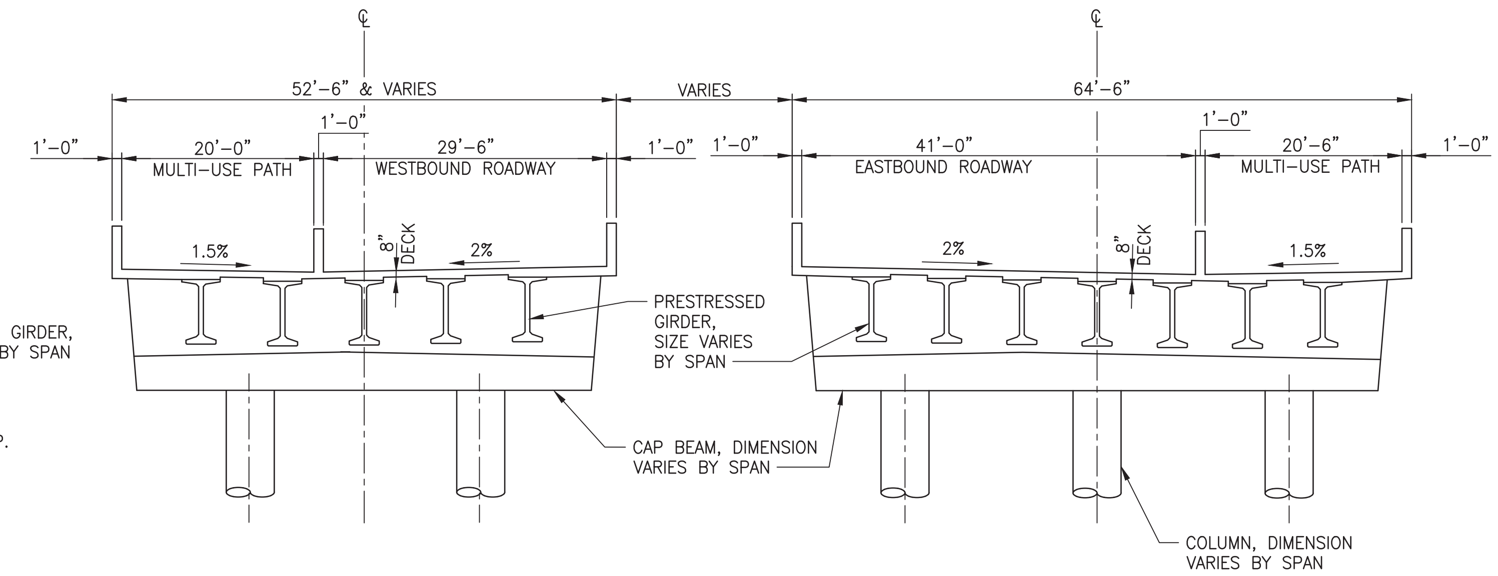
REVISIONS
NO DATE:

Sheet No. BR12



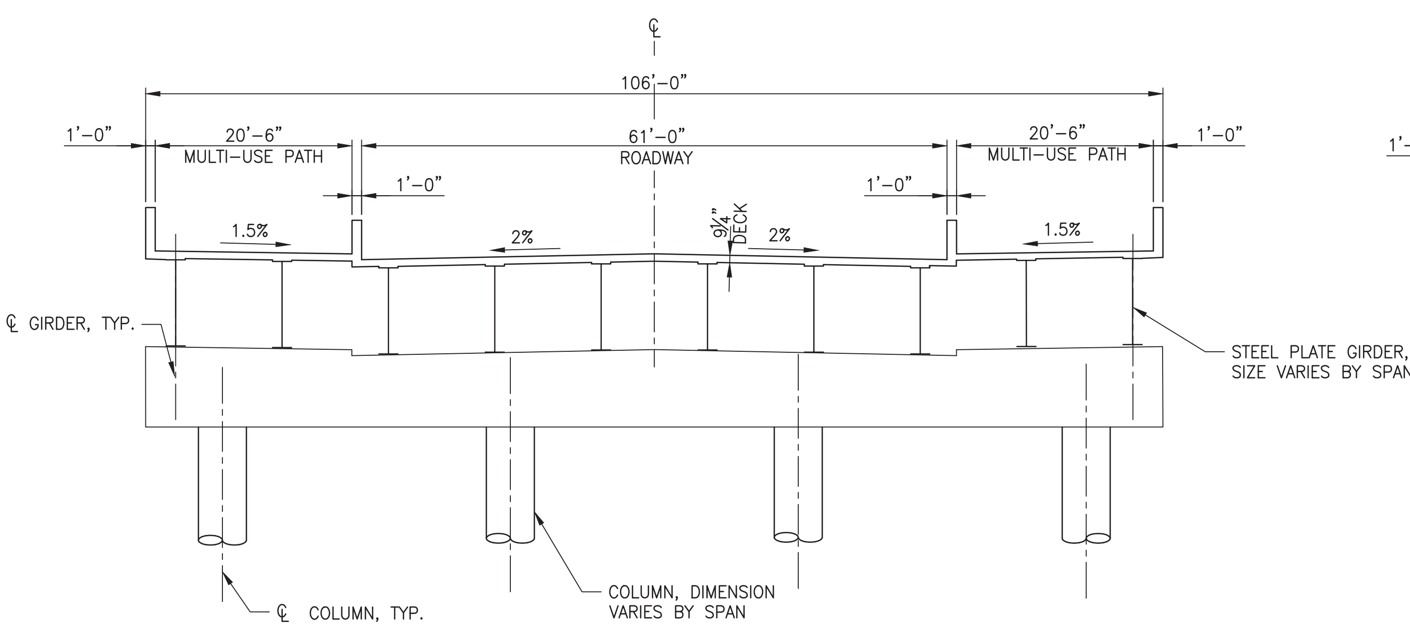
FULL WIDTH TYPICAL SECTION - PRESTRESSED CONCRETE GIRDER

SCALE: 1" = 10'-0"
(LOOKING EAST)



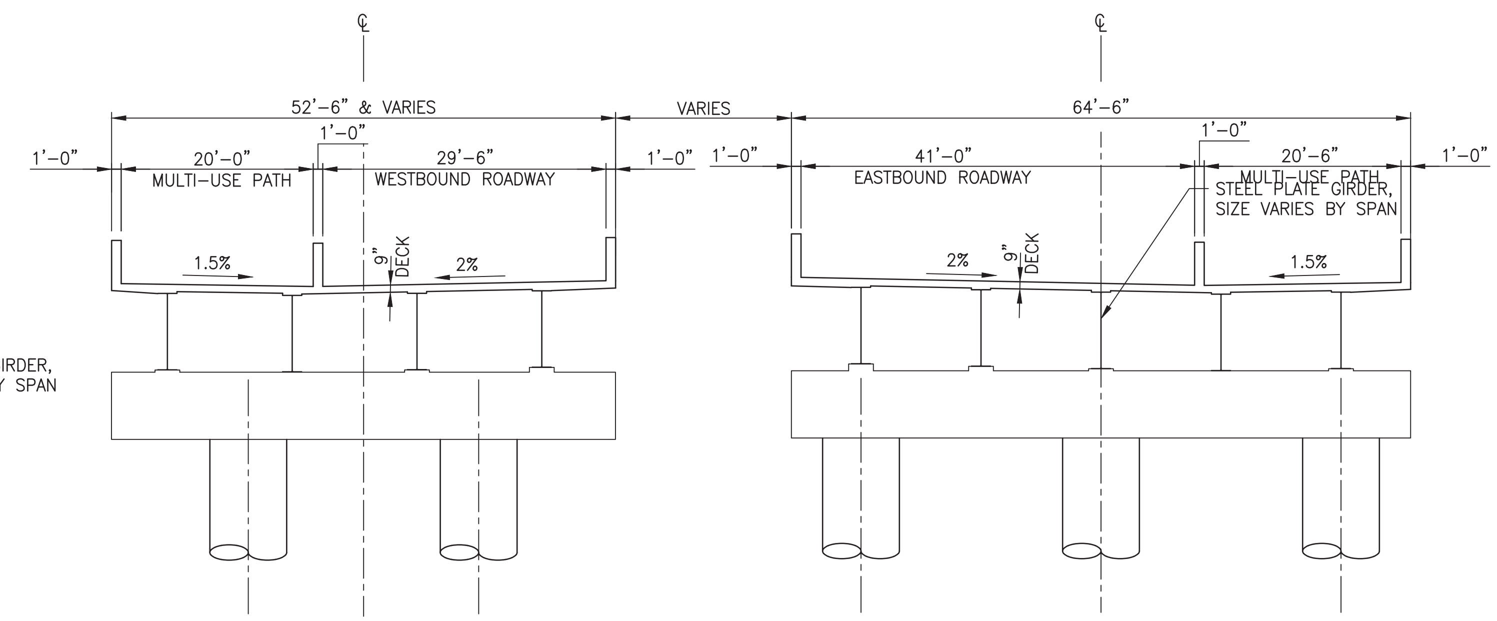
COUPLET SECTION - PRESTRESSED CONCRETE GIRDER

SCALE: 1" = 10'-0"
(LOOKING EAST)



FULL WIDTH TYPICAL SECTION - STEEL PLATE GIRDER

SCALE: 1" = 10'-0"
(LOOKING EAST)



COUPLET SECTION - STEEL PLATE GIRDER

SCALE: 1" = 10'-0"
(LOOKING EAST)

NOTES:

1. FOR LANE DESIGNATIONS, SEE ROADWAY SHEETS.
2. FOR PROPOSED BRIDGE PROFILE, SEE ROADWAY SHEETS.

CONCEPTUAL PLANS
JUNE 2020

Earthquake Ready Burnside Bridge
Replacement Alternative with Couch Extension (Bascule)
MULTNOMAH COUNTY

PROJECT NO.:
DATE:

MULTNOMAH COUNTY
DEPARTMENT OF COMMUNITY SERVICES
TRANSPORTATION DIVISION
1620 S.E. 190th AVE. PORTLAND, ORE. 97233-5999

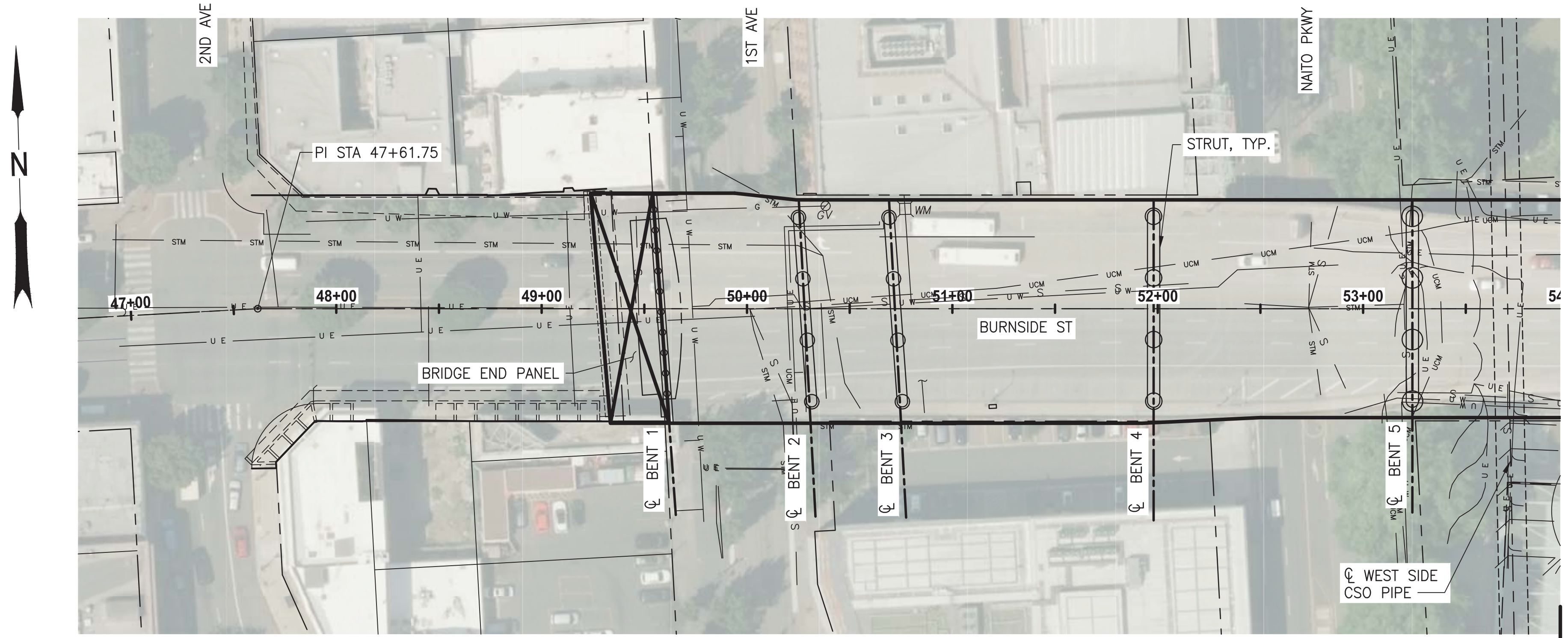
IAN B. CANNON P.E. COUNTY ENGINEER

DESIGNED BY:
DRAFTED BY:
CHECKED BY:

REVISIONS

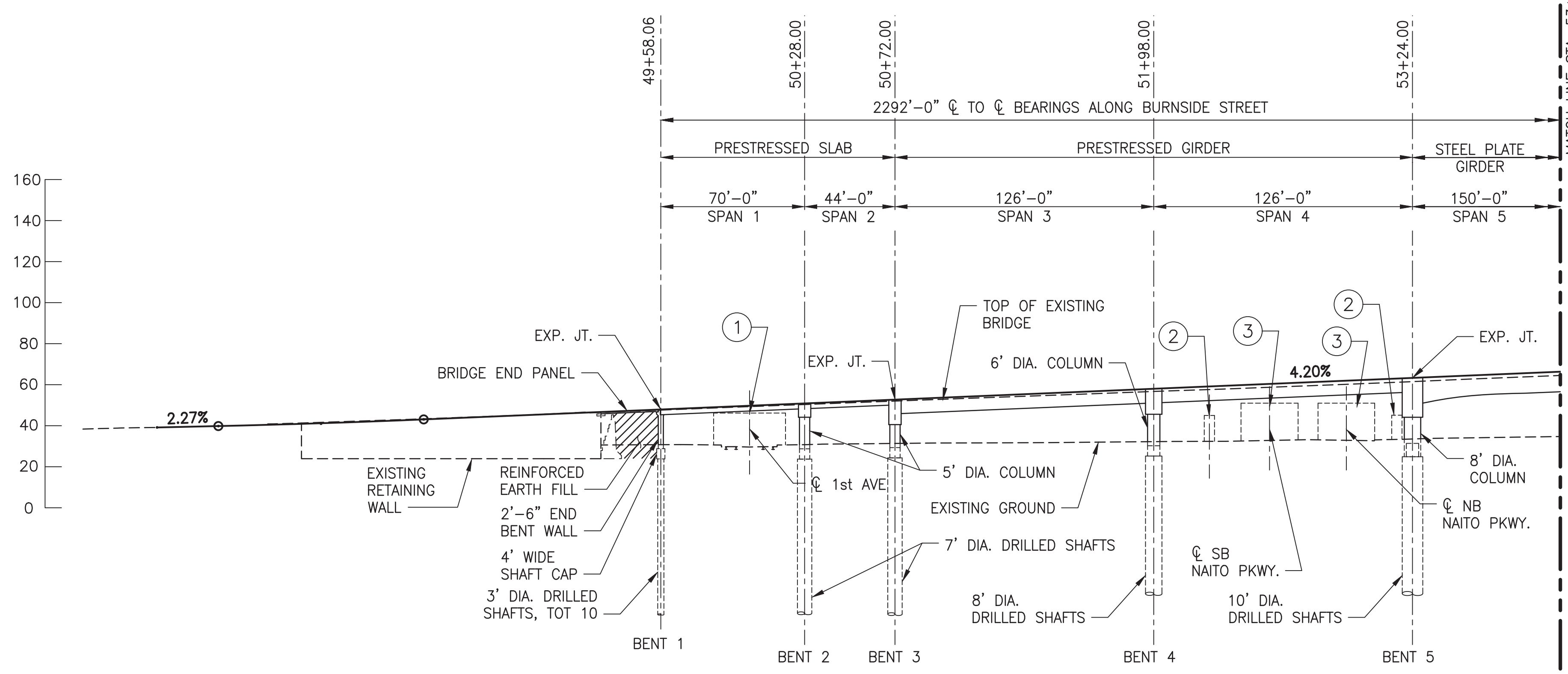
NO DATE:

Sheet No.
BR13



PLAN

SCALE: 1"=40'



ELEVATION

SCALE: 1"=40'

CLEARANCE ENVELOPE LEGEND

1	LRT	15'-6"
2	PEDESTRIAN	12'-0"
3	CITY STREET	18'-0"
4	NAVIGATION	220'-0" W x UNLIMITED H
5	HIGHWAY	17'-4"
6	UPRR	23'-6"
7	CITY STREET @ 3rd AVE	13'-8"

CONCEPTUAL PLANS
JUNE 2020

Earthquake Ready Burnside Bridge

Replacement Alternative with Couch Extension (Bascule)

MULTNOMAH COUNTY

PROJECT NO.:

DATE:

MULTNOMAH COUNTY
DEPARTMENT OF COMMUNITY SERVICES
TRANSPORTATION DIVISION
1620 S.E. 190th AVE. PORTLAND, ORE. 97233-5999

IAN B. CANNON P.E.   COUNTY ENGINEER

DESIGNED BY:

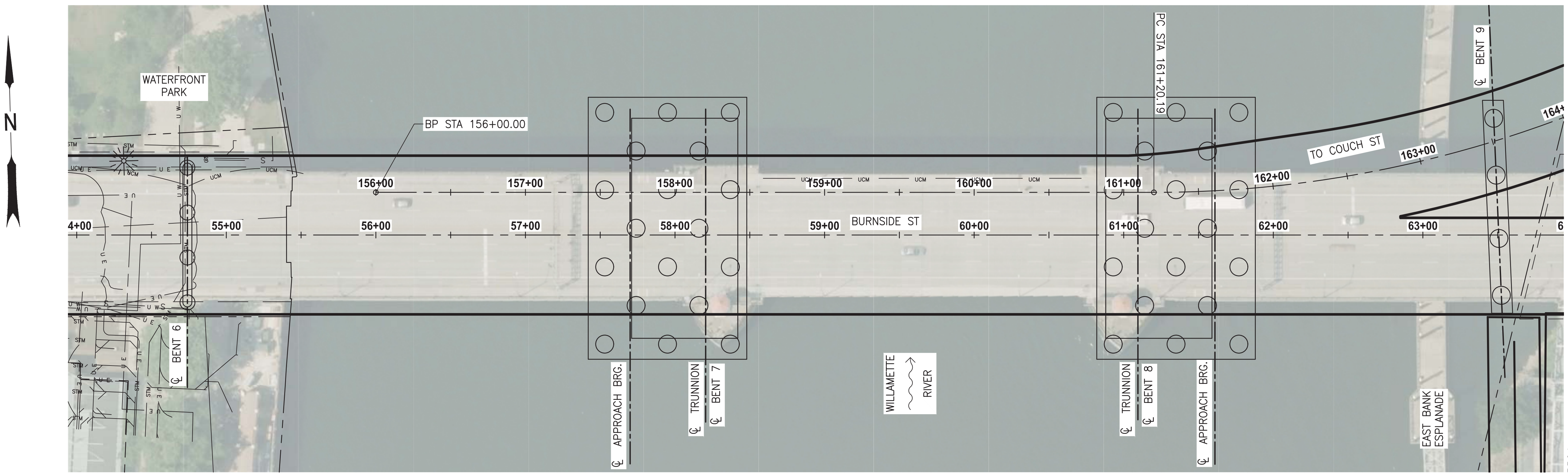
DRAFTED BY:

CHECKED BY:

REVISIONS

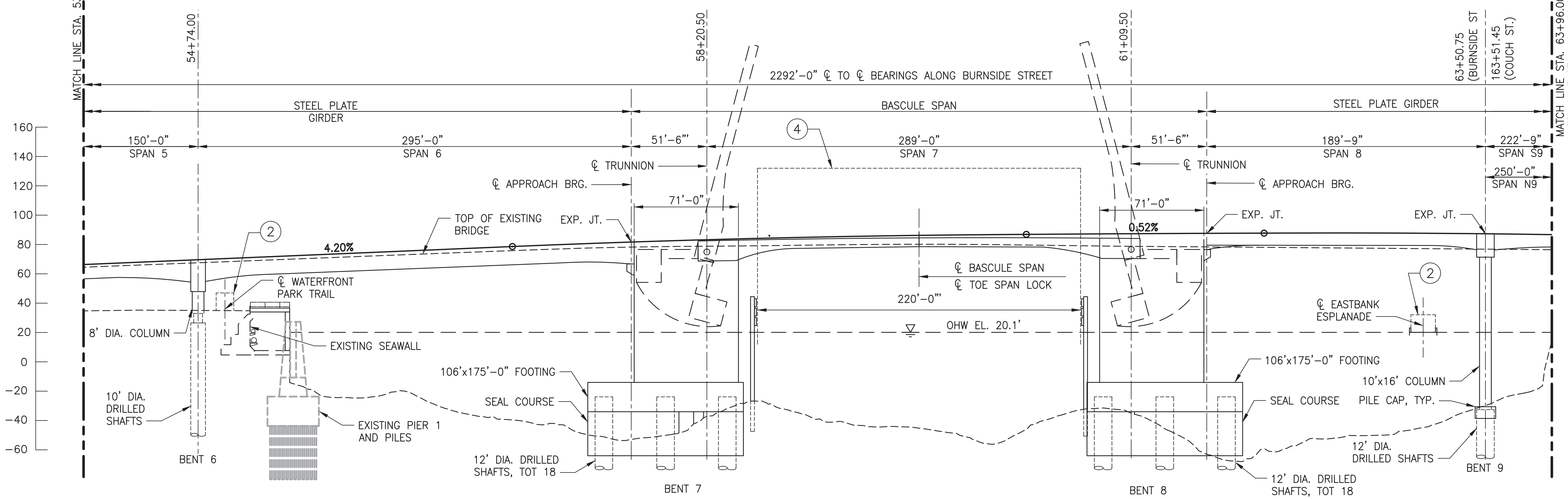
NO. DATE:

Sheet No.
BR14



PLAN

SCALE: 1"=40'



ELEVATION

SCALE: 1"=40'

NOTE:
EASTBOUND BRIDGE ELEVATION SHOWN, FOR WESTBOUND BRIDGE SEE SHEET BR05.

CLEARANCE ENVELOPE LEGEND

(1)	LRT	15'-6"	(5)	HIGHWAY	17'-4"
(2)	PEDESTRIAN	12'-0"	(6)	UPRR	23'-6"
(3)	CITY STREET	18'-0"	(7)	CITY STREET @ 3rd AVE	13'-8"
(4)	NAVIGATION	220'-0" W x UNLIMITED H			

CONCEPTUAL PLANS
JUNE 2020

Earthquake Ready Burnside Bridge
Replacement Alternative with Couch Extension (Bascule)
MULTNOMAH COUNTY

PROJECT NO.:

DATE:

MULTNOMAH COUNTY
DEPARTMENT OF COMMUNITY SERVICES
TRANSPORTATION DIVISION
1620 S.E. 190th AVE. PORTLAND, ORE. 97233-5999

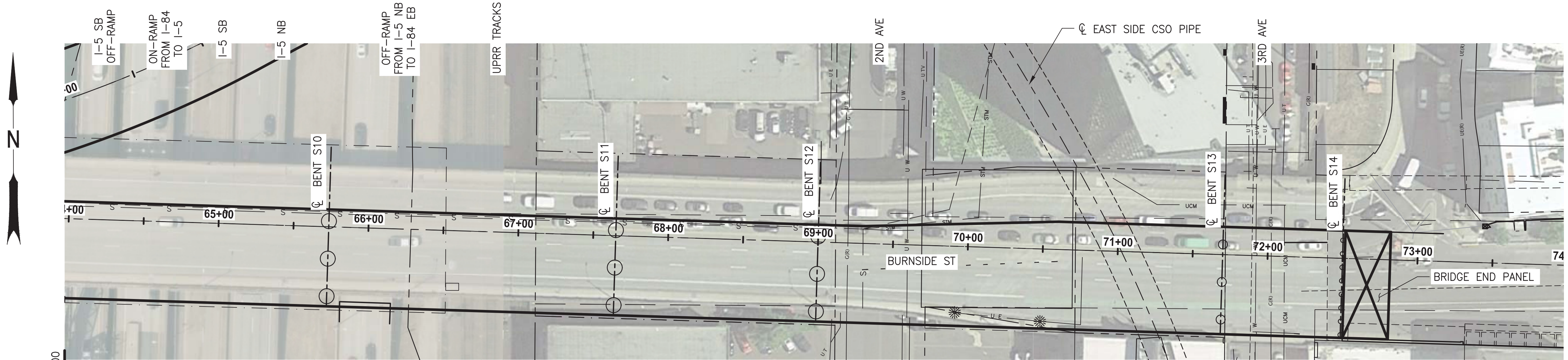
COUNTY ENGINEER
IAN B. CANNON P.E.

DESIGNED BY:
DRAFTED BY:
CHECKED BY:

REVISIONS

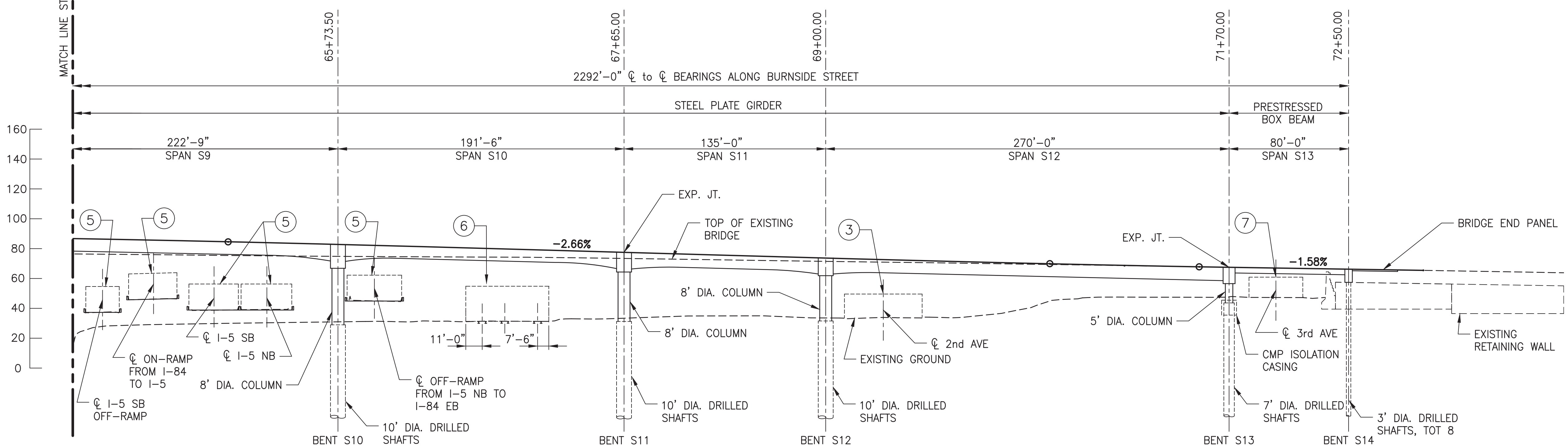
NO | DATE:

Sheet No.
BR15



PLAN

SCALE: 1"=40'



ELEVATION

SCALE: 1"=40'

NOTE:
EASTBOUND BRIDGE ELEVATION SHOWN, FOR WESTBOUND BRIDGE SEE BR05.

CLEARANCE ENVELOPE LEGEND

1	LRT	15'–6"	5	HIGHWAY	17'–4"
2	PEDESTRIAN	12'–0"	6	UPRR	23'–6"
3	CITY STREET	18'–0"	7	CITY STREET @ 3rd AVE	13'–8"
4	NAVIGATION	220'–0" W x UNLIMITED H			

CONCEPTUAL PLANS
JUNE 2020

Earthquake Ready Burnside Bridge
Replacement Alternative with Couch Extension (Bascule)
MULTNOMAH COUNTY

PROJECT NO.:
DATE:

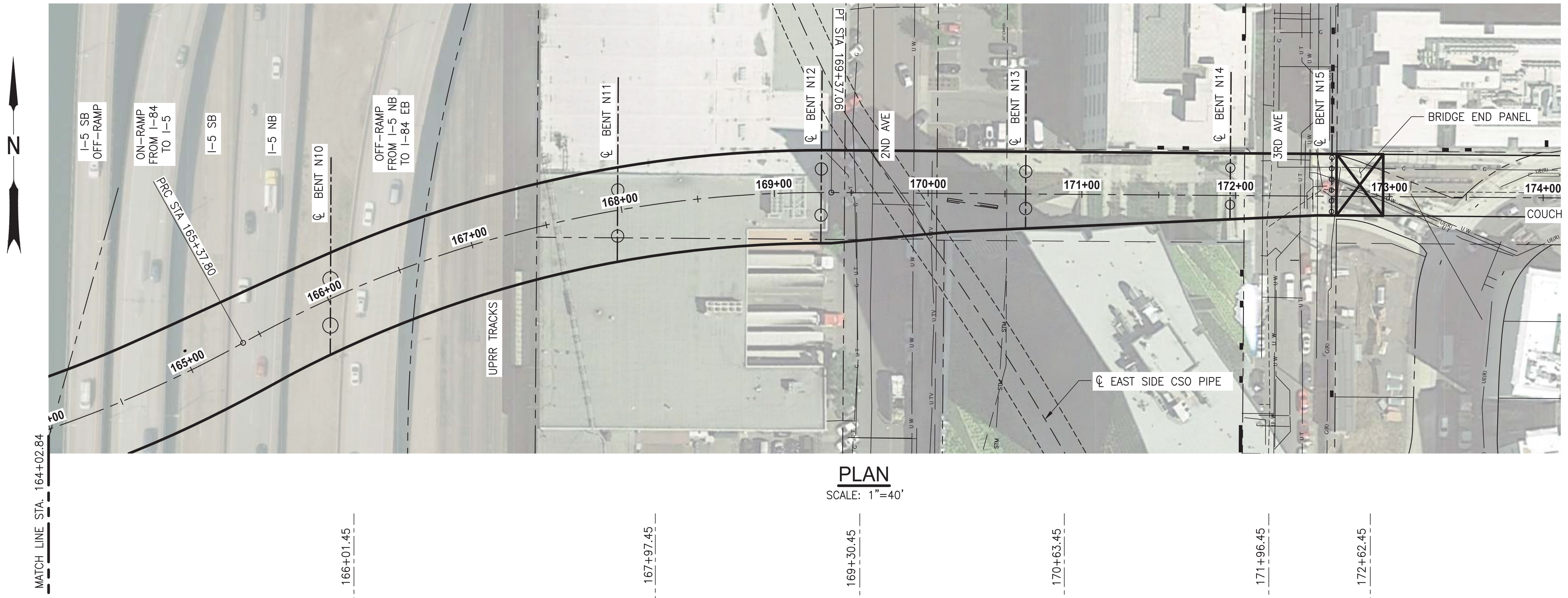
MULTNOMAH COUNTY
DEPARTMENT OF COMMUNITY SERVICES
TRANSPORTATION DIVISION
1620 S.E. 190th AVE. PORTLAND, ORE. 97233–5999

IAN B. CANNON P.E. COUNTY ENGINEER

DESIGNED BY:
DRAFTED BY:
CHECKED BY:

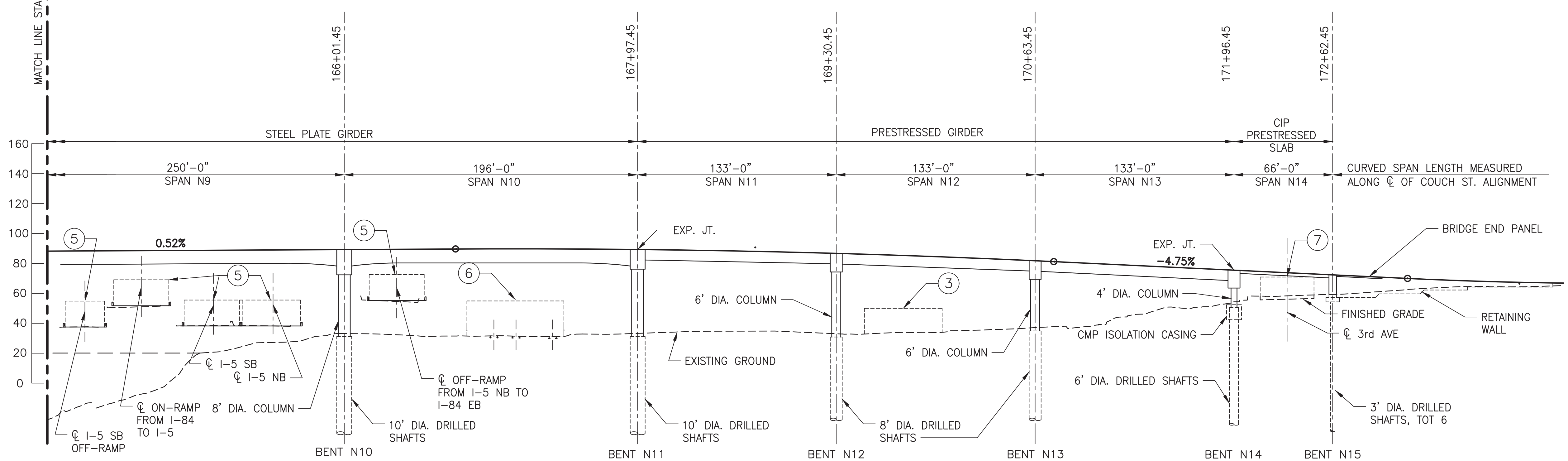
REVISIONS
NO. DATE:

Sheet No.
BR16



PLAN

SCALE: 1"=40'



DEVELOPED ELEVATION

SCALE: 1"=40'

NOTE:
WESTBOUND BRIDGE ELEVATION SHOWN,
FOR EASTBOUND BRIDGE, SEE BR04.

CLEARANCE ENVELOPE LEGEND

1	LRT	15'-6"	5	HIGHWAY	17'-4"
2	PEDESTRIAN	12'-0"	6	UPRR	23'-6"
3	CITY STREET	18'-0"	7	CITY STREET @ 3rd AVE	13'-8"
4	NAVIGATION	220'-0" W x UNLIMITED H			

CONCEPTUAL PLANS
JUNE 2020

Earthquake Ready Burnside Bridge

Replacement Alternative with Couch Extension (Bascule)

MULTNOMAH COUNTY

PROJECT NO.:

DATE:

MULTNOMAH COUNTY
DEPARTMENT OF COMMUNITY SERVICES
TRANSPORTATION DIVISION
1620 S.E. 190th AVE. PORTLAND, ORE. 97233-5999

IAN B. CANNON P.E. COUNTY ENGINEER

DESIGNED BY:

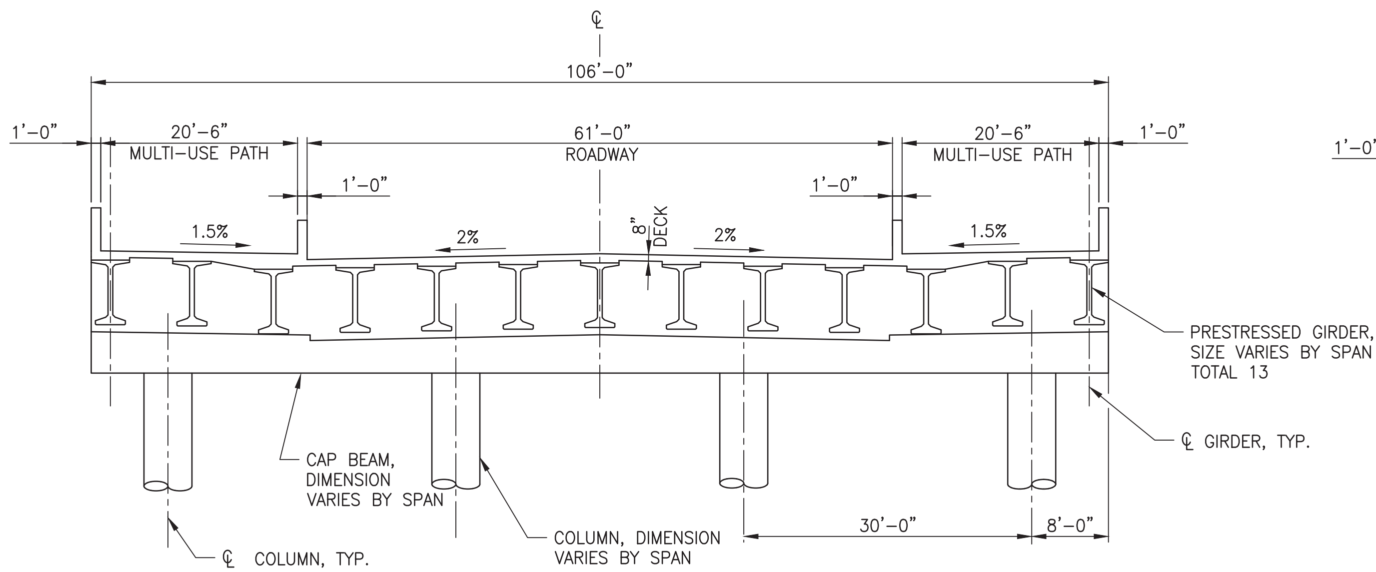
DRAFTED BY:

CHECKED BY:

REVISIONS

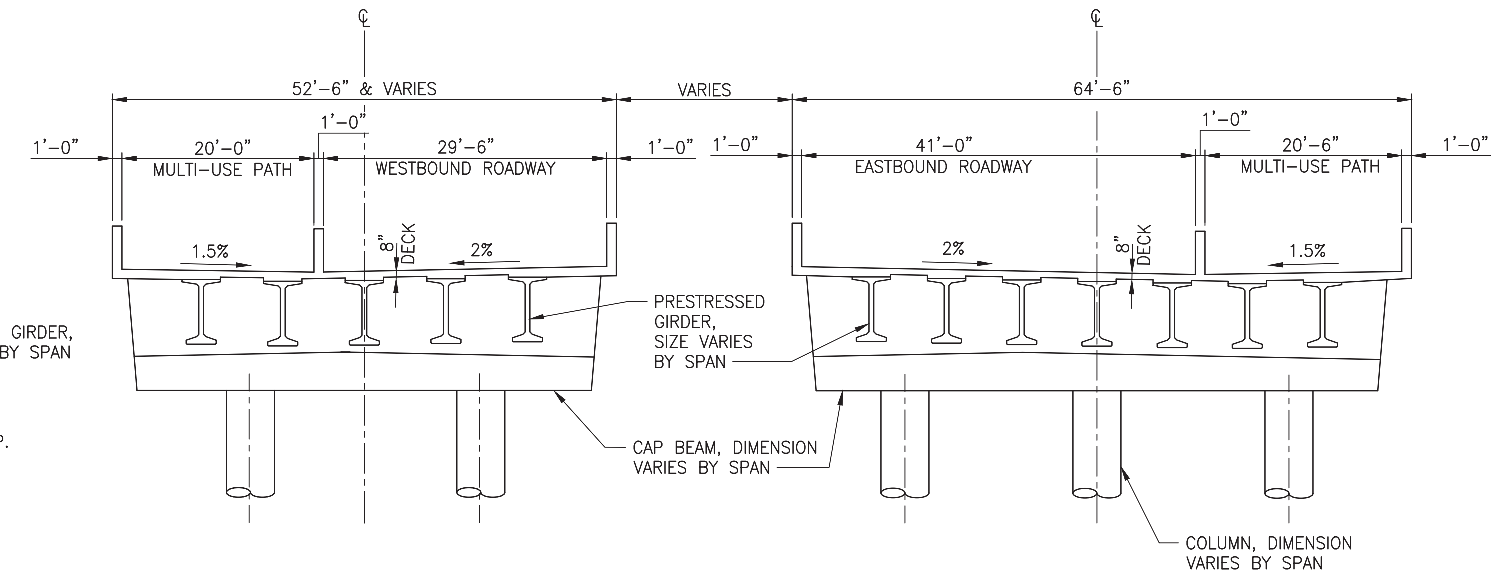
NO | DATE:

Sheet No.
BR17



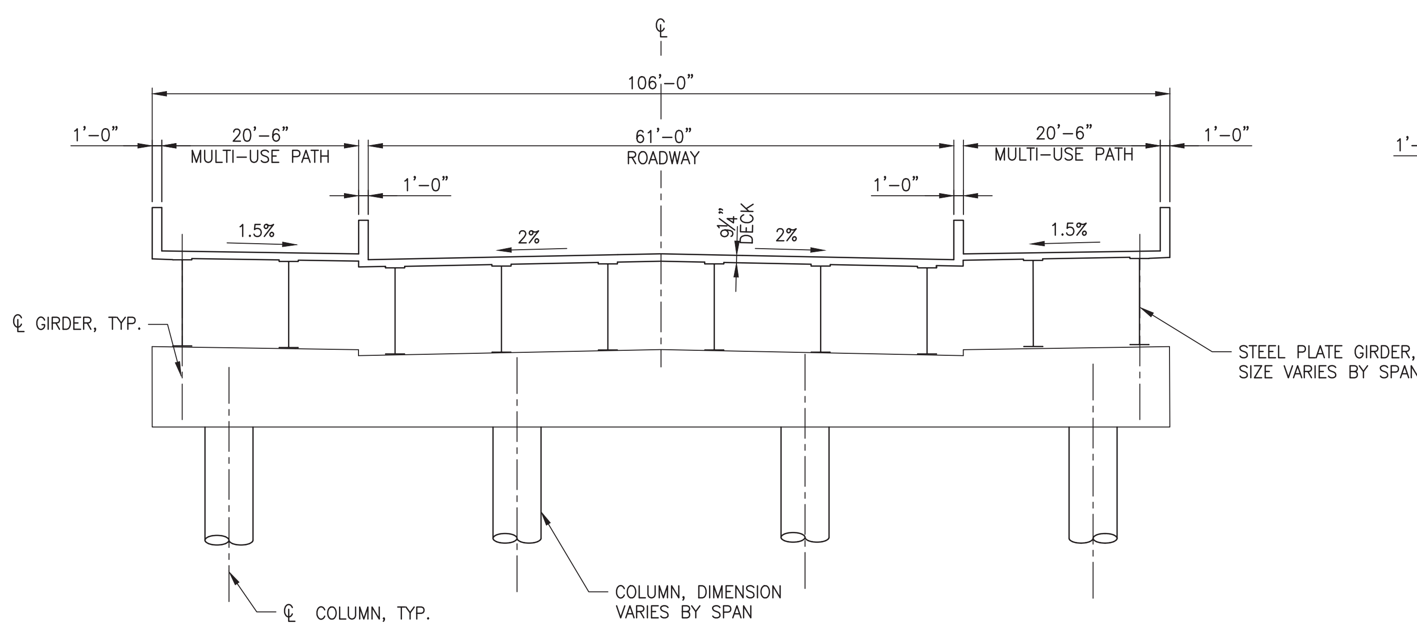
FULL WIDTH TYPICAL SECTION - PRESTRESSED CONCRETE GIRDER

SCALE: 1" = 10'-0"
(LOOKING EAST)



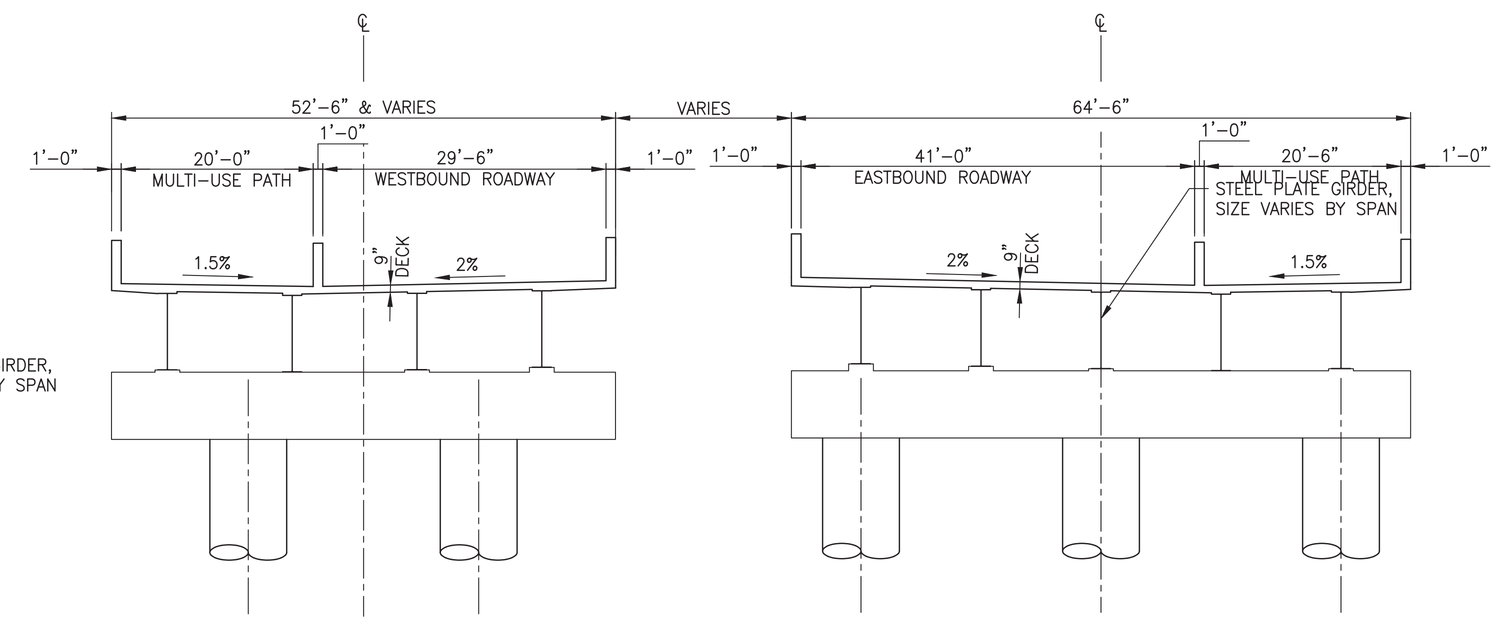
COUPLET SECTION - PRESTRESSED CONCRETE GIRDER

SCALE: 1" = 10'-0"
(LOOKING EAST)



FULL WIDTH TYPICAL SECTION - STEEL PLATE GIRDER

SCALE: 1" = 10'-0"
(LOOKING EAST)



COUPLET SECTION - STEEL PLATE GIRDER

SCALE: 1" = 10'-0"
(LOOKING EAST)

NOTES:

1. FOR LANE DESIGNATIONS, SEE ROADWAY SHEETS.
2. FOR PROPOSED BRIDGE PROFILE, SEE ROADWAY SHEETS.

CONCEPTUAL PLANS
JUNE 2020

Earthquake Ready Burnside Bridge

Replacement Alternative with Couch Extension (Lift)

MULTNOMAH COUNTY

PROJECT NO.:

DATE:

MULTNOMAH COUNTY
DEPARTMENT OF COMMUNITY SERVICES
TRANSPORTATION DIVISION
1620 S.E. 190th AVE. PORTLAND, ORE. 97233-5999

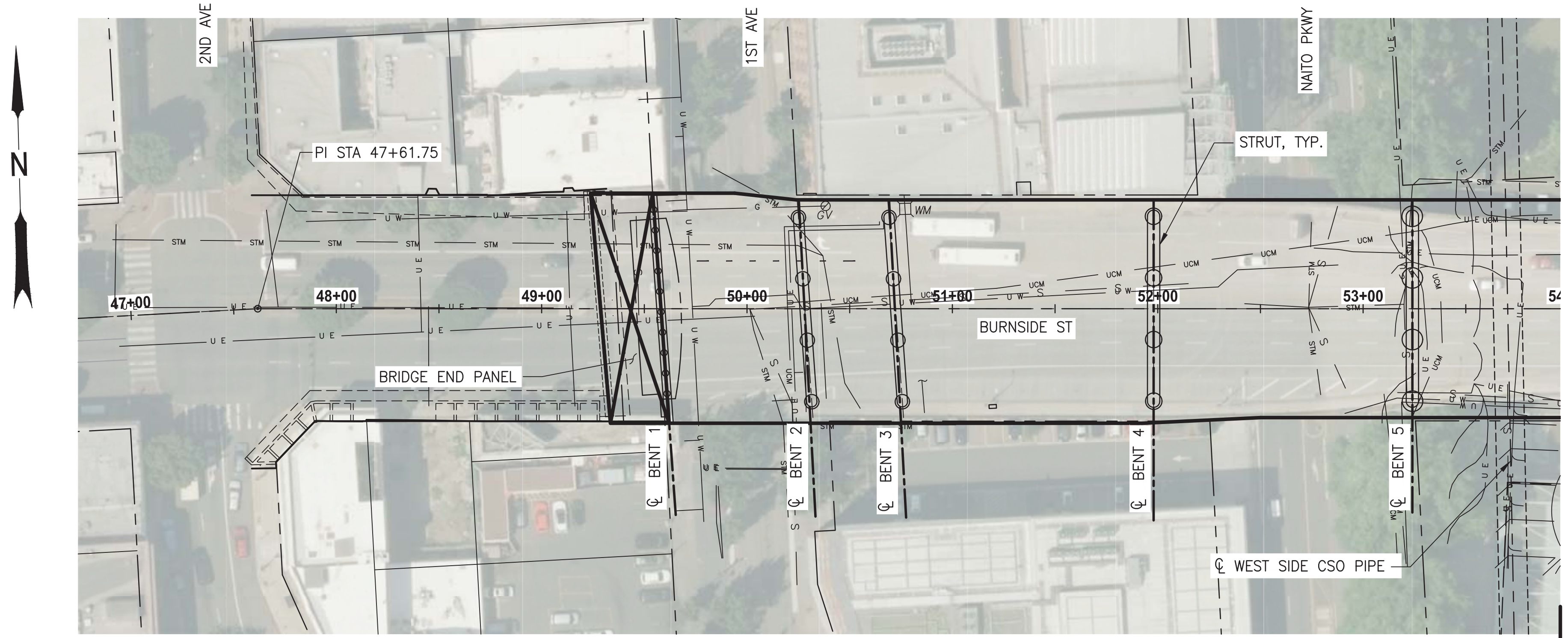
IAN B. CANNON P.E. COUNTY ENGINEER

DESIGNED BY:
DRAFTED BY:
CHECKED BY:

REVISIONS

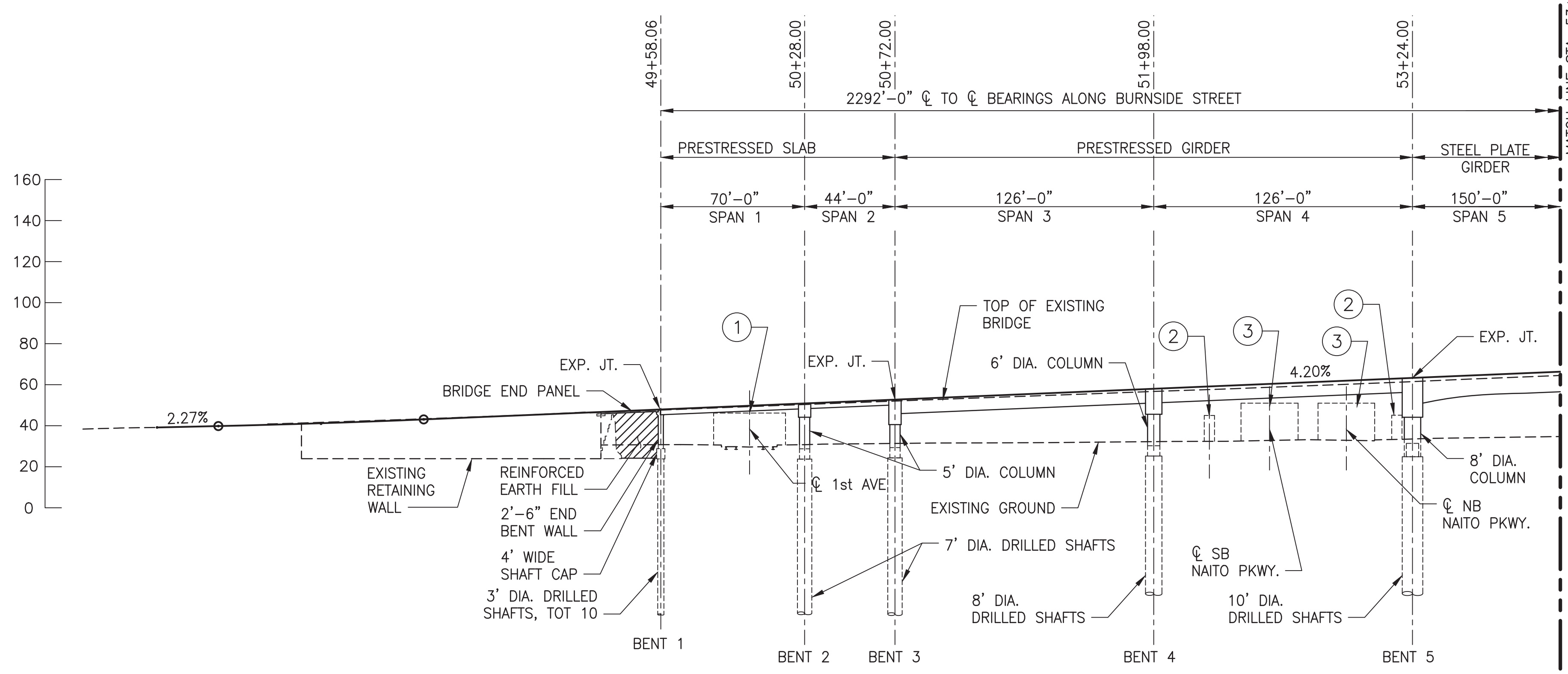
NO DATE:

Sheet No.
BR18



PLAN

SCALE: 1"=40'



ELEVATION

SCALE: 1"=40'

CLEARANCE ENVELOPE LEGEND

1	LRT	15'-6"
2	PEDESTRIAN	12'-0"
3	CITY STREET	18'-0"
4	NAVIGATION	220'-0" W x 147'-0" H
5	HIGHWAY	17'-4"
6	UPRR	23'-6"
7	CITY STREET @ 3rd AVE	13'-8"

CONCEPTUAL PLANS
JUNE 2020

Earthquake Ready Burnside Bridge

Replacement Alternative with Couch Extension (Lift)

MULTNOMAH COUNTY

PROJECT NO.:

DATE:

MULTNOMAH COUNTY
DEPARTMENT OF COMMUNITY SERVICES
TRANSPORTATION DIVISION
1620 S.E. 190th AVE. PORTLAND, ORE. 97233-5999

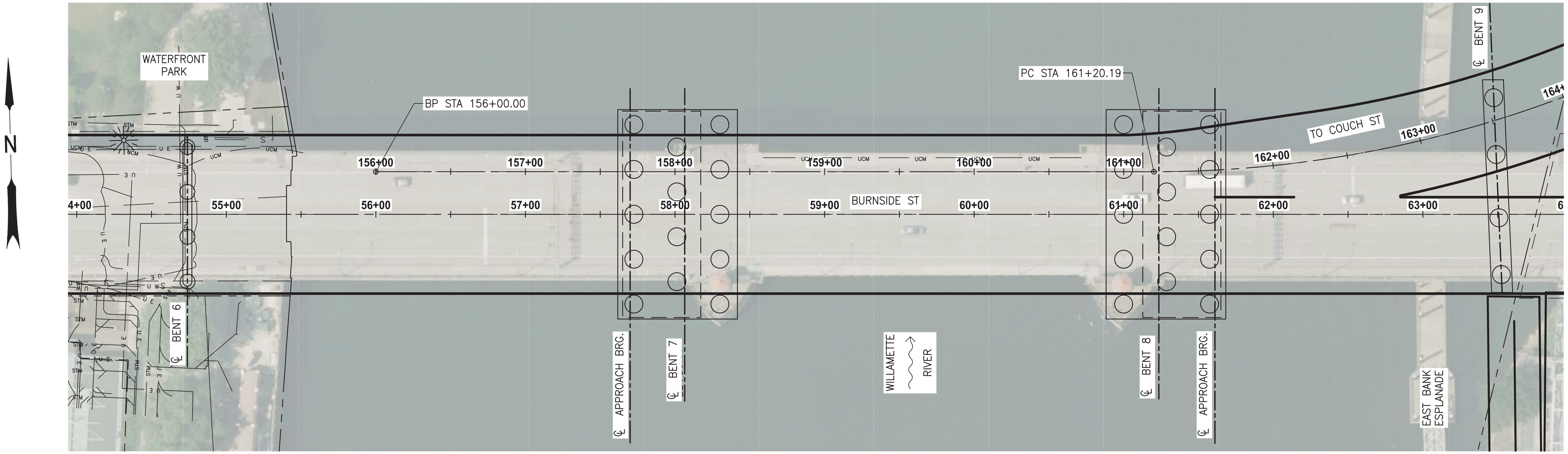
IAN B. CANNON P.E. COUNTY ENGINEER

DESIGNED BY:
DRAFTED BY:
CHECKED BY:

REVISIONS

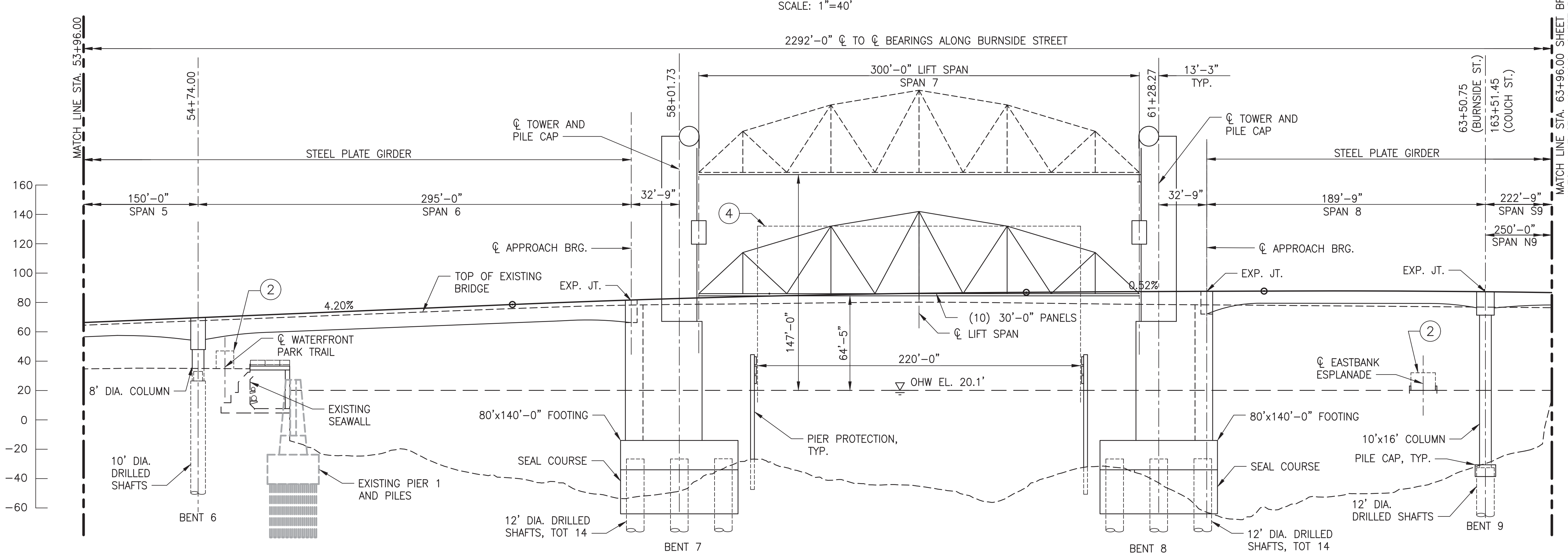
NO DATE:

Sheet No. BR19



PLAN

SCALE: 1"=40'



ELEVATION

SCALE: 1"=40'

NOTE:
EASTBOUND BRIDGE ELEVATION SHOWN, FOR WESTBOUND BRIDGE SEE SHEET BR05.

CLEARANCE ENVELOPE LEGEND

(1)	LRT	15'-6"
(2)	PEDESTRIAN	12'-0"
(3)	CITY STREET	18'-0"
(4)	NAVIGATION	220'-0" W x 147'-0" H
(5)	HIGHWAY	17'-4"
(6)	UPRR	23'-6"
(7)	CITY STREET @ 3rd AVE	13'-8"

CONCEPTUAL PLANS
JUNE 2020

Earthquake Ready Burnside Bridge
Replacement Alternative with Couch Extension (Lift)
MULTNOMAH COUNTY

DATE:
PROJECT NO.:

MULTNOMAH COUNTY
DEPARTMENT OF COMMUNITY SERVICES
TRANSPORTATION DIVISION
1620 S.E. 190th AVE. PORTLAND, ORE. 97233-5999

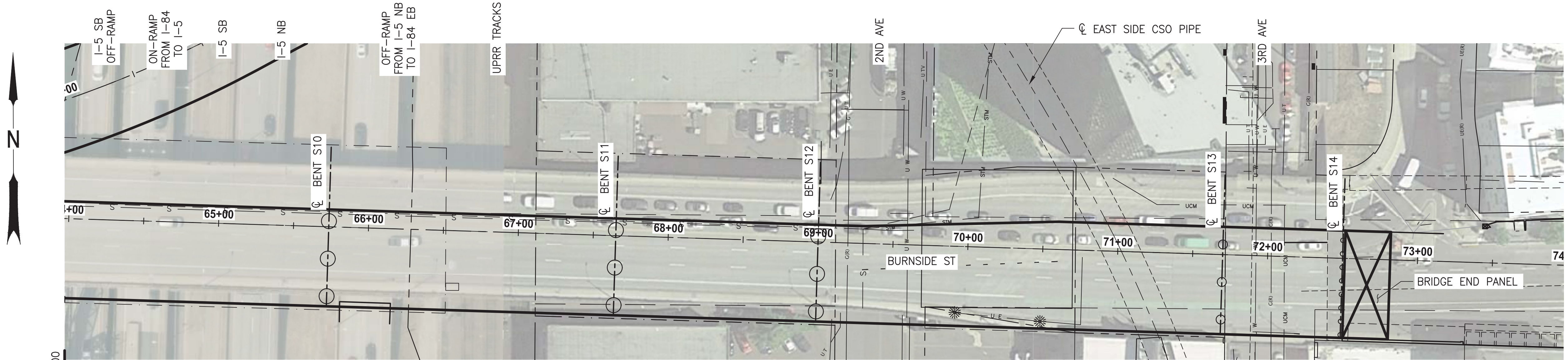
IAN B. CANNON P.E.
COUNTY ENGINEER

DESIGNED BY:
DRAFTED BY:
CHECKED BY:

REVISIONS

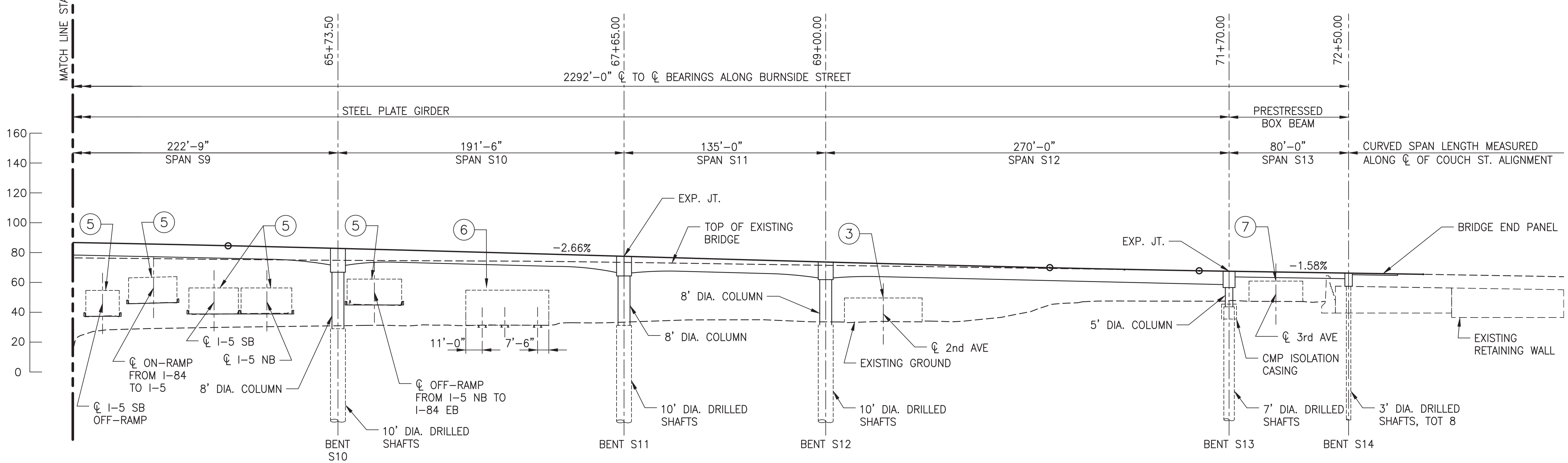
NO	DATE:

Sheet No.
BR20



PLAN

SCALE: 1"=40'



ELEVATION

SCALE: 1"=40'

NOTE:
EASTBOUND BRIDGE ELEVATION SHOWN, FOR WESTBOUND BRIDGE SEE BR05.

CLEARANCE ENVELOPE LEGEND

1	LRT	15'-6"
2	PEDESTRIAN	12'-0"
3	CITY STREET	18'-0"
4	NAVIGATION	220'-0" W x 147'-0" H
5	HIGHWAY	17'-4"
6	UPRR	23'-6"
7	CITY STREET @ 3rd AVE	13'-8"

CONCEPTUAL PLANS
JUNE 2020

Earthquake Ready Burnside Bridge

Replacement Alternative with Couch Extension (Lift)

MULTNOMAH COUNTY

PROJECT NO.:

DATE:

MULTNOMAH COUNTY
DEPARTMENT OF COMMUNITY SERVICES
TRANSPORTATION DIVISION
1620 S.E. 190th AVE. PORTLAND, ORE. 97233-5999

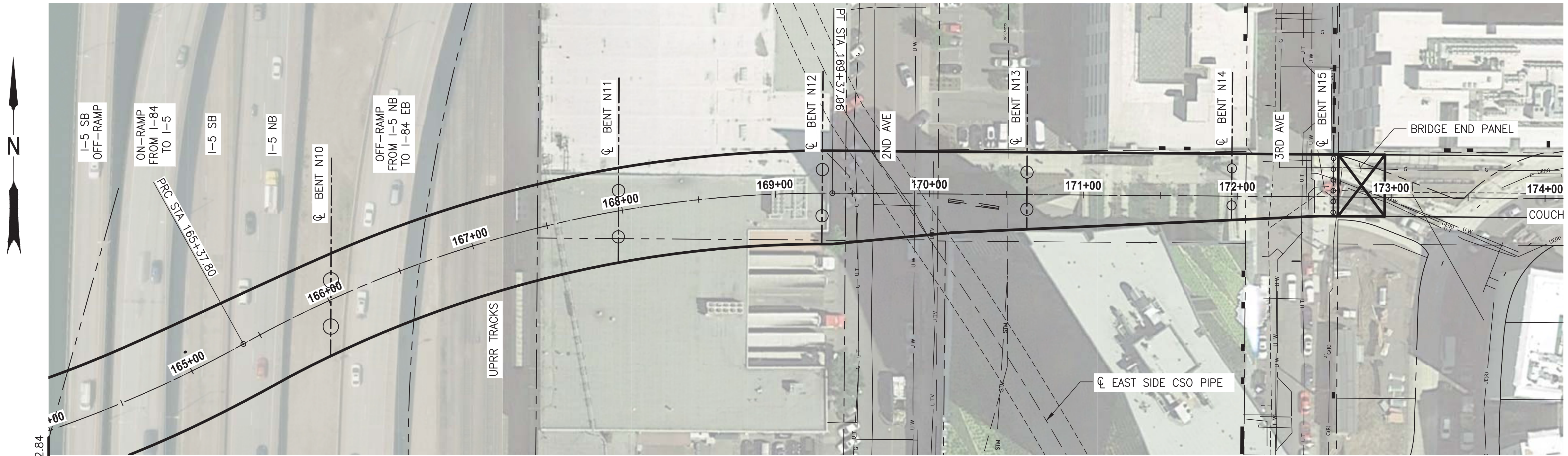
IAN B. CANNON P.E. COUNTY ENGINEER

DESIGNED BY:
DRAFTED BY:
CHECKED BY:

REVISIONS

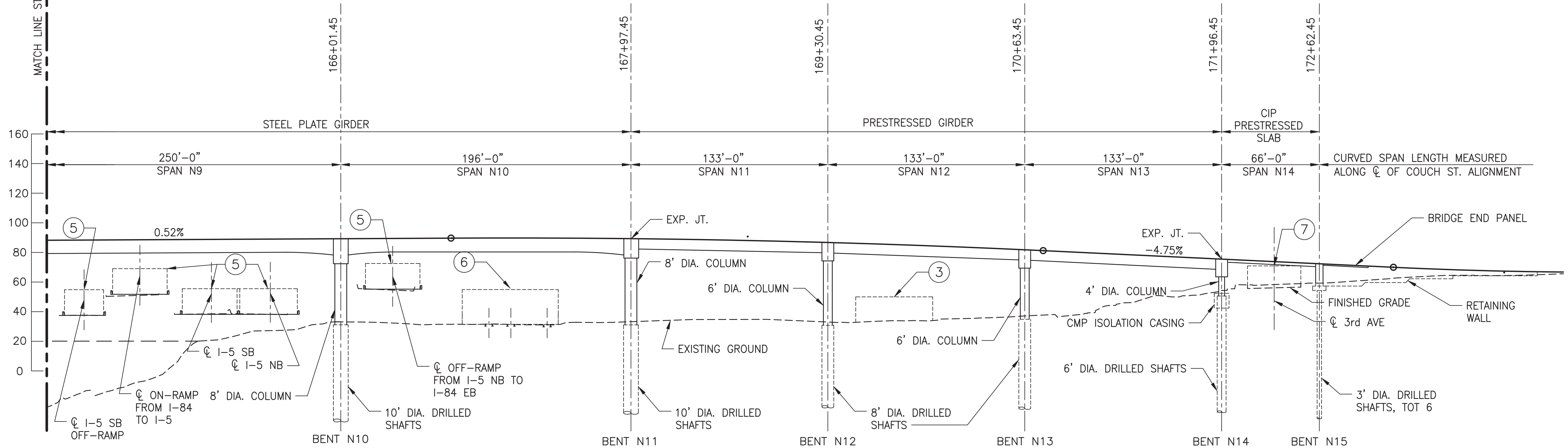
NO. DATE:

Sheet No. BR21



PLAN

SCALE: 1"=40'



DEVELOPED ELEVATION

SCALE: 1"=40'

NOTE:
WESTBOUND BRIDGE ELEVATION SHOWN, FOR EASTBOUND BRIDGE, SEE BR04.

CLEARANCE ENVELOPE LEGEND

1	LRT	15'-6"	5	HIGHWAY	17'-4"
2	PEDESTRIAN	12'-0"	6	UPRR	23'-6"
3	CITY STREET	18'-0"	7	CITY STREET @ 3rd AVE	13'-8"
4	NAVIGATION	220'-0" W x 147'-0" H			

CONCEPTUAL PLANS
JUNE 2020

Earthquake Ready Burnside Bridge
Replacement Alternative with Couch Extension (Lift)
MULTNOMAH COUNTY

PROJECT NO.:
DATE:

MULTNOMAH COUNTY
DEPARTMENT OF COMMUNITY SERVICES
TRANSPORTATION DIVISION
1620 S.E. 190th AVE. PORTLAND, ORE. 97233-5999

IAN B. CANNON P.E. COUNTY ENGINEER

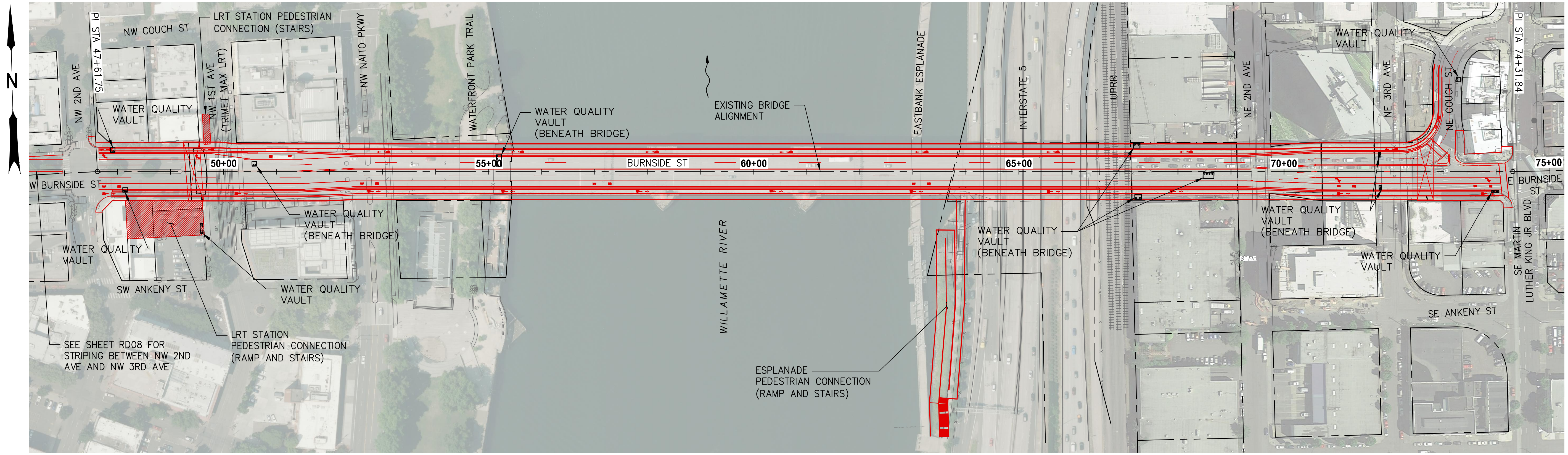
DESIGNED BY:
DRAFTED BY:
CHECKED BY:

REVISIONS

NO	DATE:	

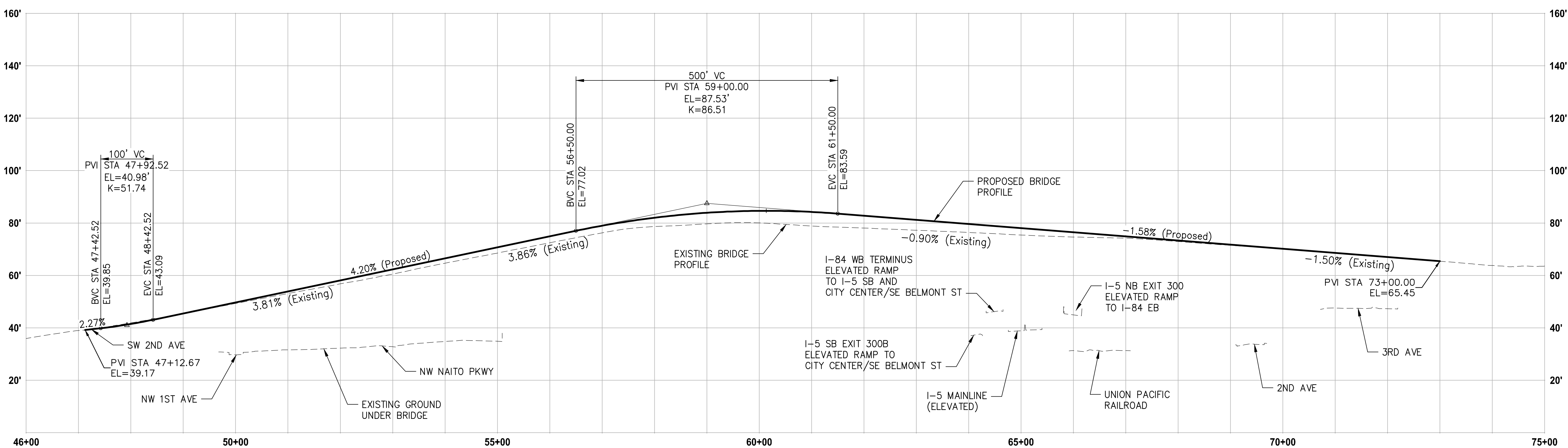
Sheet No.
BR22

Appendix C. Replacement Roadway Plan Sheets



PLAN

SCALE: 1"=200'



PROFILE

HORIZONTAL SCALE: 1"=200'
VERTICAL SCALE: 1"=40'

20
10
0
100 SCALE 0 IN 100 FEET

CONCEPTUAL PLANS
JUNE 2020

Earthquake Ready Burnside Bridge NEPA Phase

Replacement Alternative With Short-Span Approach

MULTNOMAH COUNTY

PROJECT NO.: *Proj No*

DATE: *Date*

MULTNOMAH COUNTY
DEPARTMENT OF COMMUNITY SERVICES
TRANSPORTATION DIVISION
1620 S.E. 190th AVE. PORTLAND, ORE. 97233-5999

COUNTY ENGINEER

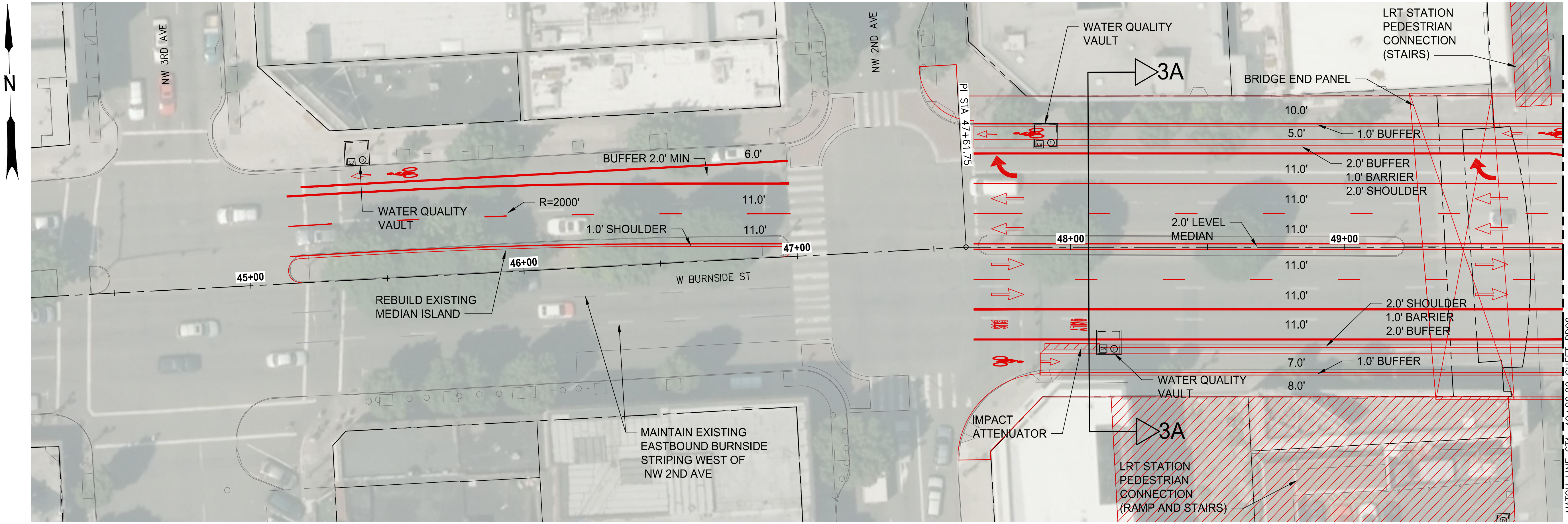
IAN B. CANNON P.E.

DESIGNED BY:
DRAFTED BY:
CHECKED BY:

REVISIONS

NO.	DATE:			

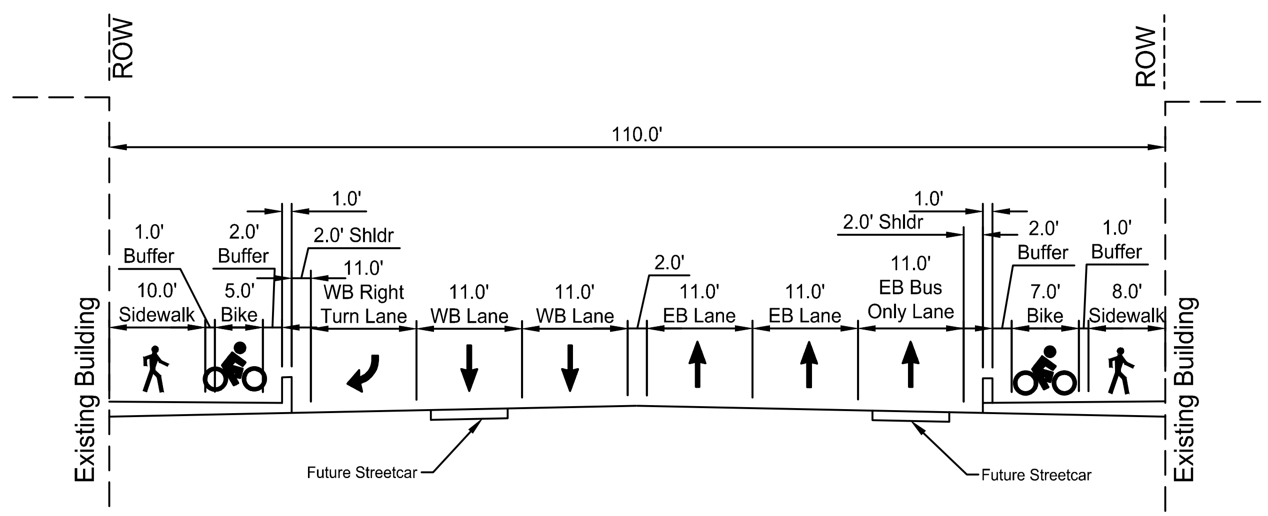
Sheet No.
RD07



PLAN

SCALE: 1"=40'

20 SCALE | 0 IN | 20 FEET



TYPICAL SECTION 3A

WEST APPROACH ON FILL
LOOKING EAST – NO SCALE

CONCEPTUAL PLANS
JUNE 2020

Earthquake Ready Burnside Bridge NEPA Phase

Replacement Alternative With Short-Span Approach

MULTNOMAH COUNTY

PROJECT NO.: *Proj No*

DATE: *Date*

MULTNOMAH COUNTY
DEPARTMENT OF COMMUNITY SERVICES
TRANSPORTATION DIVISION
1620 S.E. 190th AVE. PORTLAND, ORE. 97233-5999

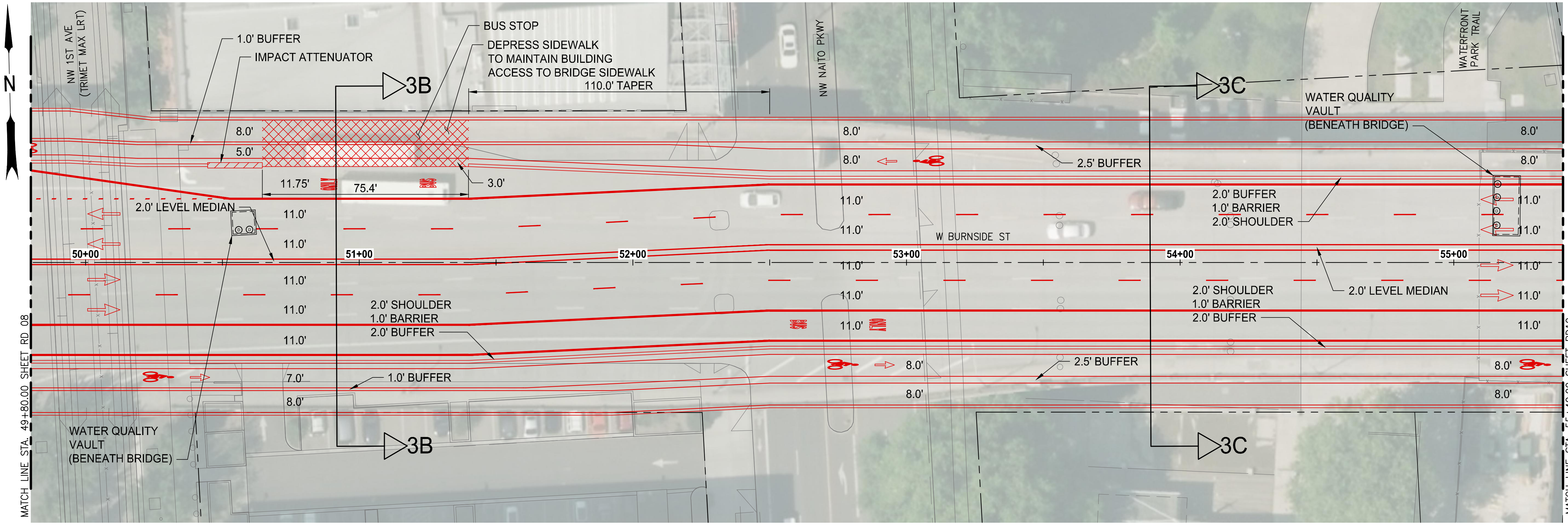
IAN B. CANNON P.E. COUNTY ENGINEER

DESIGNED BY:
DRAFTED BY:
CHECKED BY:

REVISIONS

NO. DATE:

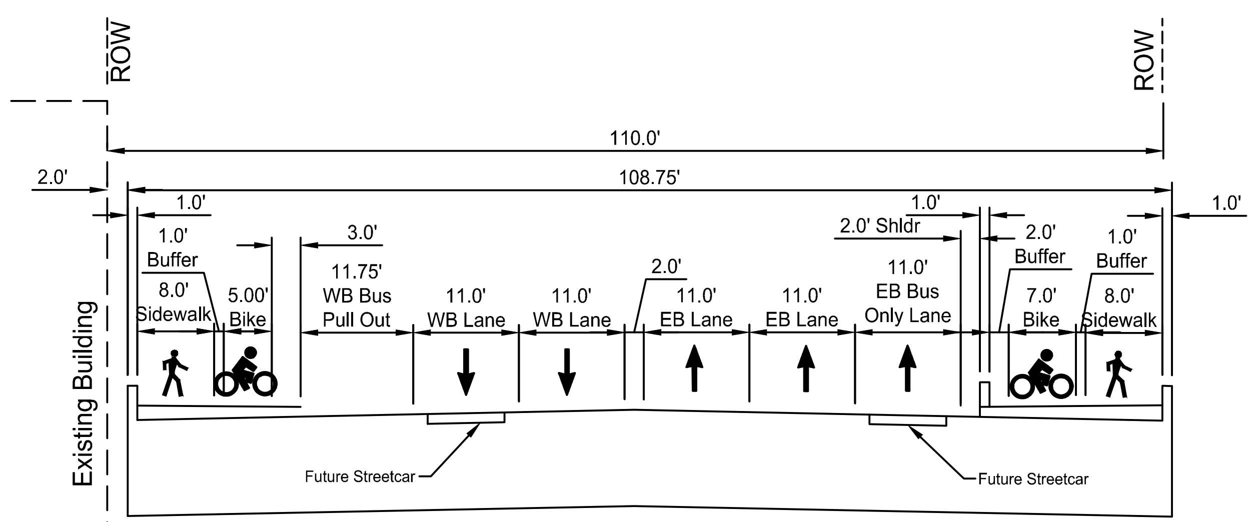
Sheet No. *RD08*



PLAN

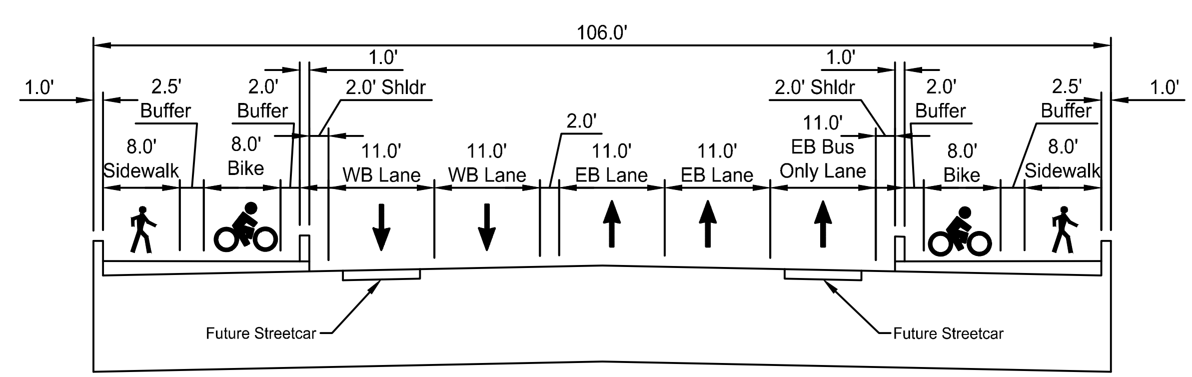
SCALE: 1"=40'

20 SCALE 0 IN 20 FEET



TYPICAL SECTION 3B

WEST APPROACH ON STRUCTURE
LOOKING EAST – NO SCALE



TYPICAL SECTION 3C

BRIDGE SPANS
LOOKING EAST – NO SCALE

CONCEPTUAL PLANS
JUNE 2020

Earthquake Ready Burnside Bridge NEPA Phase

Replacement Alternative With Short-Span Approach

MULTNOMAH COUNTY

PROJECT NO.: *Proj No*

DATE: *Date*

MULTNOMAH COUNTY
DEPARTMENT OF COMMUNITY SERVICES
TRANSPORTATION DIVISION
1620 S.E. 190th AVE. PORTLAND, ORE. 97233-5999

COUNTY ENGINEER

IAN B. CANNON P.E.

DESIGNED BY:

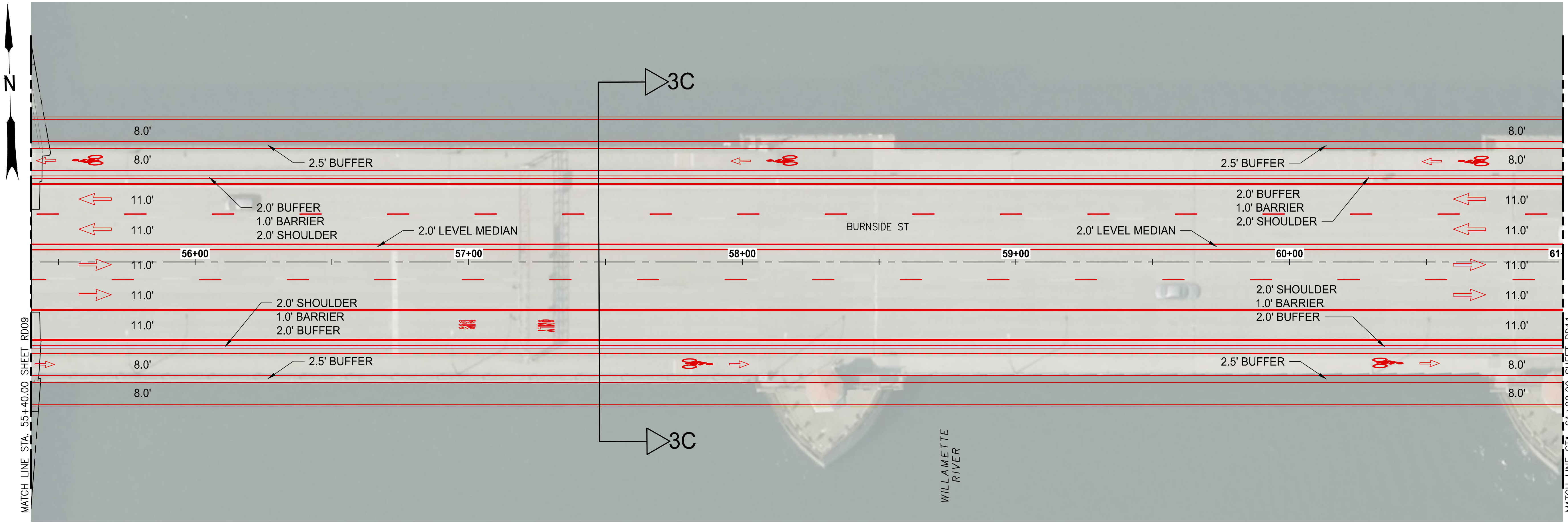
DRAFTED BY:

CHECKED BY:

REVISIONS

NO. DATE:

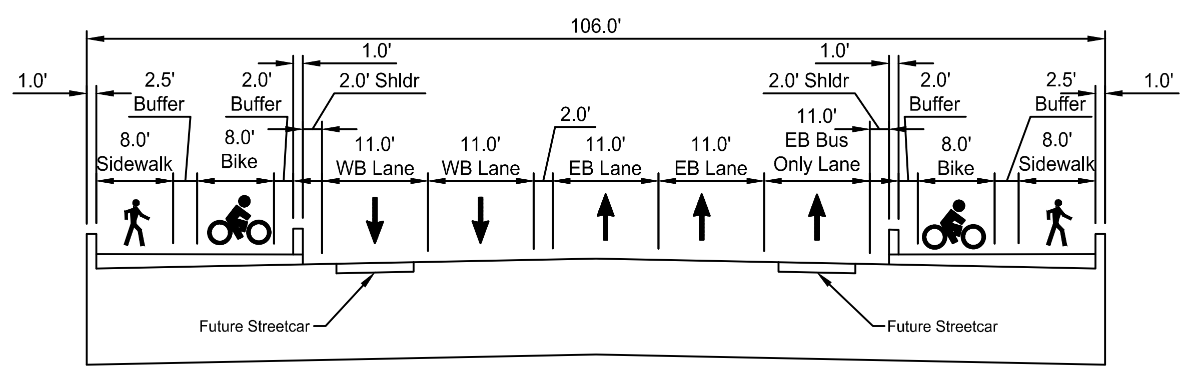
Sheet No. *RD09*



PLAN

SCALE: 1"=40'

20 0 20
SCALE IN FEET



TYPICAL SECTION 3C

BRIDGE SPANS
LOOKING EAST – NO SCALE

CONCEPTUAL PLANS
JUNE 2020

Earthquake Ready Burnside Bridge NEPA Phase

Replacement Alternative With Short-Span Approach
MULTNOMAH COUNTY

PROJECT NO.: *Proj No*
DATE: *Date*

MULTNOMAH COUNTY
DEPARTMENT OF COMMUNITY SERVICES
TRANSPORTATION DIVISION
1620 S.E. 190th AVE. PORTLAND, ORE. 97233-5999

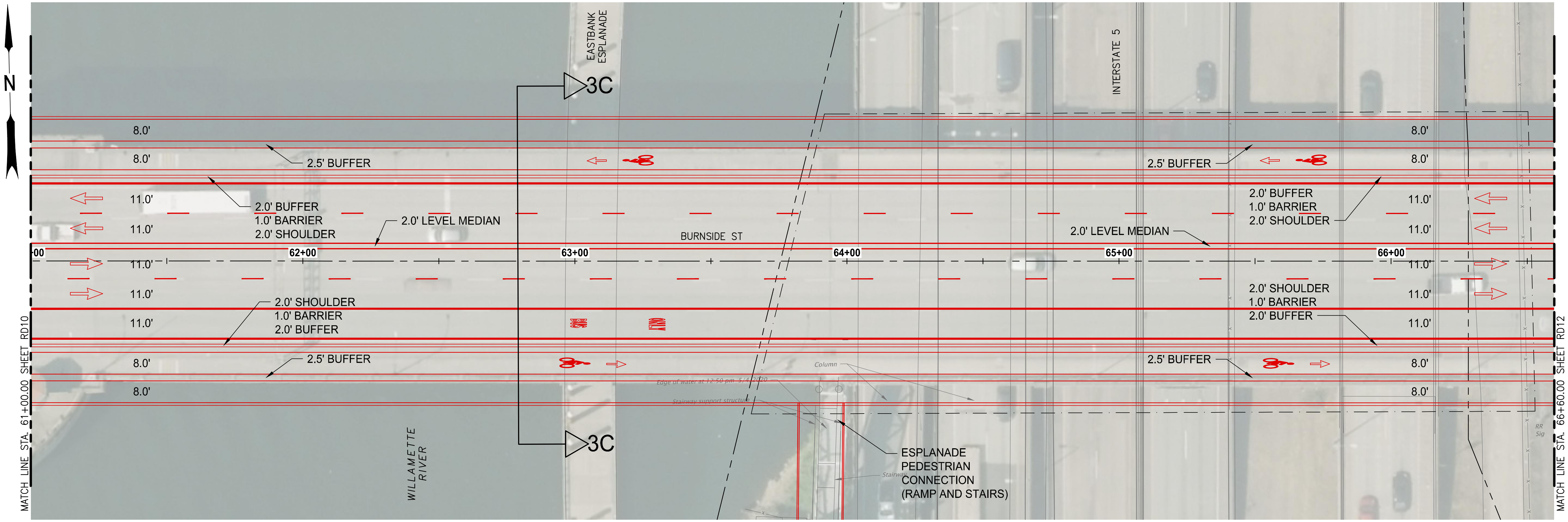
IAN B. CANNON P.E.
COUNTY ENGINEER

DESIGNED BY:
DRAFTED BY:
CHECKED BY:

REVISIONS

NO. DATE:

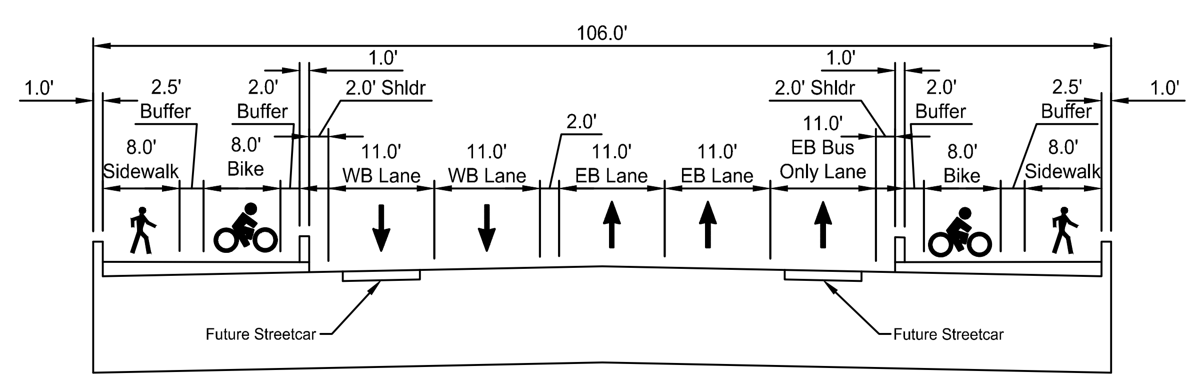
Sheet No.
RD10



PLAN

SCALE: 1"=40'

20 SCALE 0 IN 20 FEET



TYPICAL SECTION 3C

BRIDGE SPANS

LOOKING EAST – NO SCALE

CONCEPTUAL PLANS
JUNE 2020

Earthquake Ready Burnside Bridge NEPA Phase

Replacement Alternative With Short-Span Approach

MULTNOMAH COUNTY

PROJECT NO.: Proj No

DATE: Date

MULTNOMAH COUNTY
DEPARTMENT OF COMMUNITY SERVICES
TRANSPORTATION DIVISION
1620 S.E. 190th AVE. PORTLAND, ORE. 97233-5999

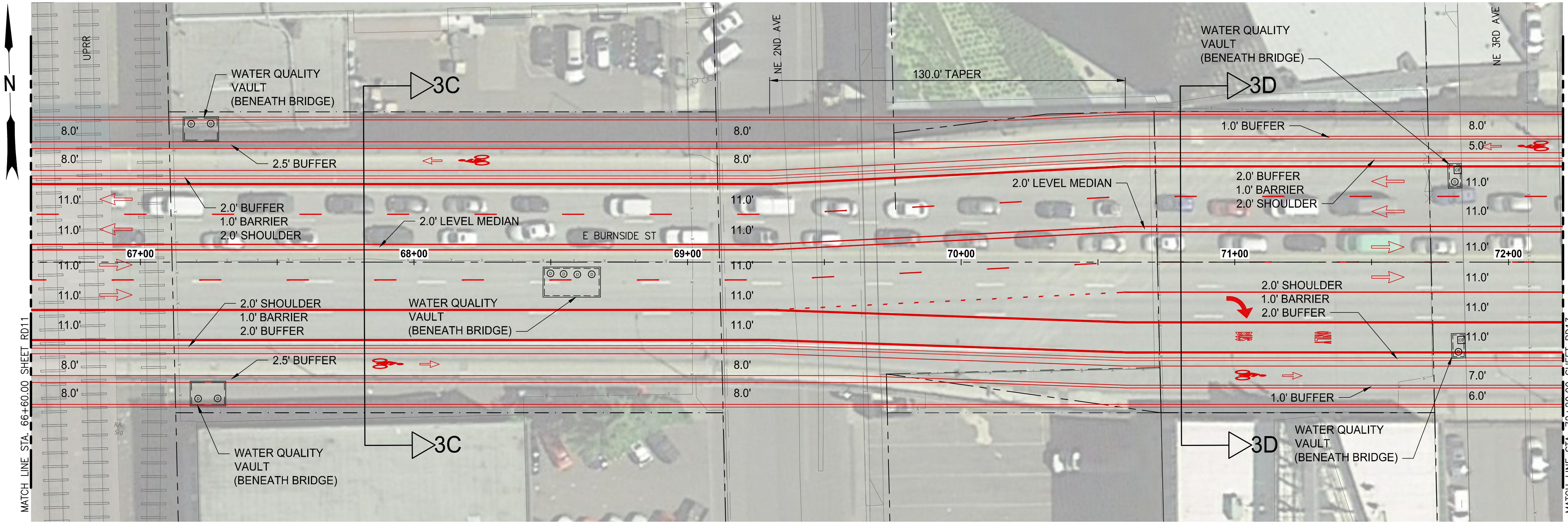
IAN B. CANNON P.E.
COUNTY ENGINEER

DESIGNED BY:
DRAFTED BY:
CHECKED BY:

REVISIONS

NO.	DATE:

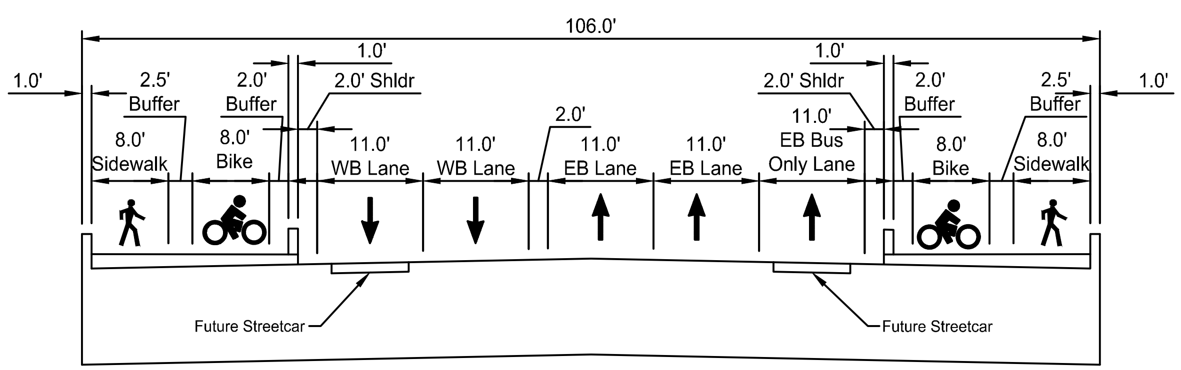
Sheet No.
RD11



PLAN

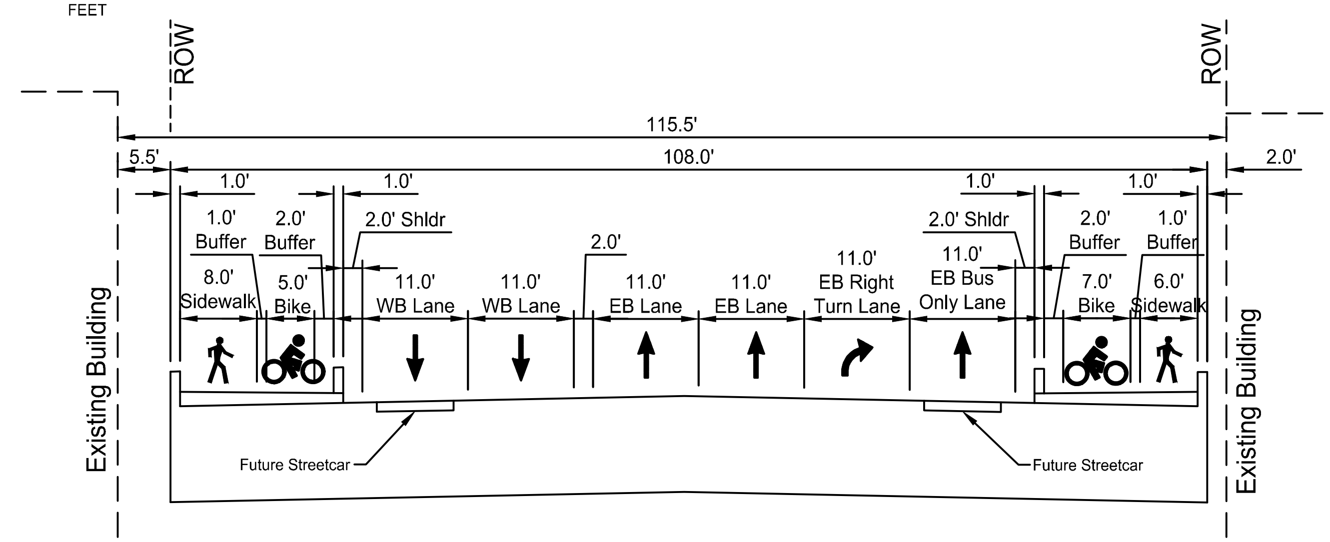
SCALE: 1"=40'

20 SCALE | 0 IN | 20 FEET



TYPICAL SECTION 3C

BRIDGE SPANS
LOOKING EAST – NO SCALE



TYPICAL SECTION 3D

EAST APPROACH ON STRUCTURE
LOOKING EAST – NO SCALE

CONCEPTUAL PLANS
JUNE 2020

Earthquake Ready Burnside Bridge NEPA Phase

Replacement Alternative With Short-Span Approach

MULTNOMAH COUNTY

PROJECT NO.: *Proj No*

DATE: *Date*

MULTNOMAH COUNTY
DEPARTMENT OF COMMUNITY SERVICES
TRANSPORTATION DIVISION
1620 S.E. 190th AVE. PORTLAND, ORE. 97233-5999

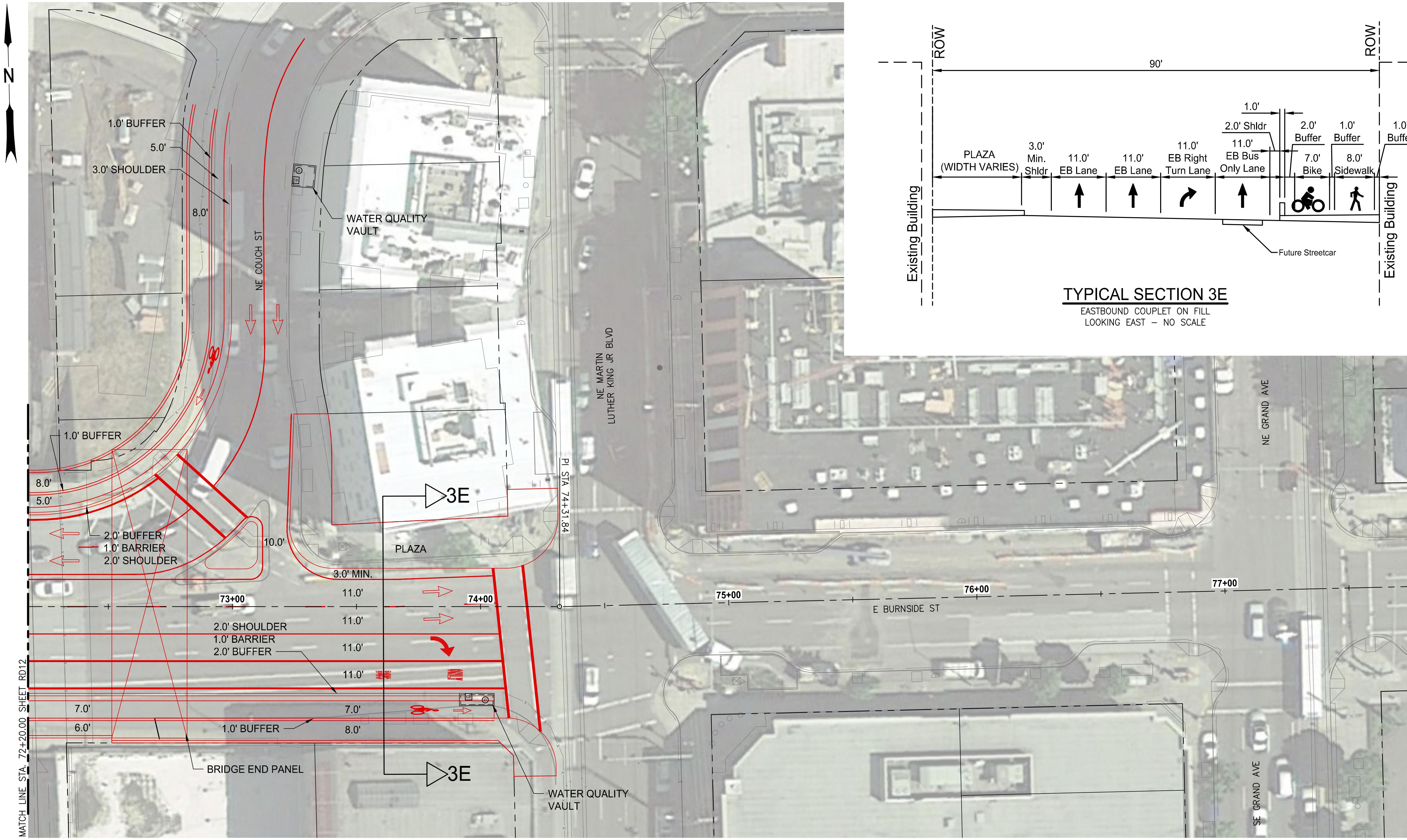
IAN B. CANNON P.E. COUNTY ENGINEER

DESIGNED BY: | DRAFTED BY: | CHECKED BY:

REVISIONS

NO.	DATE:		

Sheet No.
RD12



TYPICAL SECTION 3E

EASTBOUND COUPLET ON FILL
LOOKING EAST – NO SCALE

PLAN

SCALE: 1"=40'

20 SCALE 0 IN 20 FEET

CONCEPTUAL PLANS
JUNE 2020

Earthquake Ready Burnside Bridge NEPA Phase

Replacement Alternative With Short-Span Approach

MULTNOMAH COUNTY

PROJECT NO.: *Proj No*

DATE: *Date*

MULTNOMAH COUNTY
DEPARTMENT OF COMMUNITY SERVICES
TRANSPORTATION DIVISION
1620 S.E. 190th AVE. PORTLAND, ORE. 97233-5999

COUNTY ENGINEER

IAN B. CANNON P.E.

DESIGNED BY:

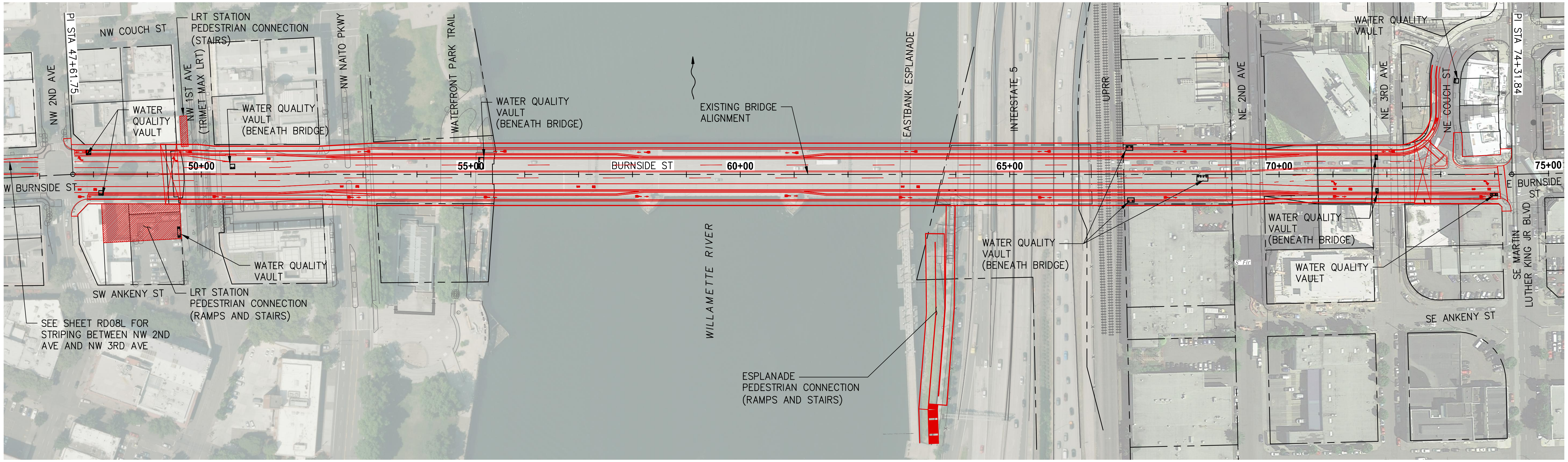
DRAFTED BY:

CHECKED BY:

REVISIONS

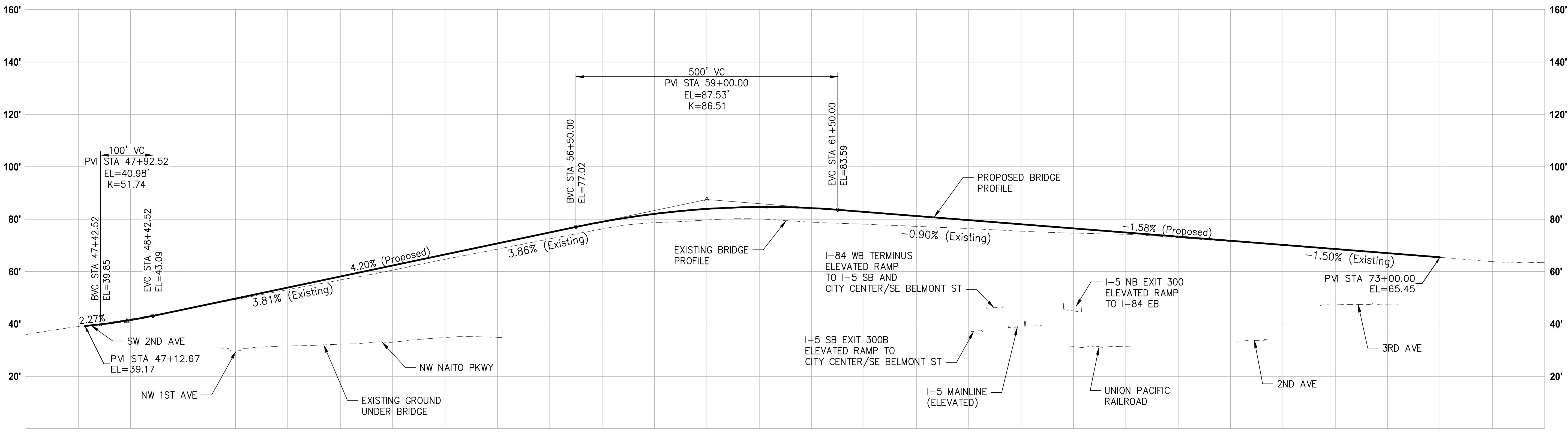
NO.	DATE:	

Sheet No.
RD13



PLAN

SCALE: 1"=200'



PROFILE

HORIZONTAL SCALE: 1"=200'
VERTICAL SCALE: 1"=40'

CONCEPTUAL PLANS
JUNE 2020

20
10
0
100 0 100
SCALE IN FEET

Earthquake Ready Burnside Bridge NEPA Phase

Replacement Alternative With Long-Span Approach

MULTNOMAH COUNTY

PROJECT NO: *Proj No*

DATE: *Date*

MULTNOMAH COUNTY
DEPARTMENT OF COMMUNITY SERVICES
TRANSPORTATION DIVISION
1620 S.E. 190th AVE. PORTLAND, ORE. 97233-5999

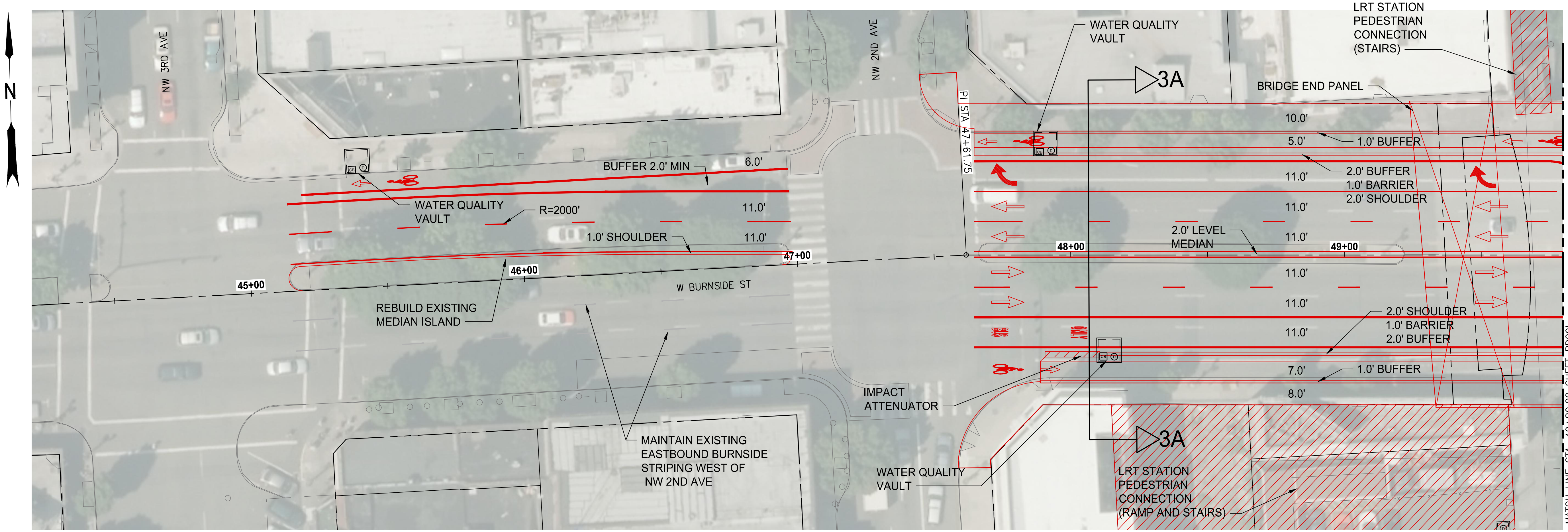
COUNTY ENGINEER
IAN B. CANNON P.E.

DESIGNED BY:
DRAFTED BY:
CHECKED BY:

REVISIONS

NO.	DATE:	

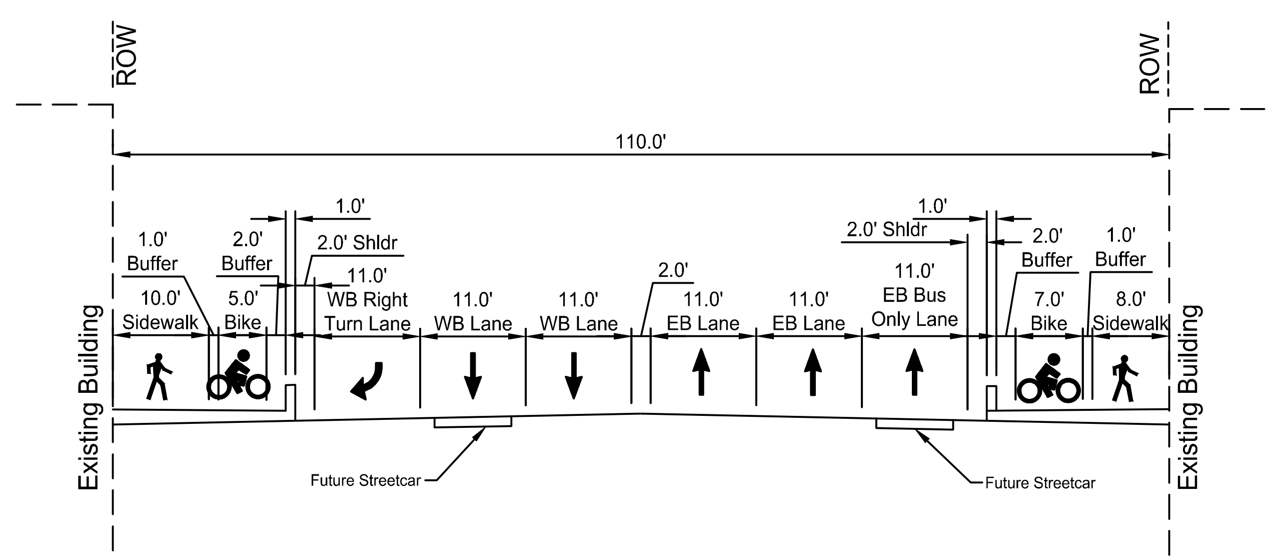
Sheet No.
RD07L



PLAN

SCALE: 1"=40'

20 SCALE 0 IN 20 FEET



TYPICAL SECTION 3A

WEST APPROACH ON FILL
LOOKING EAST – NO SCALE

CONCEPTUAL PLANS
JUNE 2020

Earthquake Ready Burnside Bridge NEPA Phase

Replacement Alternative With Long-Span Approach

MULTNOMAH COUNTY

PROJECT NO.: *Proj No*

DATE: *Date*

MULTNOMAH COUNTY
DEPARTMENT OF COMMUNITY SERVICES
TRANSPORTATION DIVISION
1620 S.E. 190th AVE. PORTLAND, ORE. 97233-5999

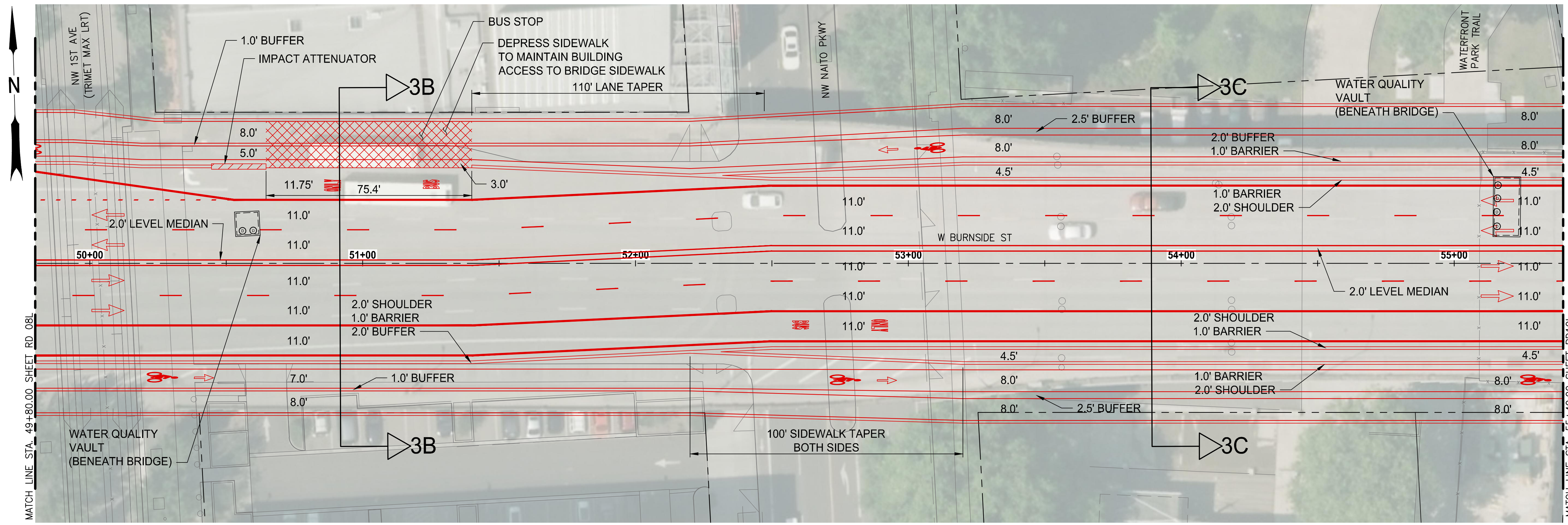
IAN B. CANNON P.E. COUNTY ENGINEER

DESIGNED BY:
DRAFTED BY:
CHECKED BY:

REVISIONS

NO.	DATE:			

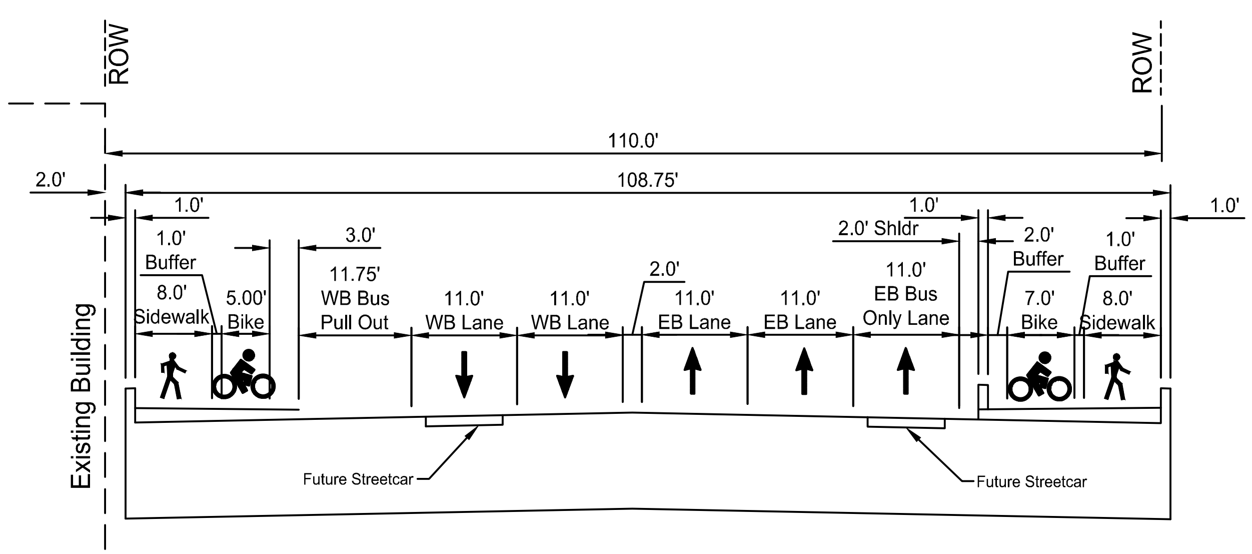
Sheet No.
RD08L



PLAN

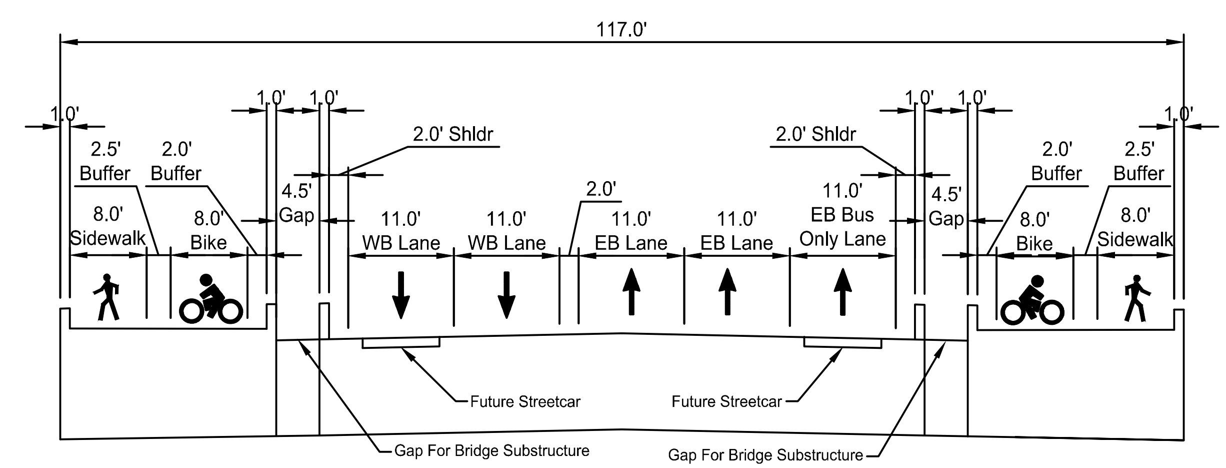
SCALE: 1"=40'

20 0 20
SCALE IN FEET



TYPICAL SECTION 3B

WEST APPROACH ON STRUCTURE
LOOKING EAST – NO SCALE



TYPICAL SECTION 3C

BRIDGE SPANS
LOOKING EAST – NO SCALE

CONCEPTUAL PLANS
JUNE 2020

Earthquake Ready Burnside Bridge NEPA Phase

Replacement Alternative With Long–Span Approach

MULTNOMAH COUNTY

PROJECT NO.: *Proj No*

DATE: *Date*

MULTNOMAH COUNTY
DEPARTMENT OF COMMUNITY SERVICES
TRANSPORTATION DIVISION
1620 S.E. 190th AVE. PORTLAND, ORE. 97233–5999

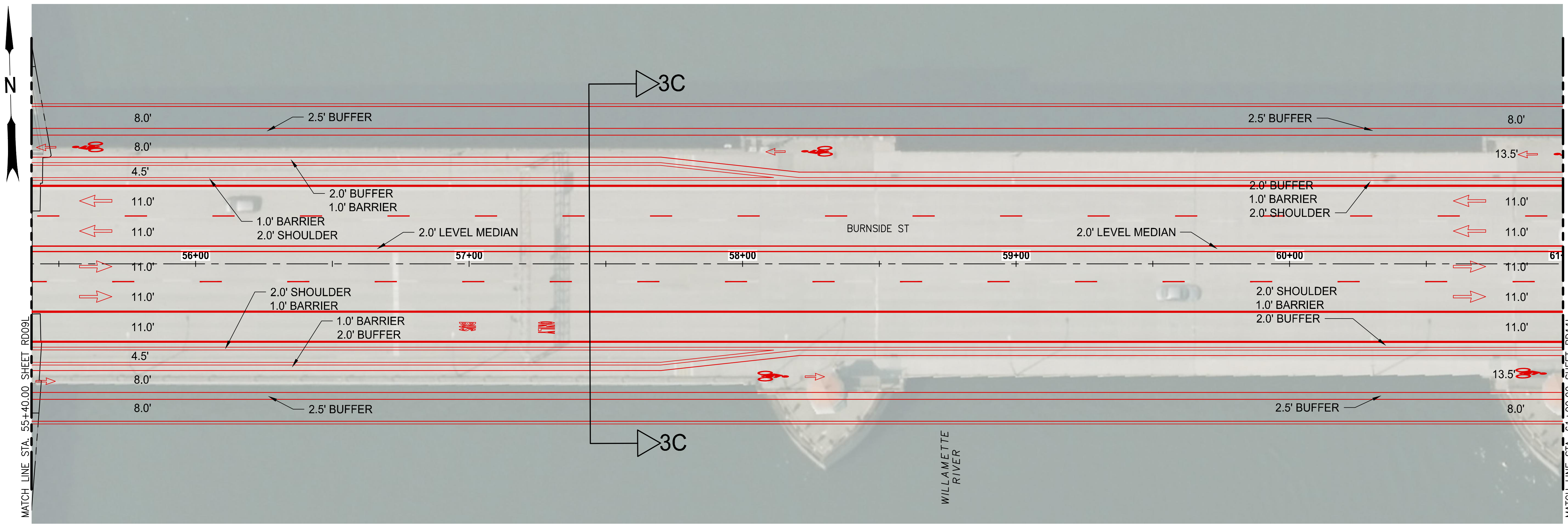
IAN B. CANNON P.E.
COUNTY ENGINEER

DESIGNED BY:
DRAFTED BY:
CHECKED BY:

REVISIONS

NO.	DATE:	

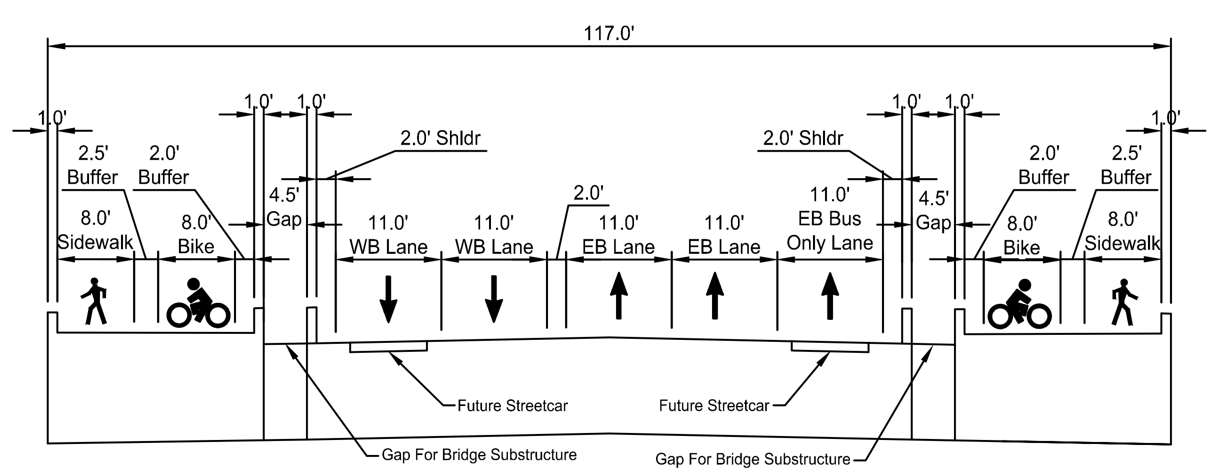
Sheet No.
RD09L



PLAN

SCALE: 1"=40'

20 0 20
SCALE IN FEET



TYPICAL SECTION 3C

BRIDGE SPANS
LOOKING EAST – NO SCALE

CONCEPTUAL PLANS
JUNE 2020

Earthquake Ready Burnside Bridge NEPA Phase

Replacement Alternative With Long-Span Approach

MULTNOMAH COUNTY

PROJECT NO.: *Proj No*

DATE: *Date*

MULTNOMAH COUNTY
DEPARTMENT OF COMMUNITY SERVICES
TRANSPORTATION DIVISION
1620 S.E. 190th AVE. PORTLAND, ORE. 97233-5999

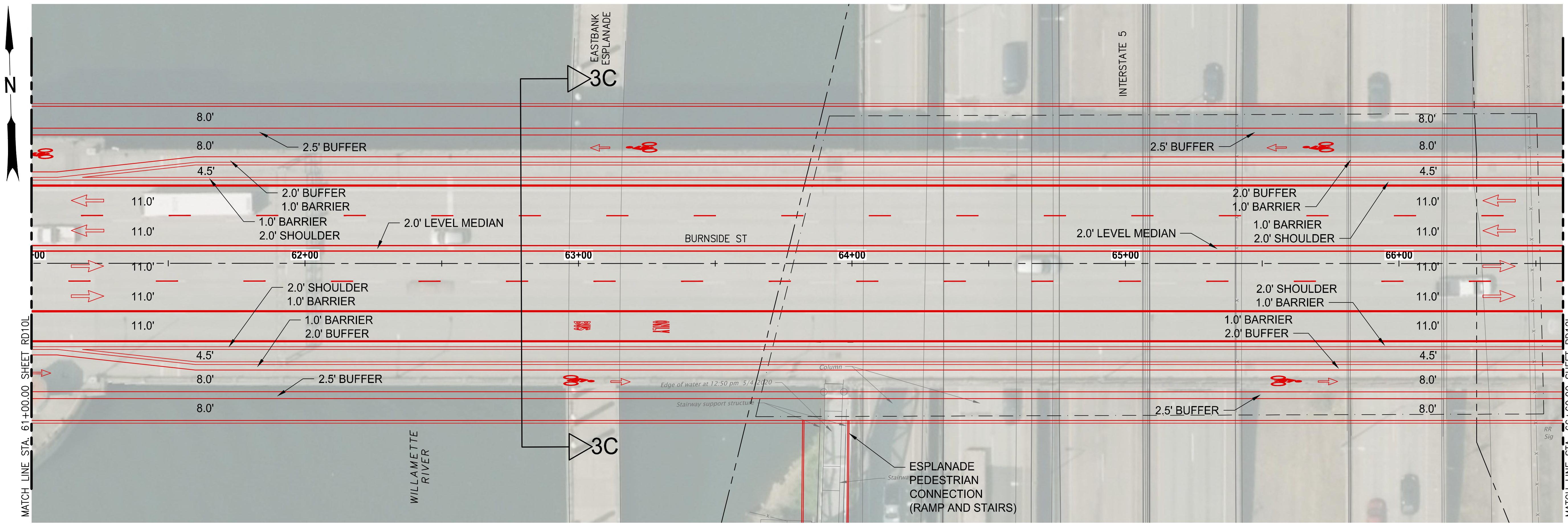
IAN B. CANNON P.E.
COUNTY ENGINEER

DESIGNED BY: | DRAFTED BY: | CHECKED BY:

REVISIONS

NO. | DATE:

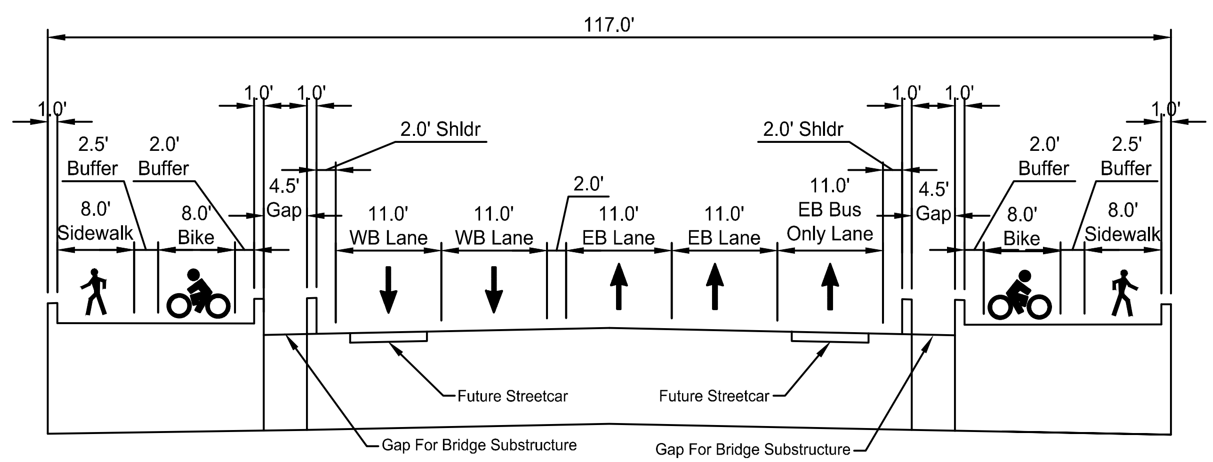
Sheet No. RD10L



PLAN

SCALE: 1"=40'

20 SCALE 0 IN 20 FEET



TYPICAL SECTION 3C

BRIDGE SPANS

LOOKING EAST – NO SCALE

CONCEPTUAL PLANS
JUNE 2020

Earthquake Ready Burnside Bridge NEPA Phase

Replacement Alternative With Long-Span Approach

MULTNOMAH COUNTY

PROJECT NO.: Proj No

DATE: Date

MULTNOMAH COUNTY
DEPARTMENT OF COMMUNITY SERVICES
TRANSPORTATION DIVISION
1620 S.E. 190th AVE. PORTLAND, ORE. 97233-5999

COUNTY ENGINEER

IAN B. CANNON P.E.

DESIGNED BY:

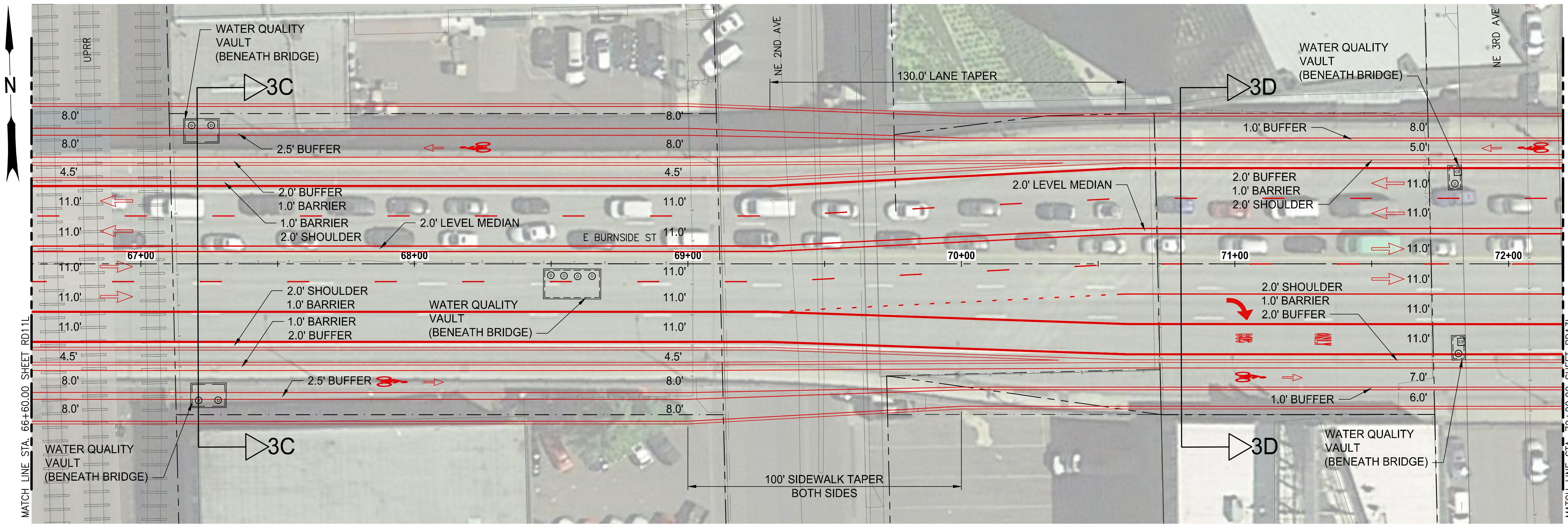
DRAFTED BY:

CHECKED BY:

REVISIONS

NO.	DATE:			

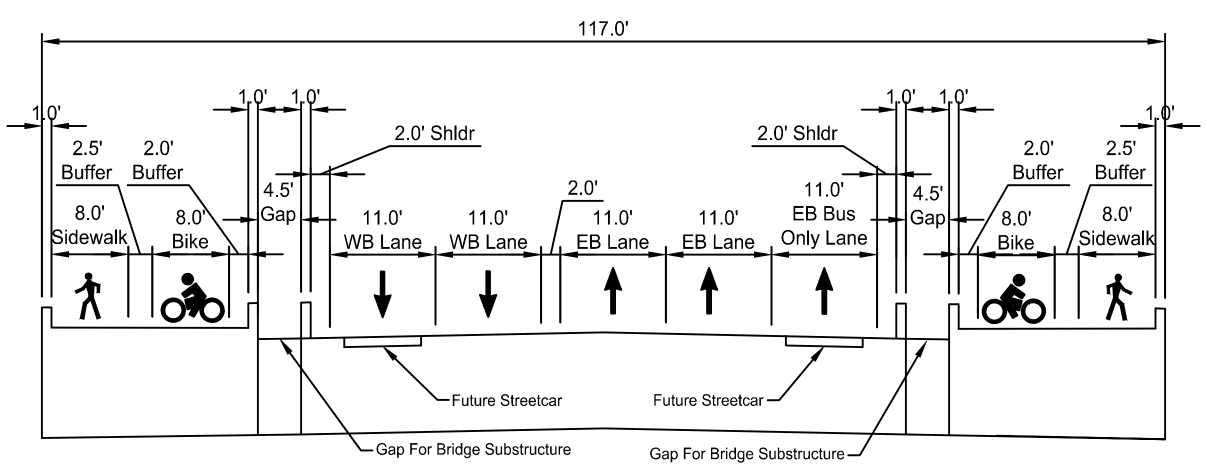
Sheet No.
RD11L



PLAN

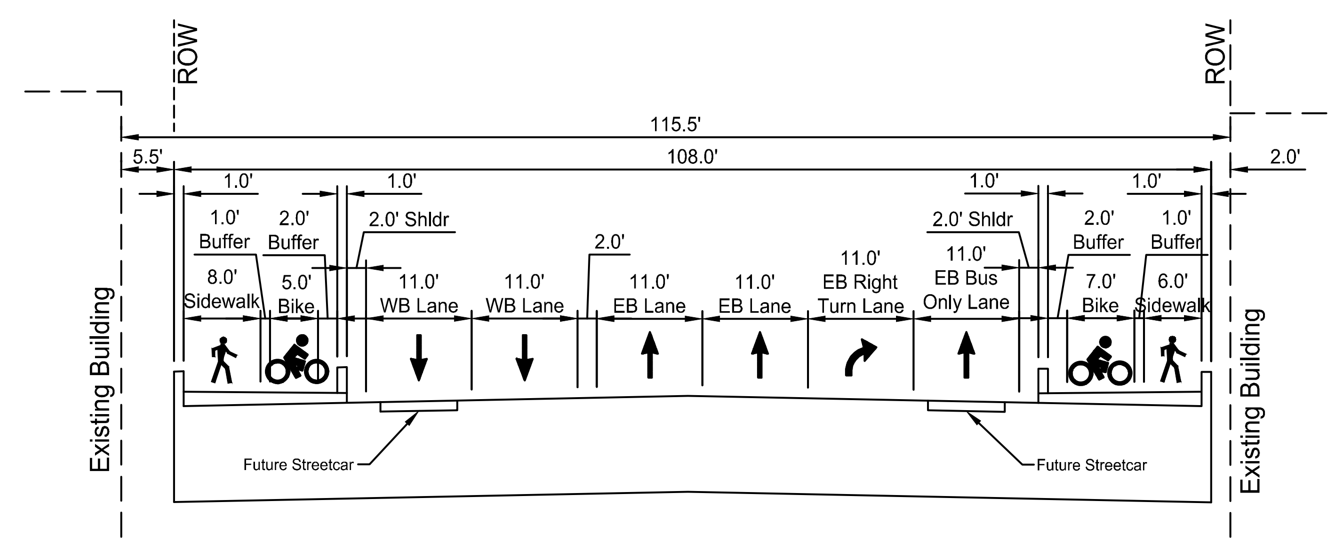
SCALE: 1"=40'

20 SCALE 0 IN 20 FEET



TYPICAL SECTION 3C

BRIDGE SPANS
LOOKING EAST – NO SCALE



TYPICAL SECTION 3D

EAST APPROACH ON STRUCTURE
LOOKING EAST – NO SCALE

CONCEPTUAL PLANS
JUNE 2020

Earthquake Ready Burnside Bridge NEPA Phase
Replacement Alternative With Long-Span Approach
MULTNOMAH COUNTY

PROJECT NO.: Proj No
DATE: Date

MULTNOMAH COUNTY
DEPARTMENT OF COMMUNITY SERVICES
TRANSPORTATION DIVISION
1620 S.E. 190th AVE. PORTLAND, ORE. 97233-5999

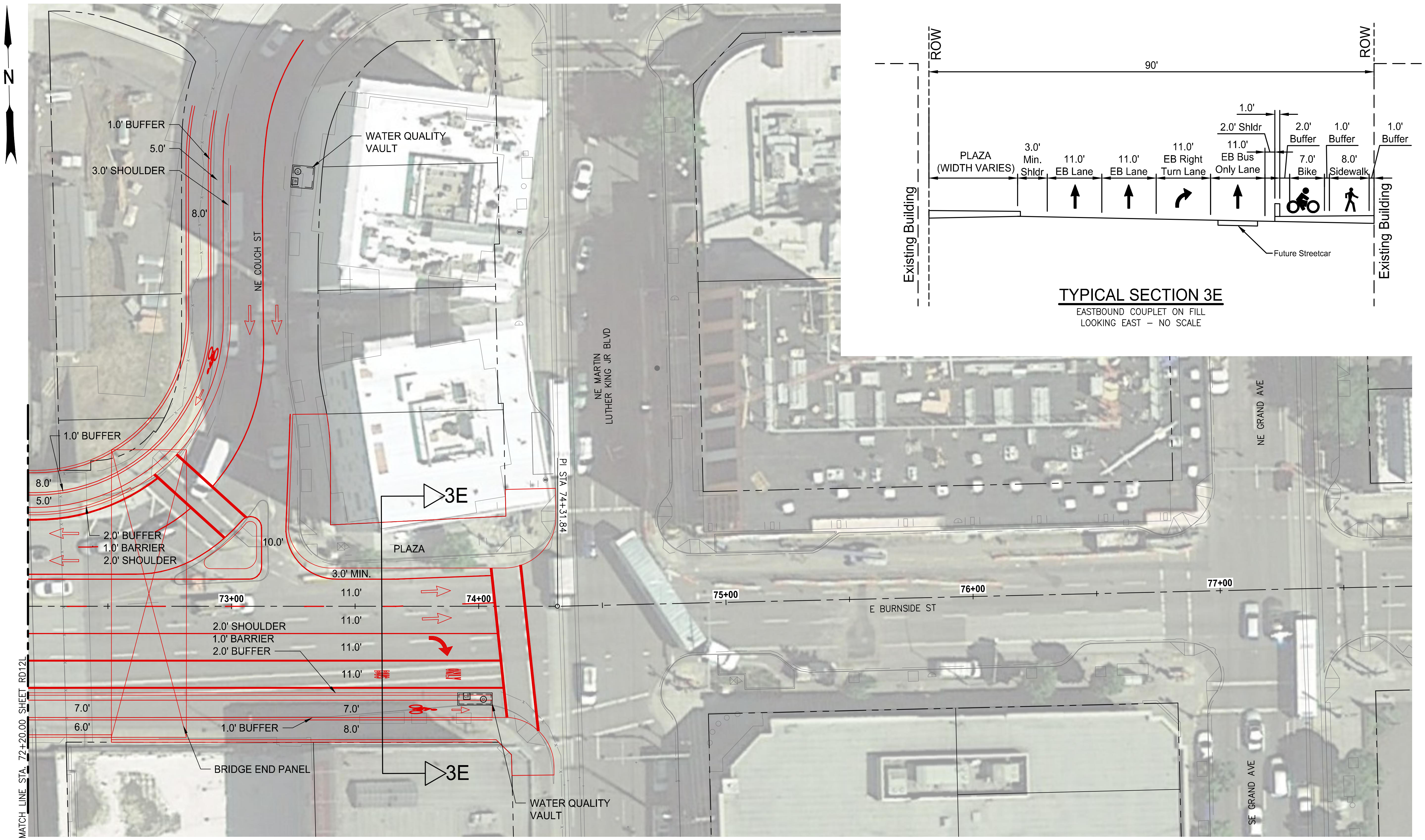
IAN B. CANNON P.E.
COUNTY ENGINEER

DESIGNED BY: DRAFTED BY: CHECKED BY:

REVISIONS

NO. DATE:

Sheet No.
RD12L



TYPICAL SECTION 3E

EASTBOUND COUPLET ON FILL
LOOKING EAST – NO SCALE

PLAN

SCALE: 1"=40'

20 0 20
SCALE IN FEET

CONCEPTUAL PLANS
JUNE 2020

Earthquake Ready Burnside Bridge NEPA Phase

Replacement Alternative With Long-Span Approach

MULTNOMAH COUNTY

PROJECT NO.: *Proj No*

DATE: *Date*

MULTNOMAH COUNTY
DEPARTMENT OF COMMUNITY SERVICES
TRANSPORTATION DIVISION
1620 S.E. 190th AVE. PORTLAND, ORE. 97233-5999

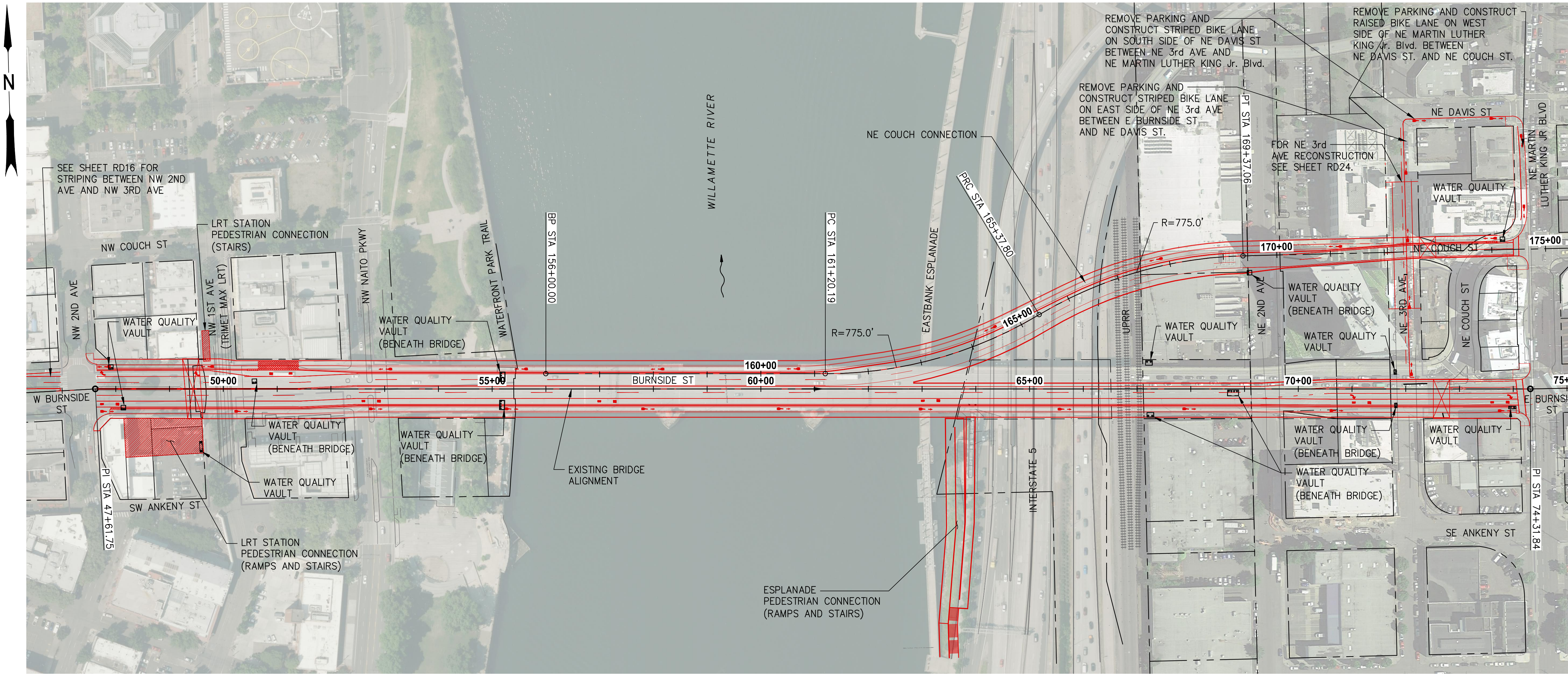
IAN B. CANNON P.E.
COUNTY ENGINEER

DESIGNED BY:
DRAFTED BY:
CHECKED BY:

REVISIONS

NO.	DATE:			

Sheet No. *RD13L*



PLAN

SCALE: 1"=200'

CONCEPTUAL PLANS
JUNE 2020

100 0 100
SCALE IN FEET

Earthquake Ready Burnside Bridge NEPA Phase

Replacement Alternative With Couch Extension

MULTNOMAH COUNTY

PROJECT NO.: *Proj No*

DATE: *Date*

MULTNOMAH COUNTY
DEPARTMENT OF COMMUNITY SERVICES
TRANSPORTATION DIVISION
1620 S.E. 190th AVE. PORTLAND, ORE. 97233-5999

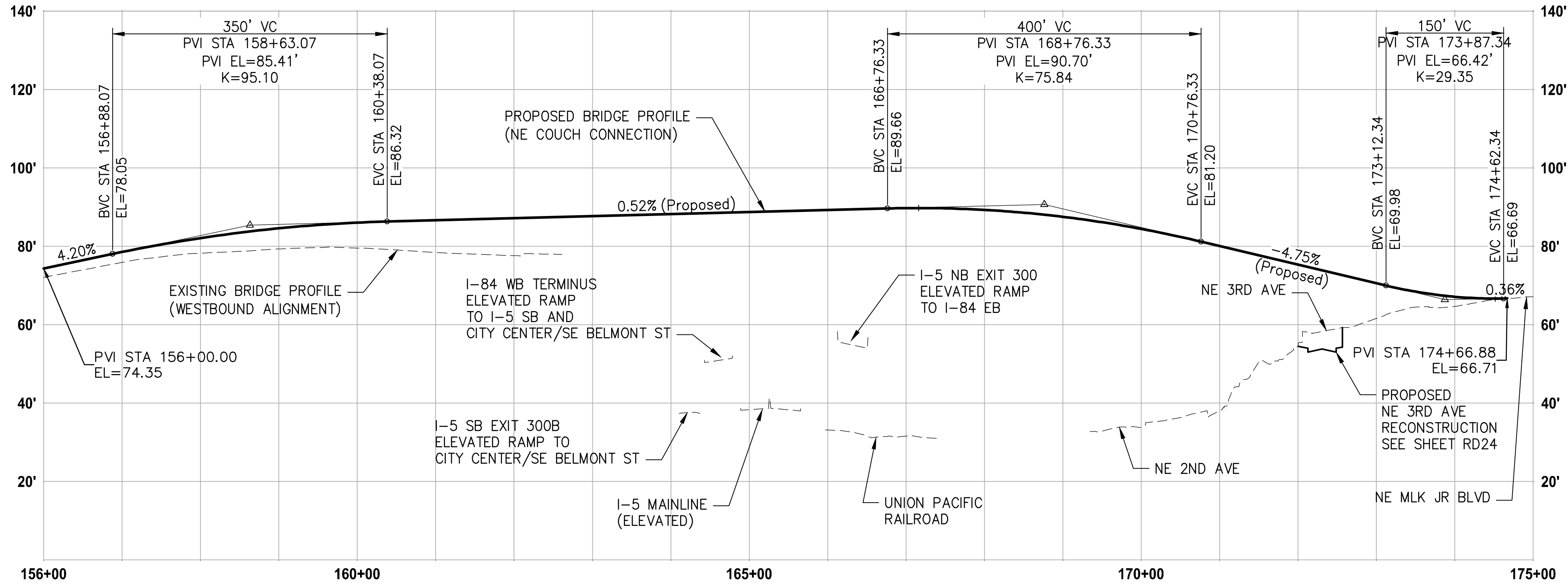
IAN B. CANNON P.E.
COUNTY ENGINEER

DESIGNED BY:
DRAFTED BY:
CHECKED BY:

REVISIONS

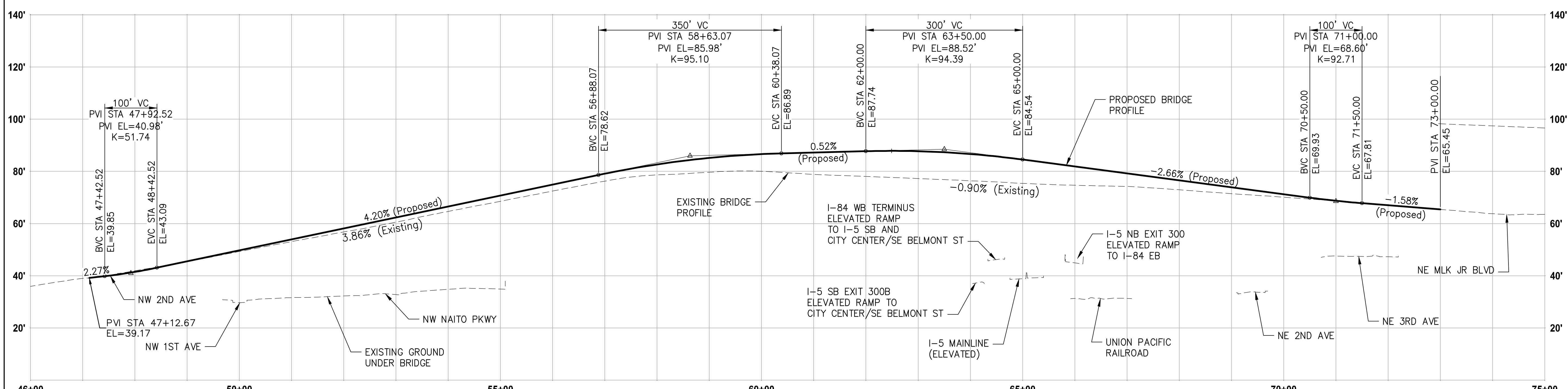
NO.	DATE:	

Sheet No.
RD14



PROFILE - NE COUCH CONNECTION

HORIZONTAL SCALE: 1"=200'
VERTICAL SCALE: 1"=40'



PROFILE - REPLACEMENT MOVABLE BRIDGE

HORIZONTAL SCALE: 1"=200'
VERTICAL SCALE: 1"=40'

CONCEPTUAL PLANS
JUNE 2020

20
10
0
100 0 100
SCALE IN FEET

Earthquake Ready Burnside Bridge NEPA Phase

Replacement Alternative With Couch Extension

MULTNOMAH COUNTY

PROJECT NO.: *Proj No*

DATE: *Date*

MULTNOMAH COUNTY
DEPARTMENT OF COMMUNITY SERVICES
TRANSPORTATION DIVISION
1620 S.E. 190th AVE. PORTLAND, ORE. 97233-5999

COUNTY ENGINEER

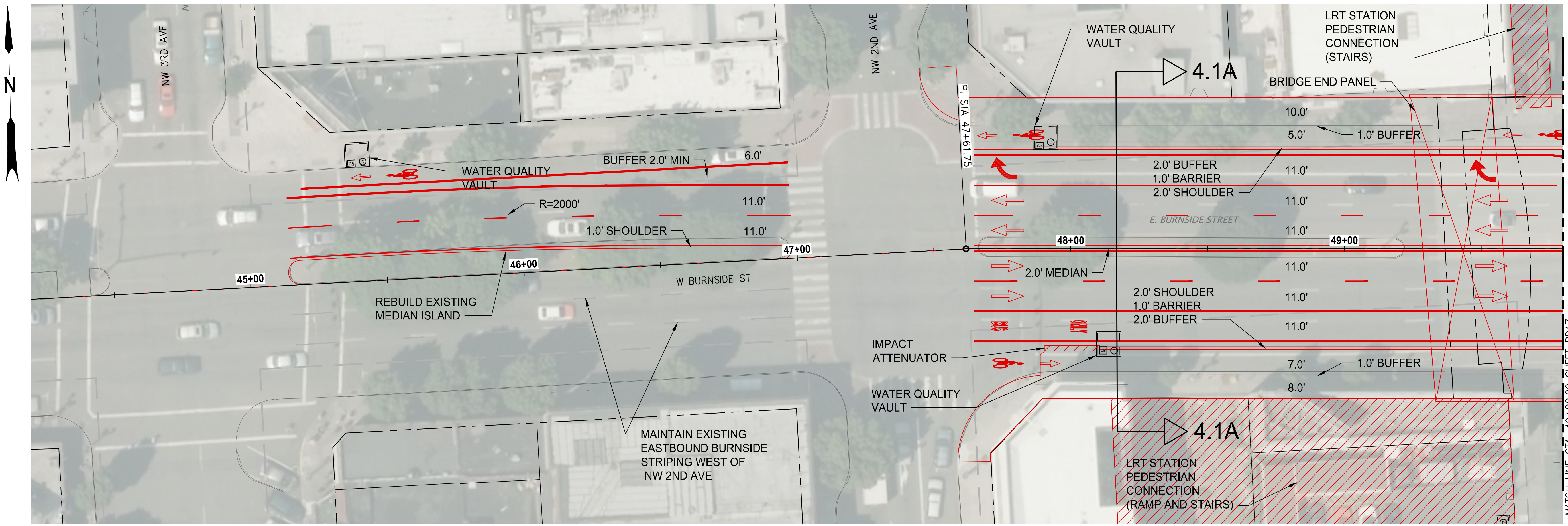
IAN B. CANNON P.E.

DESIGNED BY:
DRAFTED BY:
CHECKED BY:

REVISIONS

NO. DATE:

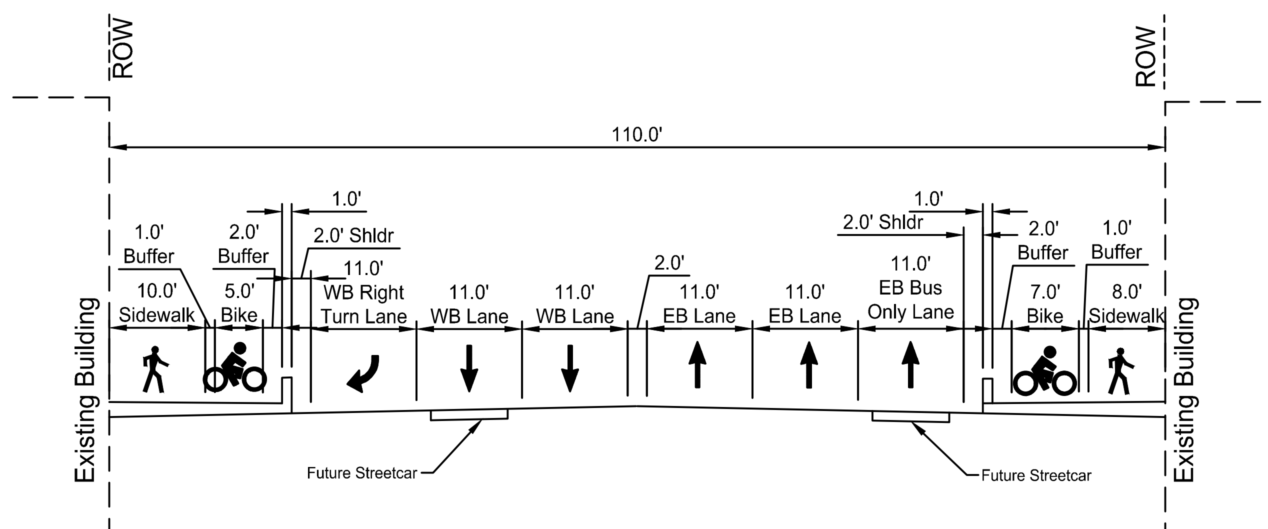
Sheet No.
RD15



PLAN

SCALE: 1"=40'

20 0 20
SCALE IN FEET



TYPICAL SECTION 4.1A

WEST APPROACH ON FILL
LOOKING EAST – NO SCALE

CONCEPTUAL PLANS
JUNE 2020

Earthquake Ready Burnside Bridge NEPA Phase

Replacement Alternative With Couch Extension

MULTNOMAH COUNTY

PROJECT NO.: *Proj No*

DATE: *Date*

MULTNOMAH COUNTY
DEPARTMENT OF COMMUNITY SERVICES
TRANSPORTATION DIVISION
1620 S.E. 190th AVE. PORTLAND, ORE. 97233–5999

COUNTY ENGINEER

IAN B. CANNON P.E.

DESIGNED BY:

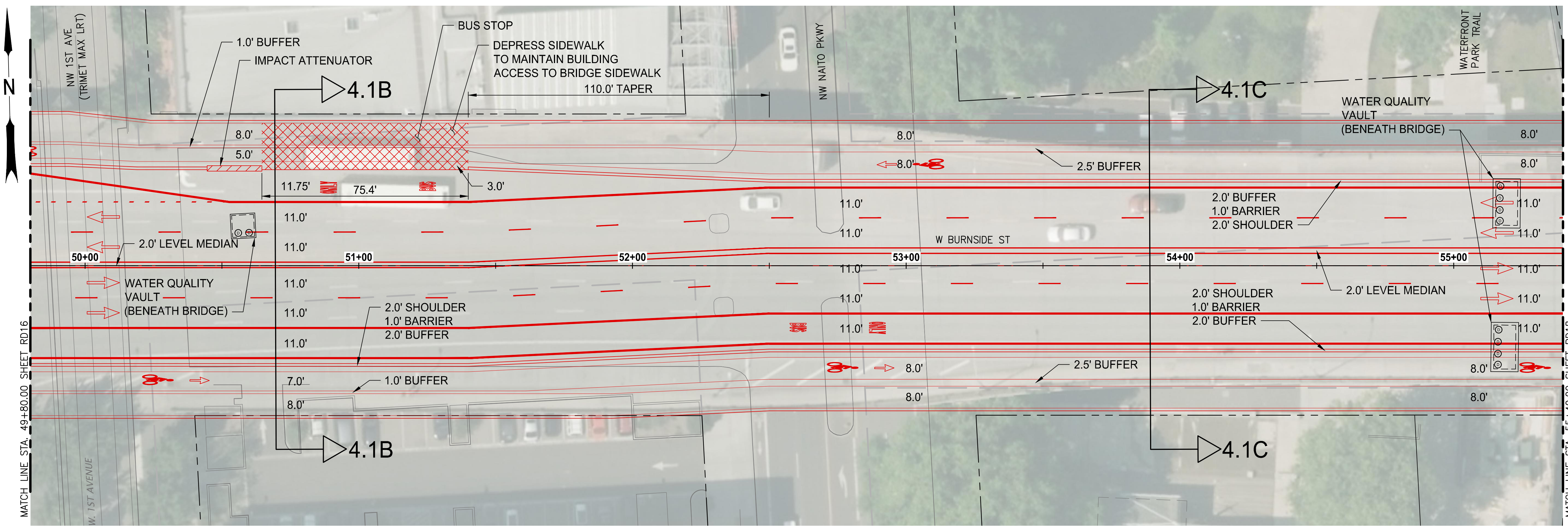
DRAFTED BY:

CHECKED BY:

REVISIONS

NO.	DATE:

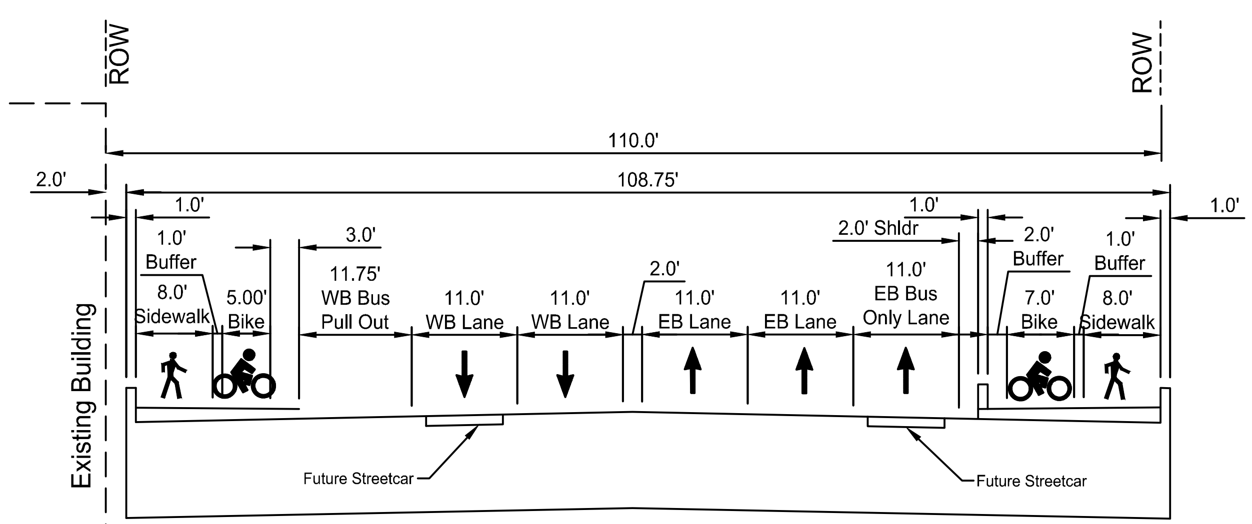
Sheet No.
RD16



PLAN

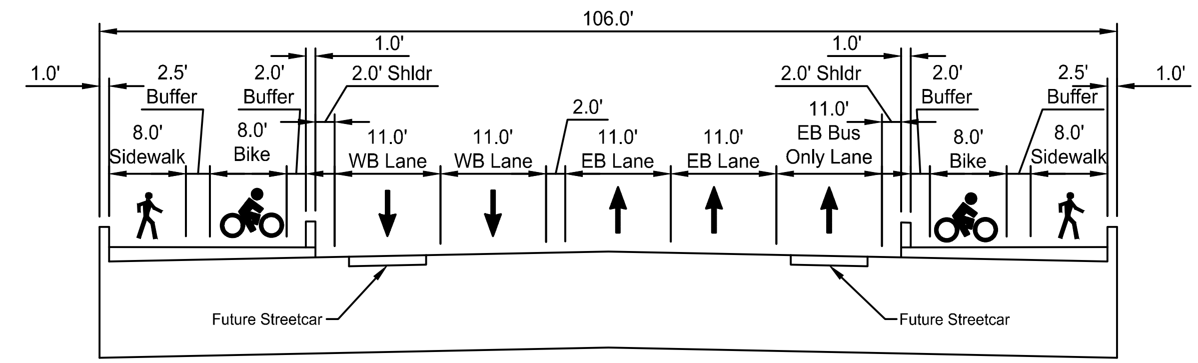
SCALE: 1"=40'

20 0 20
SCALE IN FEET



TYPICAL SECTION 4.1B

WEST APPROACH ON STRUCTURE
LOOKING EAST – NO SCALE



TYPICAL SECTION 4.1C

BRIDGE SPANS
LOOKING EAST – NO SCALE

CONCEPTUAL PLANS
JUNE 2020

Earthquake Ready Burnside Bridge NEPA Phase
Replacement Alternative With Couch Extension
MULTNOMAH COUNTY

PROJECT NO.: Proj No
DATE: Date

MULTNOMAH COUNTY
DEPARTMENT OF COMMUNITY SERVICES
TRANSPORTATION DIVISION
1620 S.E. 190th AVE. PORTLAND, ORE. 97233-5999

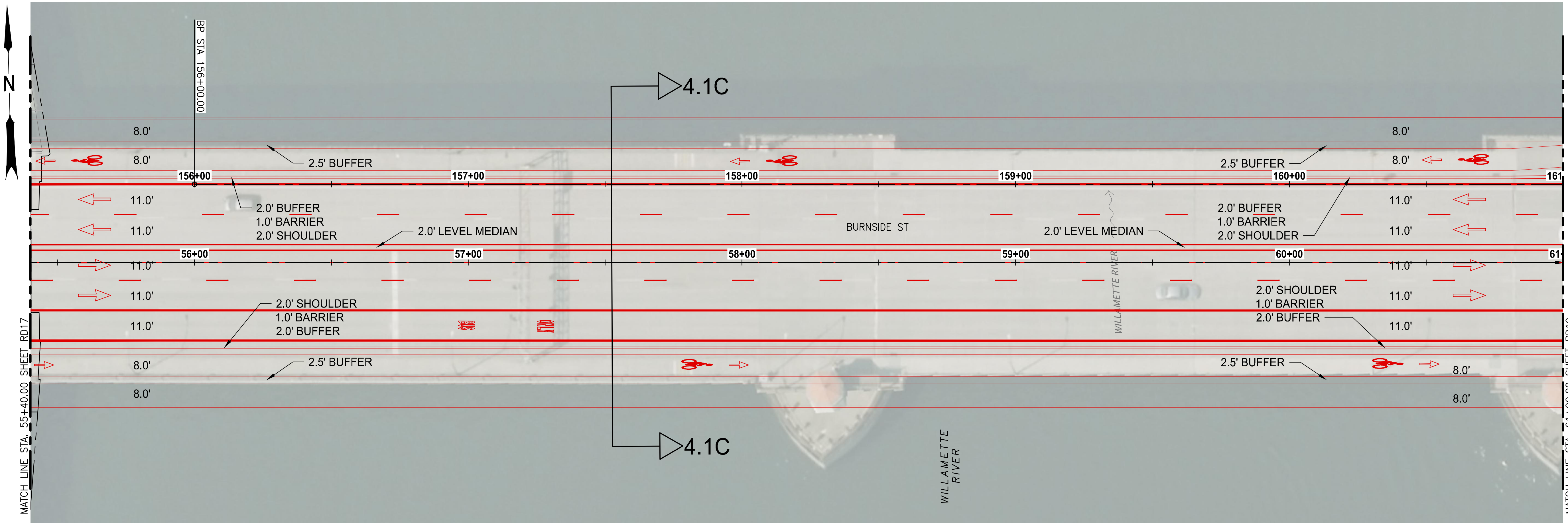
IAN B. CANNON P.E.
COUNTY ENGINEER

DESIGNED BY:
DRAFTED BY:
CHECKED BY:

REVISIONS

NO.	DATE:

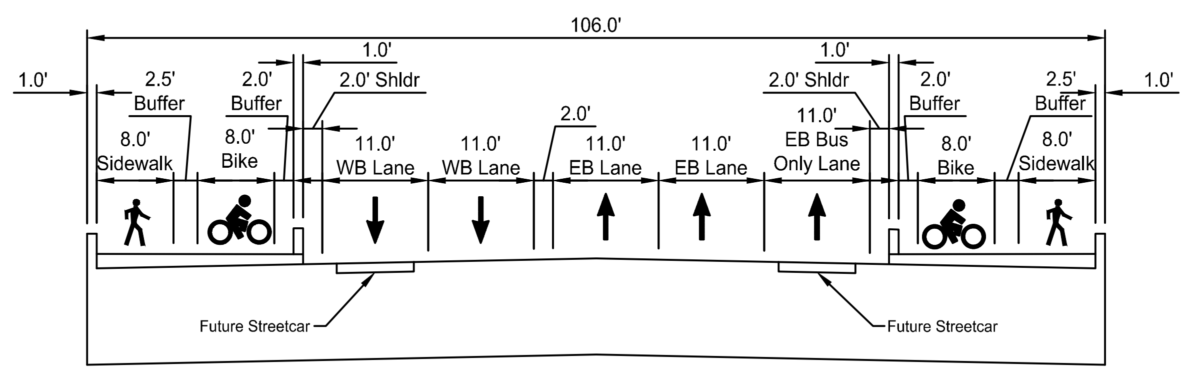
Sheet No.
RD17



PLAN

SCALE: 1"=40'

20 SCALE | 0 IN | 20 FEET



TYPICAL SECTION 4.1C

BRIDGE SPANS
LOOKING EAST – NO SCALE

CONCEPTUAL PLANS
JUNE 2020

Earthquake Ready Burnside Bridge NEPA Phase

Replacement Alternative With Couch Extension

MULTNOMAH COUNTY

PROJECT NO.: *Proj No*

DATE: *Date*

MULTNOMAH COUNTY
DEPARTMENT OF COMMUNITY SERVICES
TRANSPORTATION DIVISION
1620 S.E. 190th AVE. PORTLAND, ORE. 97233-5999

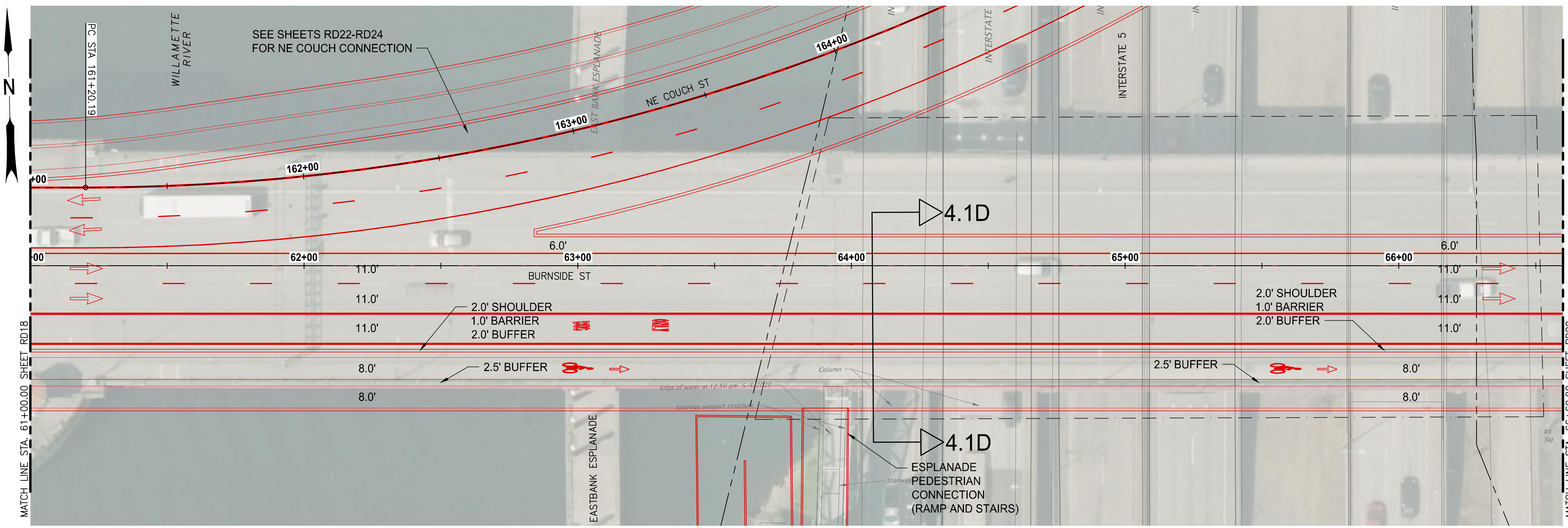
IAN B. CANNON P.E.
COUNTY ENGINEER

DESIGNED BY:
DRAFTED BY:
CHECKED BY:

REVISIONS

NO.	DATE:

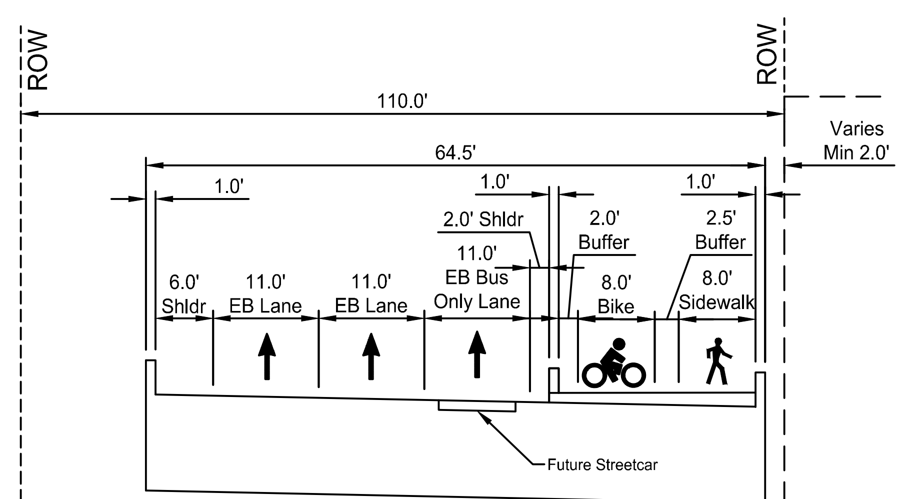
Sheet No.
RD18



PLAN

SCALE: 1"=40'

20 SCALE 0 IN 20 FEET



TYPICAL SECTION 4.1D

EASTBOUND BRIDGE SPANS
LOOKING EAST – NO SCALE

CONCEPTUAL PLANS
JUNE 2020

Earthquake Ready Burnside Bridge NEPA Phase

Replacement Alternative With Couch Extension

MULTNOMAH COUNTY

PROJECT NO.: *Proj No*

DATE: *Date*

MULTNOMAH COUNTY
DEPARTMENT OF COMMUNITY SERVICES
TRANSPORTATION DIVISION
1620 S.E. 190th AVE. PORTLAND, ORE. 97233-5999

COUNTY ENGINEER

IAN B. CANNON P.E.

DESIGNED BY:

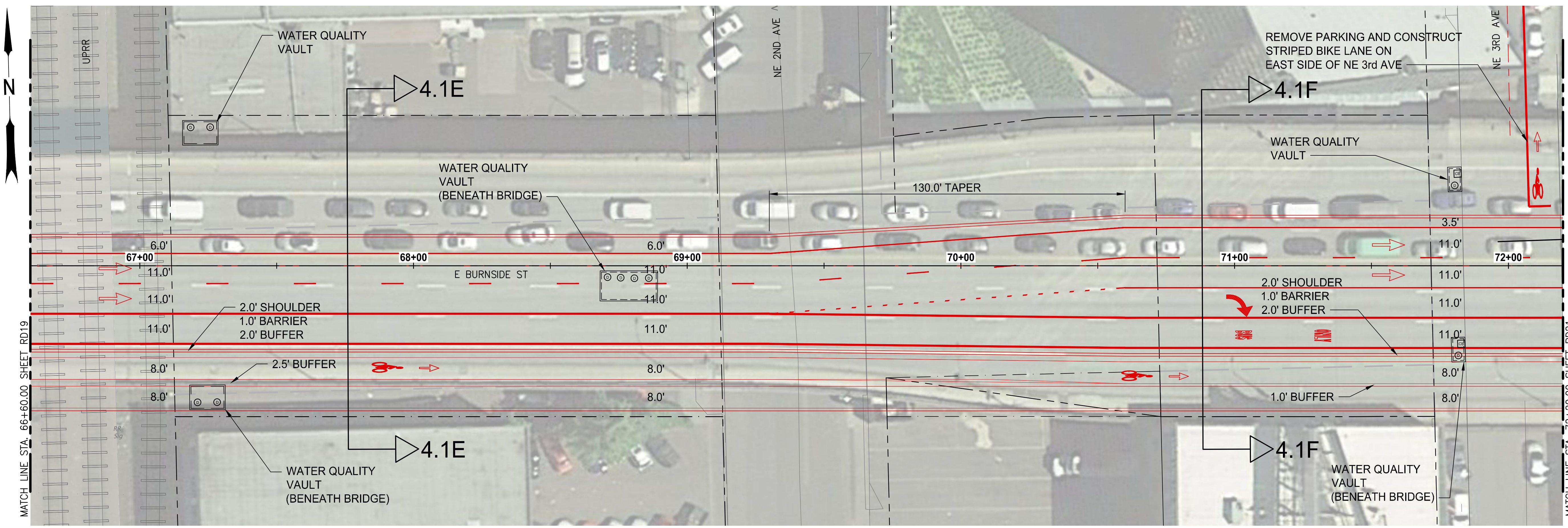
DRAFTED BY:

CHECKED BY:

REVISIONS

NO.	DATE:			

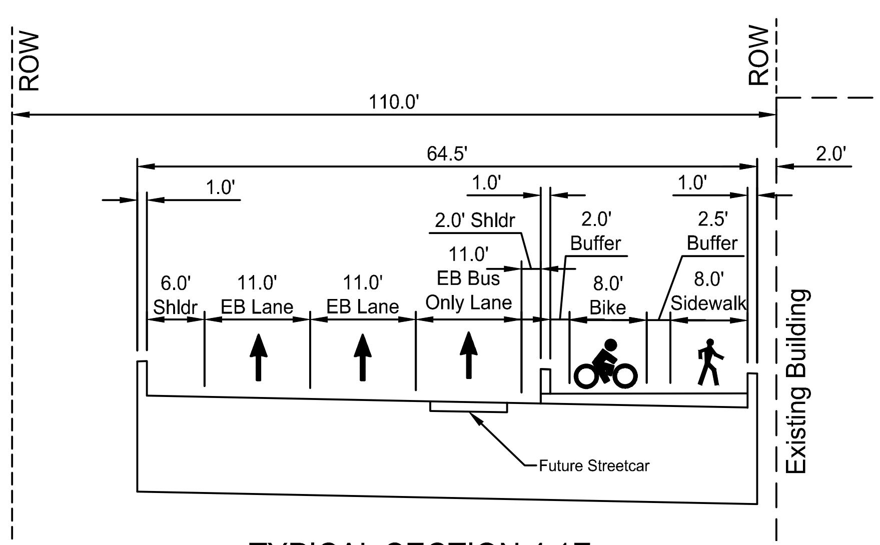
Sheet No.
RD19



PLAN

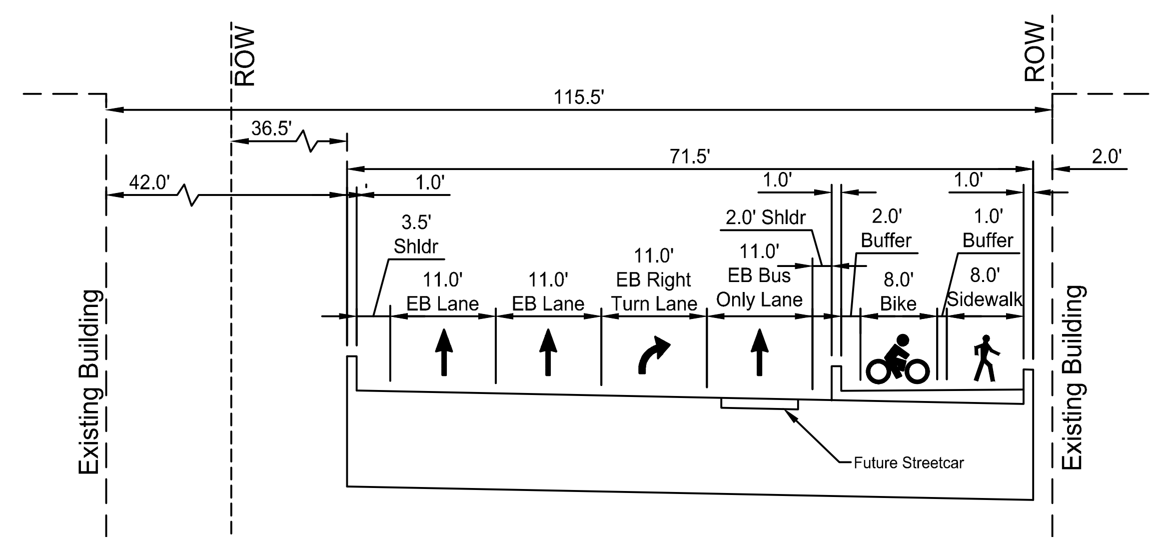
SCALE: 1"=40'

20 0 20
SCALE IN FEET



TYPICAL SECTION 4.1E

EASTBOUND BRIDGE SPANS
LOOKING EAST – NO SCALE



TYPICAL SECTION 4.1F

EAST APPROACH ON STRUCTURE
LOOKING EAST – NO SCALE

CONCEPTUAL PLANS
JUNE 2020

Earthquake Ready Burnside Bridge NEPA Phase
Replacement Alternative With Couch Extension
MULTNOMAH COUNTY

PROJECT NO.: Proj No
DATE: Date

MULTNOMAH COUNTY
DEPARTMENT OF COMMUNITY SERVICES
TRANSPORTATION DIVISION
1620 S.E. 190th AVE. PORTLAND, ORE. 97233-5999

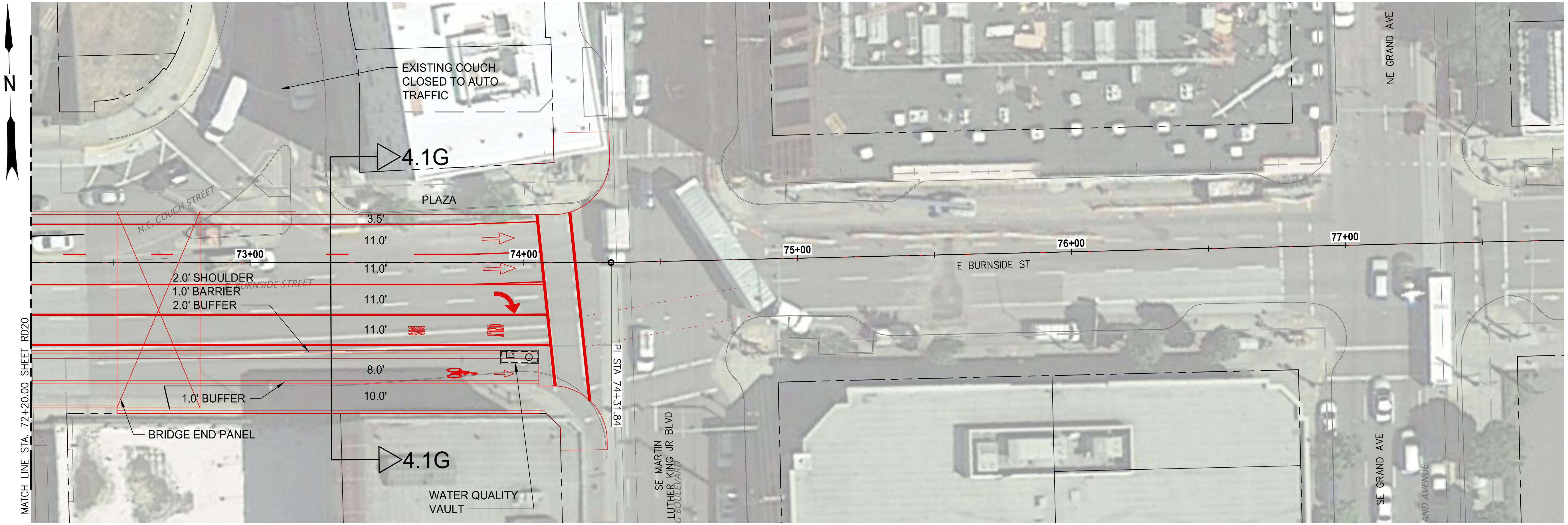
IAN B. CANNON P.E.
COUNTY ENGINEER

DESIGNED BY:
DRAFTED BY:
CHECKED BY:

REVISIONS

NO	DATE:	

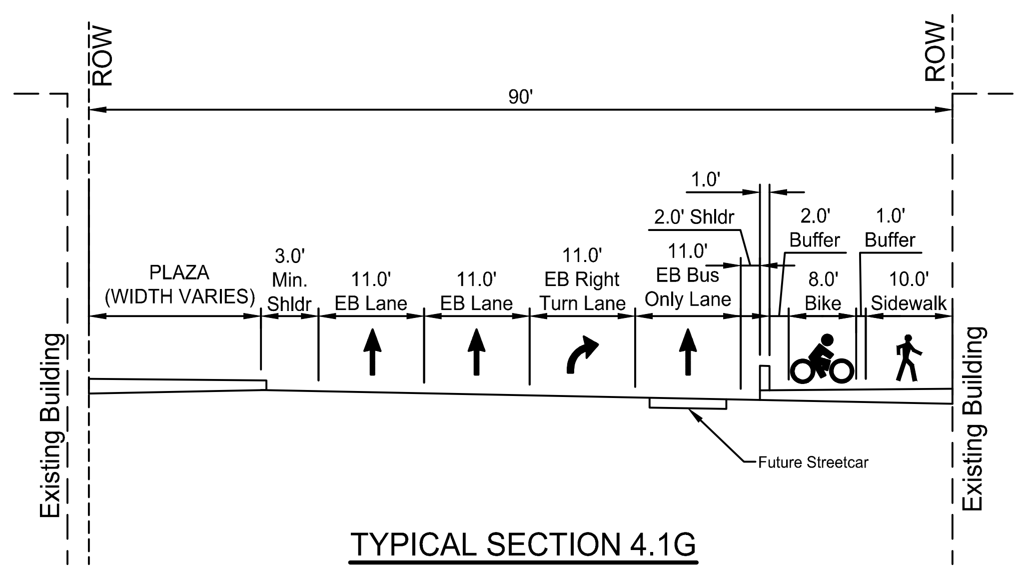
Sheet No.
RD20



PLAN

SCALE: 1"=40'

20 0 20
SCALE IN FEET



TYPICAL SECTION 4.1G

EASTBOUND COUPLET ON FILL
LOOKING EAST – NO SCALE

CONCEPTUAL PLANS
JUNE 2020

Earthquake Ready Burnside Bridge NEPA Phase

Replacement Alternative With
Couch Extension
MULTNOMAH COUNTY

PROJECT NO.: Proj No

DATE: Date

MULTNOMAH COUNTY
DEPARTMENT OF COMMUNITY SERVICES
TRANSPORTATION DIVISION
1620 S.E. 190th AVE. PORTLAND, ORE. 97233-5999

COUNTY ENGINEER

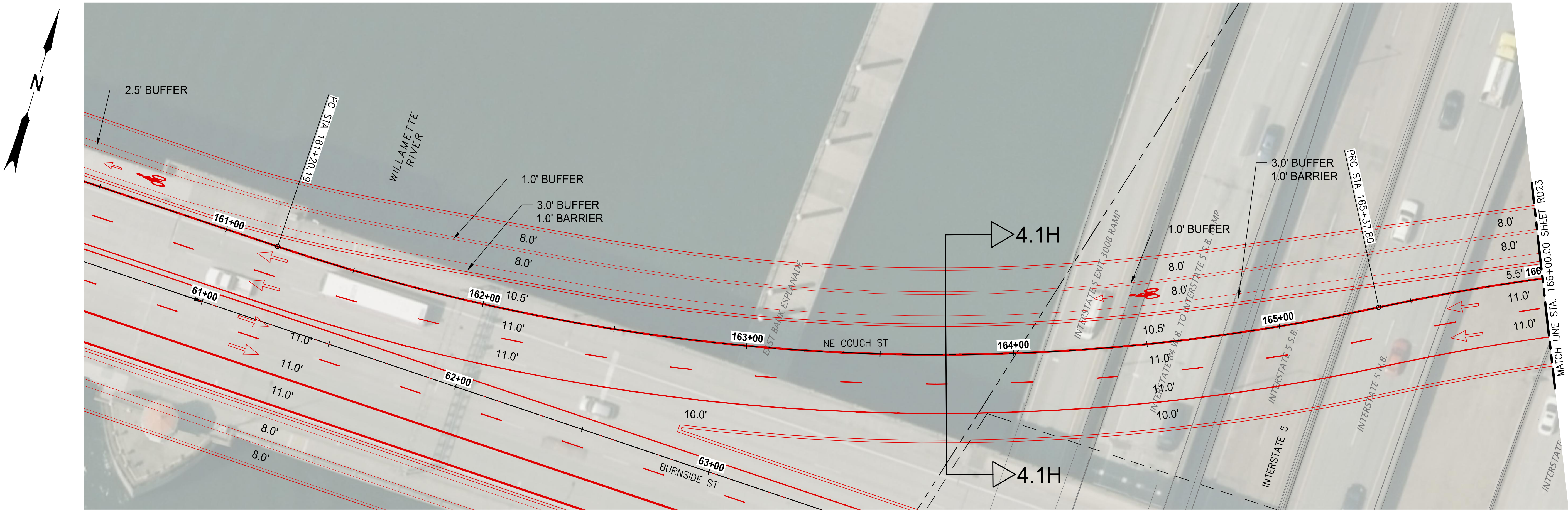
IAN B. CANNON P.E.

DESIGNED BY:
DRAFTED BY:
CHECKED BY:

REVISIONS

NO.	DATE:	

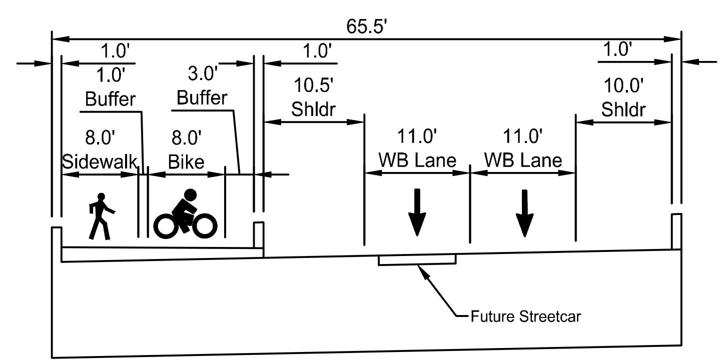
Sheet No.
RD21



PLAN

SCALE: 1"=40'

20 SCALE 0 IN 20 FEET



TYPICAL SECTION 4.1H

WESTBOUND BRIDGE SPANS
LOOKING EAST – NO SCALE

CONCEPTUAL PLANS
JUNE 2020

Earthquake Ready Burnside Bridge NEPA Phase

Replacement Alternative With Couch Extension

MULTNOMAH COUNTY

PROJECT NO.: *Proj No*

DATE: *Date*

MULTNOMAH COUNTY
DEPARTMENT OF COMMUNITY SERVICES
TRANSPORTATION DIVISION
1620 S.E. 190th AVE. PORTLAND, ORE. 97233-5999

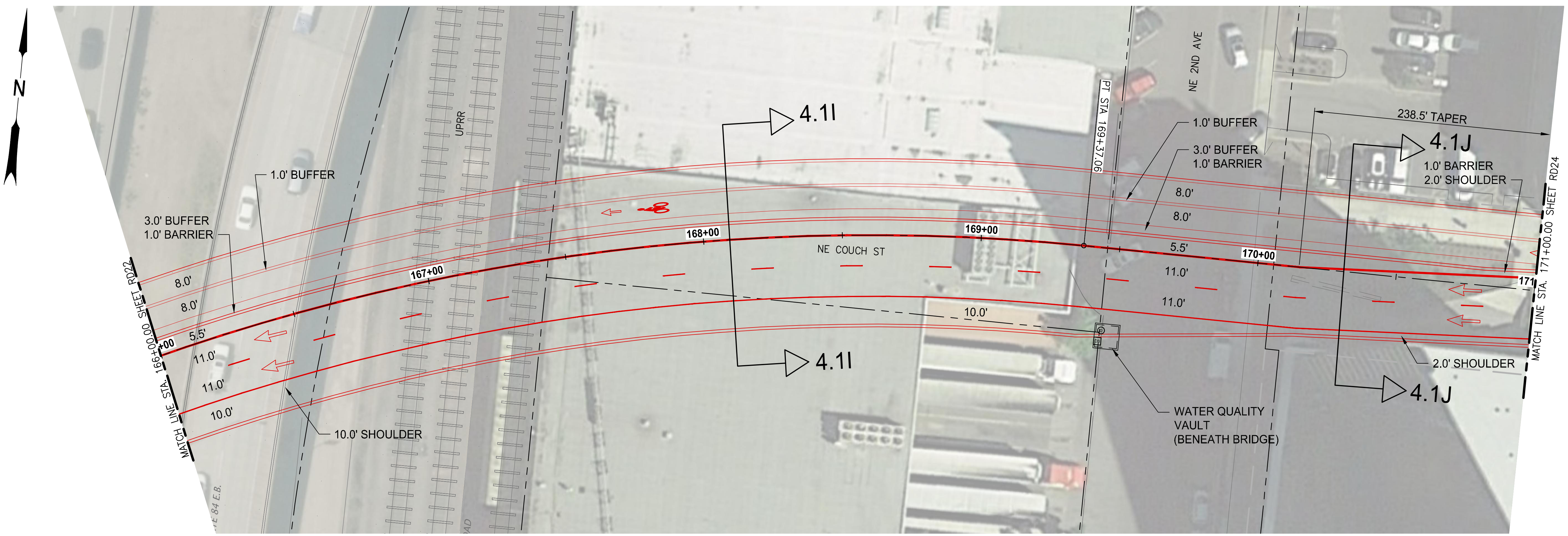
IAN B. CANNON P.E. COUNTY ENGINEER

DESIGNED BY:
DRAFTED BY:
CHECKED BY:

REVISIONS

NO.	DATE:

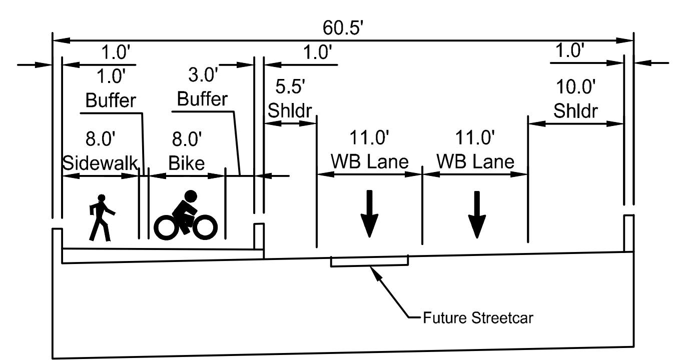
Sheet No. *RD22*



PLAN

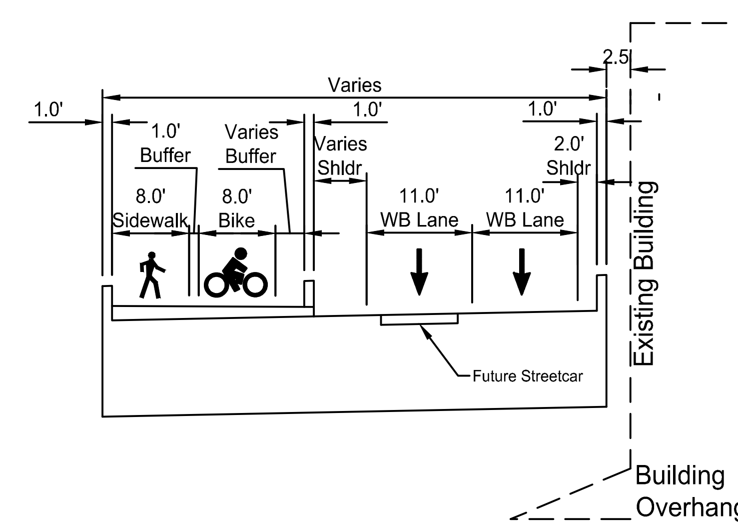
SCALE: 1"=40'

20 0 20
SCALE IN FEET



TYPICAL SECTION 4.1I

WESTBOUND BRIDGE SPANS
LOOKING EAST – NO SCALE



TYPICAL SECTION 4.1J

WESTBOUND BRIDGE SPANS
LOOKING EAST – NO SCALE

CONCEPTUAL PLANS
JUNE 2020

Earthquake Ready Burnside Bridge NEPA Phase

Replacement Alternative With Couch Extension

MULTNOMAH COUNTY

PROJECT NO.: *Proj No*

DATE: *Date*

MULTNOMAH COUNTY
DEPARTMENT OF COMMUNITY SERVICES
TRANSPORTATION DIVISION
1620 S.E. 190th AVE. PORTLAND, ORE. 97233-5999

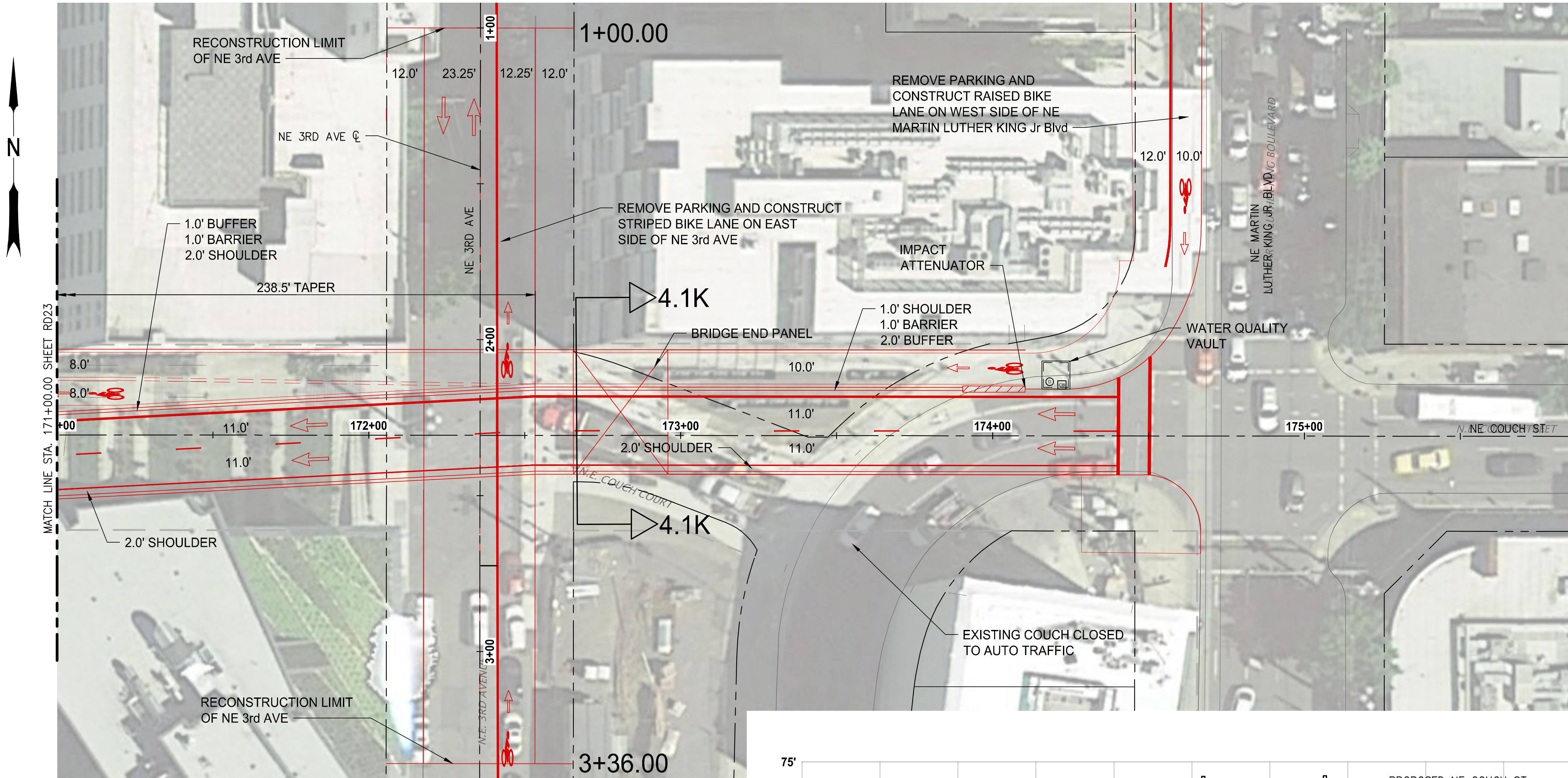
IAN B. CANNON P.E.
COUNTY ENGINEER

DESIGNED BY:
DRAFTED BY:
CHECKED BY:

REVISIONS

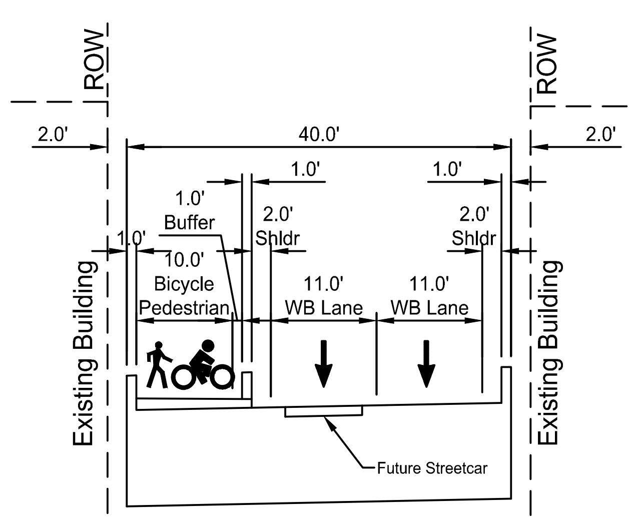
NO. DATE:

Sheet No.
RD23



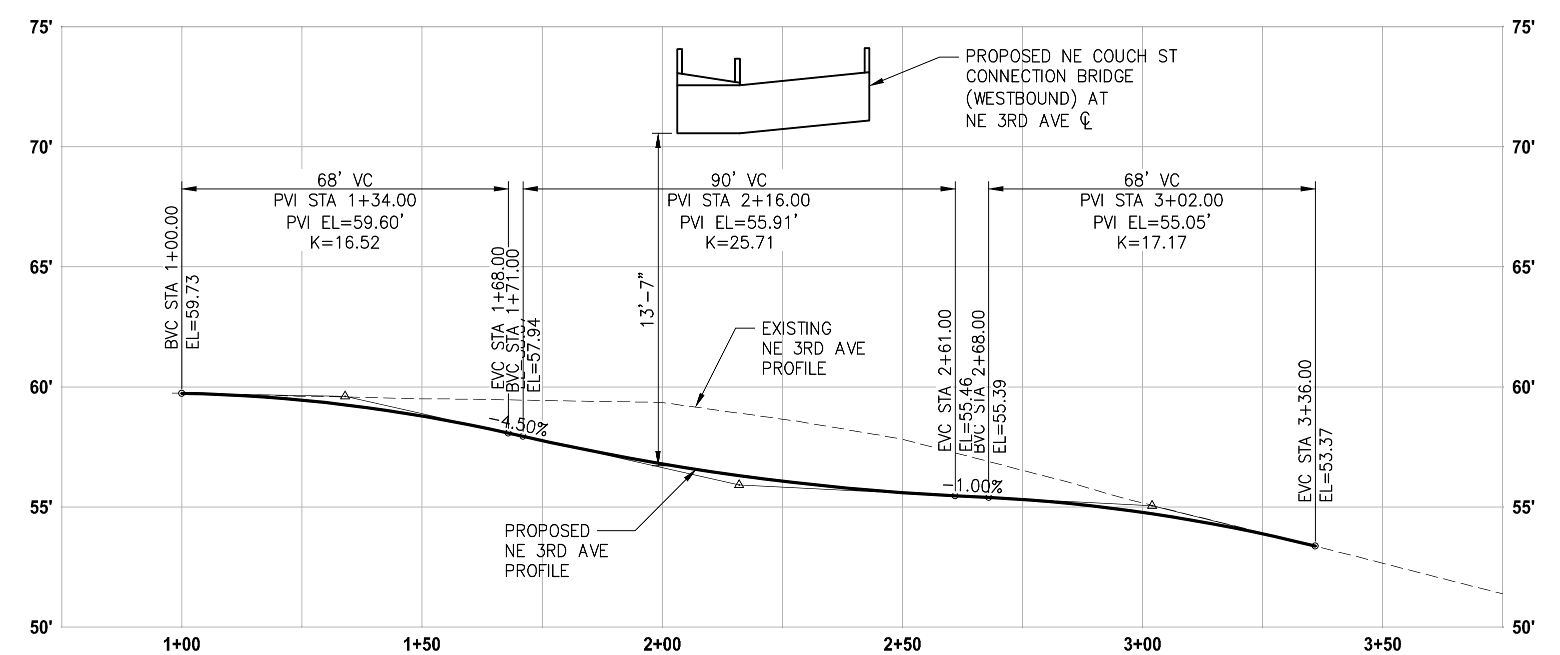
PLAN

SCALE: 1"=40'



TYPICAL SECTION 4.1K

WESTBOUND APPROACH ON STRUCTURE
LOOKING EAST – NO SCALE



PROFILE - NE 3RD AVE RECONSTRUCTION

HORIZONTAL SCALE: 1"=40'
VERTICAL SCALE: 1"=8'

20 0 20
SCALE IN FEET

CONCEPTUAL PLANS
JUNE 2020

Earthquake Ready Burnside Bridge NEPA Phase

Replacement Alternative With Couch Extension

MULTNOMAH COUNTY

PROJECT NO.: *Proj No*

DATE: *Date*

MULTNOMAH COUNTY
DEPARTMENT OF COMMUNITY SERVICES
TRANSPORTATION DIVISION
1620 S.E. 190th AVE. PORTLAND, ORE. 97233-5999

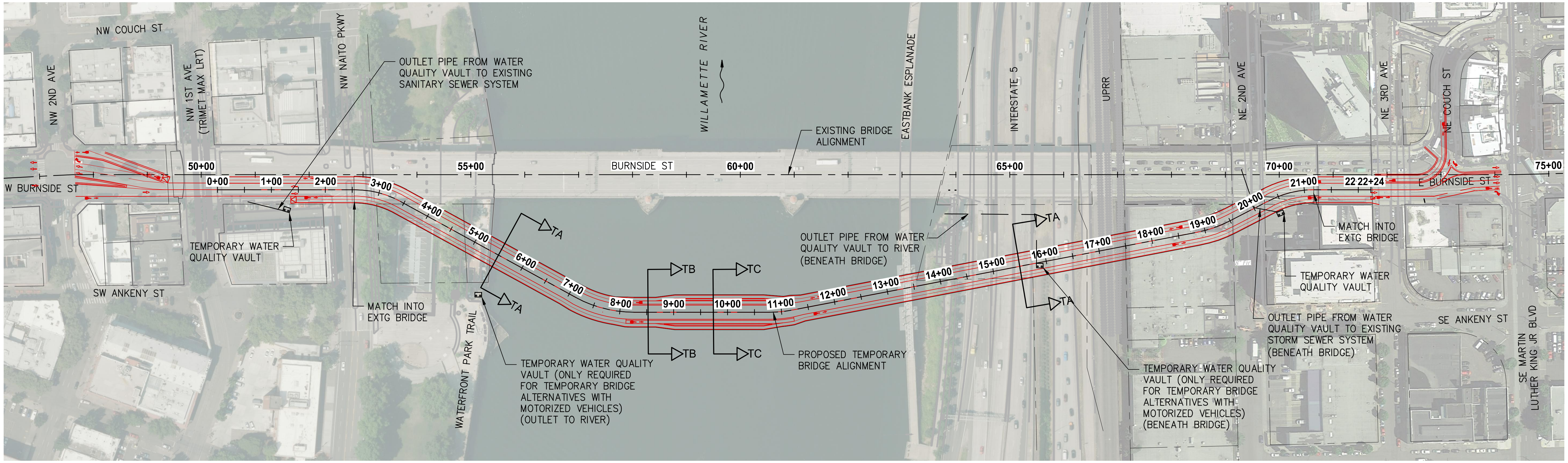
IAN B. CANNON P.E.
COUNTY ENGINEER

DESIGNED BY:
DRAFTED BY:
CHECKED BY:

REVISIONS

NO.	DATE:			

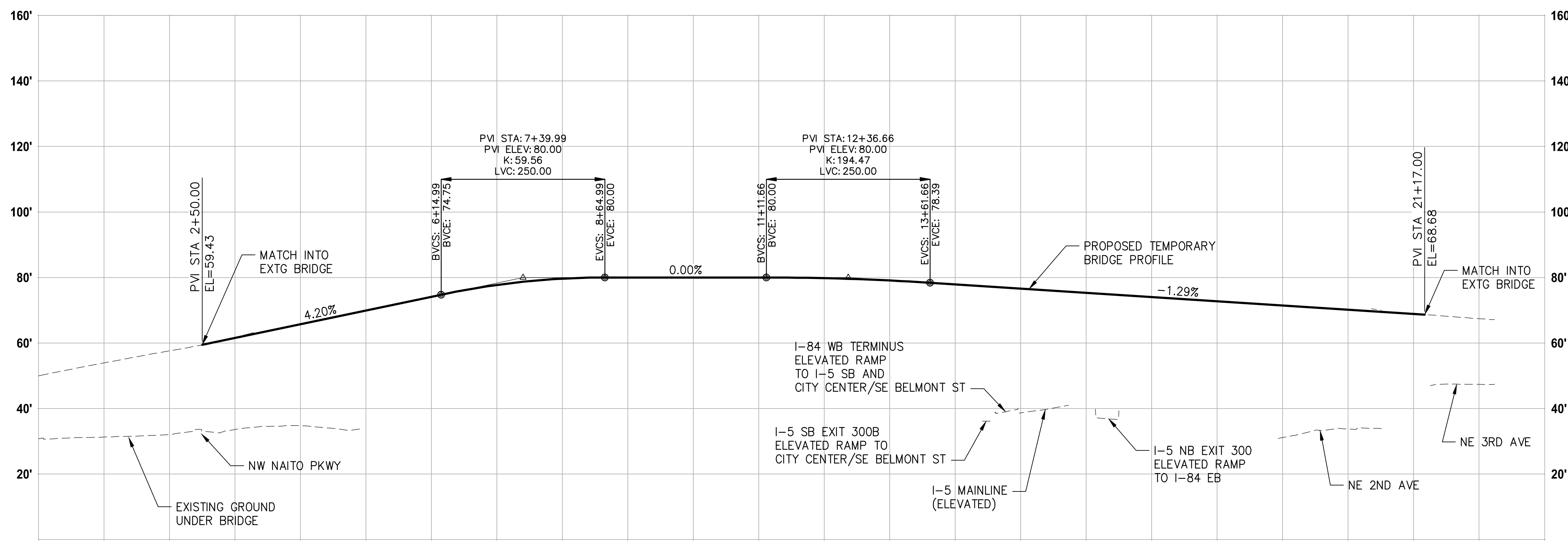
Sheet No. *RD24*



PLAN

SCALE: 1"=200'

NOTE: SEE SHEET T03 FOR TYPICAL SECTIONS



PROFILE

HORIZONTAL SCALE: 1"=200'
VERTICAL SCALE: 1"=40'

CONCEPTUAL PLANS
JUNE 2020

100 0 100
SCALE IN FEET

20 10 0

Earthquake Ready Burnside Bridge NEPA Phase

Temporary Detour Bridge Option

MULTNOMAH COUNTY

PROJECT NO.: *Proj No*

DATE: *Date*

MULTNOMAH COUNTY
DEPARTMENT OF COMMUNITY SERVICES
TRANSPORTATION DIVISION
1620 S.E. 190th AVE. PORTLAND, ORE. 97233-5999

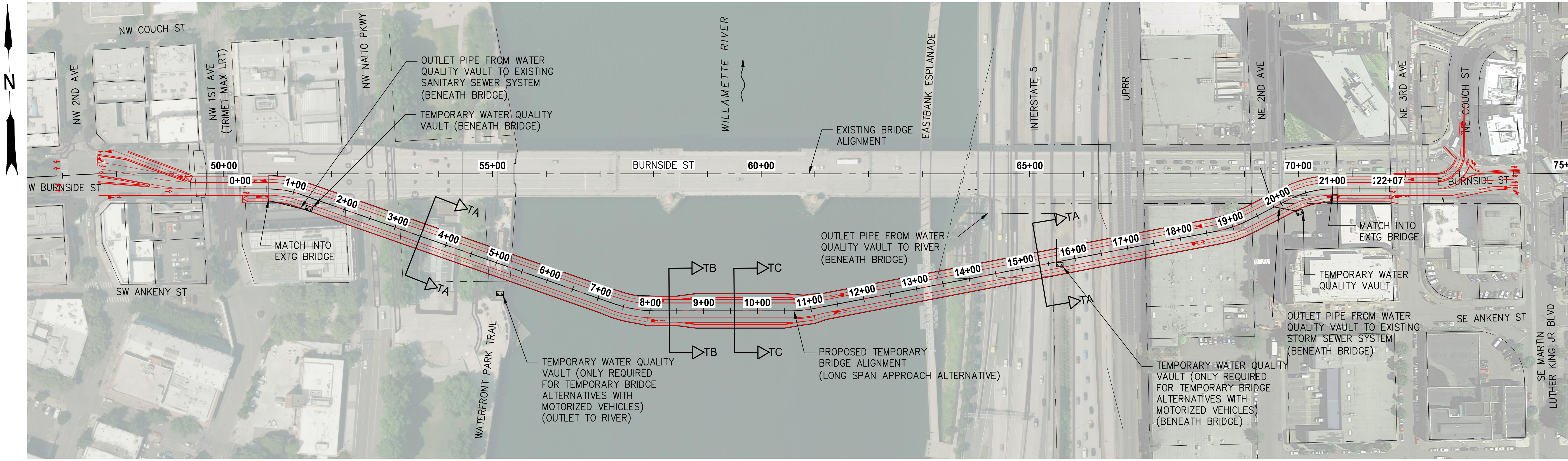
COUNTY ENGINEER
IAN B. CANNON P.E.

DESIGNED BY:
DRAFTED BY:
CHECKED BY:

REVISIONS

NO. DATE:

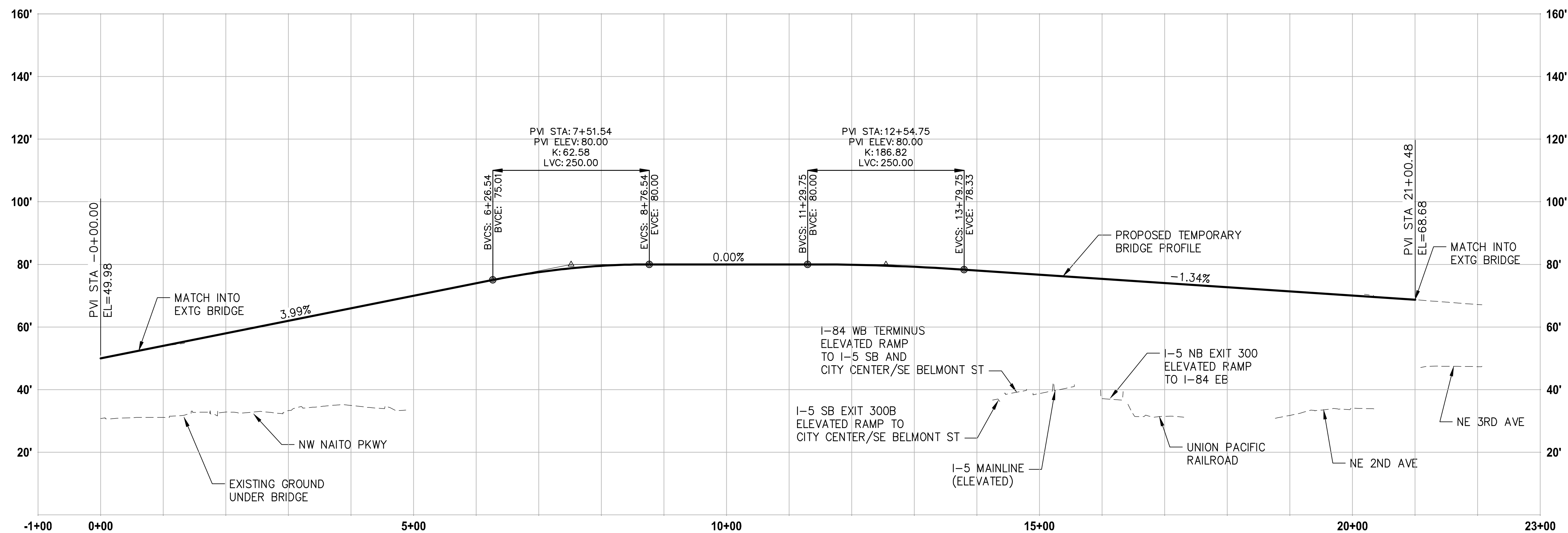
Sheet No. *T01*



PLAN

SCALE: 1"=200'

NOTE: SEE SHEET T03 FOR TYPICAL SECTIONS



PROFILE

HORIZONTAL SCALE: 1"=200'
VERTICAL SCALE: 1"=40'

CONCEPTUAL PLANS
JUNE 2020

100 0 100
SCALE IN FEET
0 10 20

Earthquake Ready Burnside Bridge NEPA Phase

Temporary Detour Bridge Option For Replacement Alt. With Long Span Approach

MULTNOMAH COUNTY

PROJECT NO.: Proj No

DATE: Date

MULTNOMAH COUNTY
DEPARTMENT OF COMMUNITY SERVICES
TRANSPORTATION DIVISION
1620 S.E. 190th AVE. PORTLAND, ORE. 97233-5999

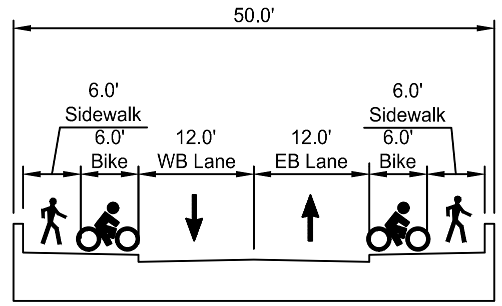
IAN B. CANNON P.E.
COUNTY ENGINEER

DESIGNED BY:
DRAFTED BY:
CHECKED BY:

REVISIONS

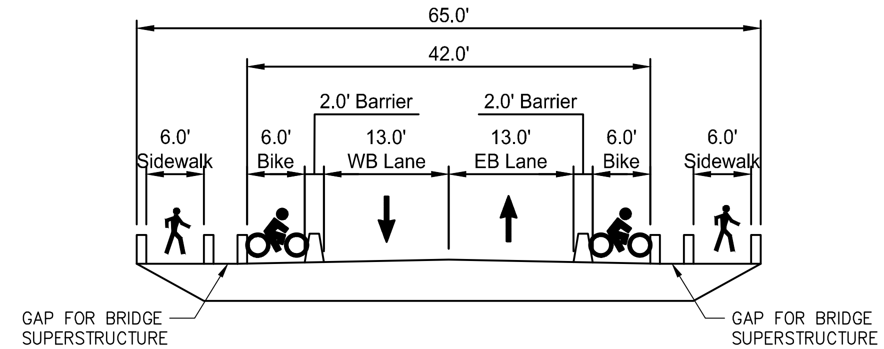
NO. DATE:

Sheet No.
T02



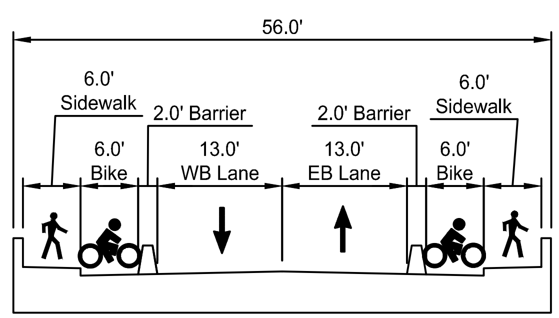
TYPICAL SECTION TA - ALL MODES

WEST & EAST APPROACH ON STRUCTURE
LOOKING EAST – NO SCALE



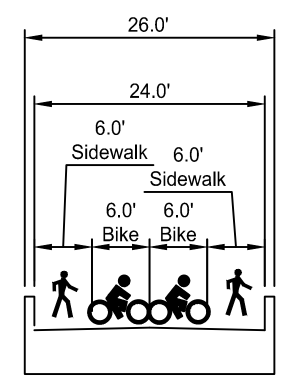
TYPICAL SECTION TC - ALL MODES

LIFT SPAN
LOOKING EAST – NO SCALE



TYPICAL SECTION TB - ALL MODES

WEST & EAST APPROACH ON STRUCTURE NEAR LIFT SPAN
LOOKING EAST – NO SCALE



TYPICAL SECTION TA/TB/TC - BIKE PED ONLY OPTION

NOT DRAWN ON SHEETS T01 AND T02
LOOKING EAST – NO SCALE

CONCEPTUAL PLANS
JUNE 2020

Earthquake Ready Burnside Bridge NEPA Phase

Temporary Detour Bridge Option
Typical Sections
MULTNOMAH COUNTY

PROJECT NO.: *Proj No*

DATE: *Date*

MULTNOMAH COUNTY
DEPARTMENT OF COMMUNITY SERVICES
TRANSPORTATION DIVISION
1620 S.E. 190th AVE. PORTLAND, ORE. 97233–5999

IAN B. CANNON P.E. COUNTY ENGINEER

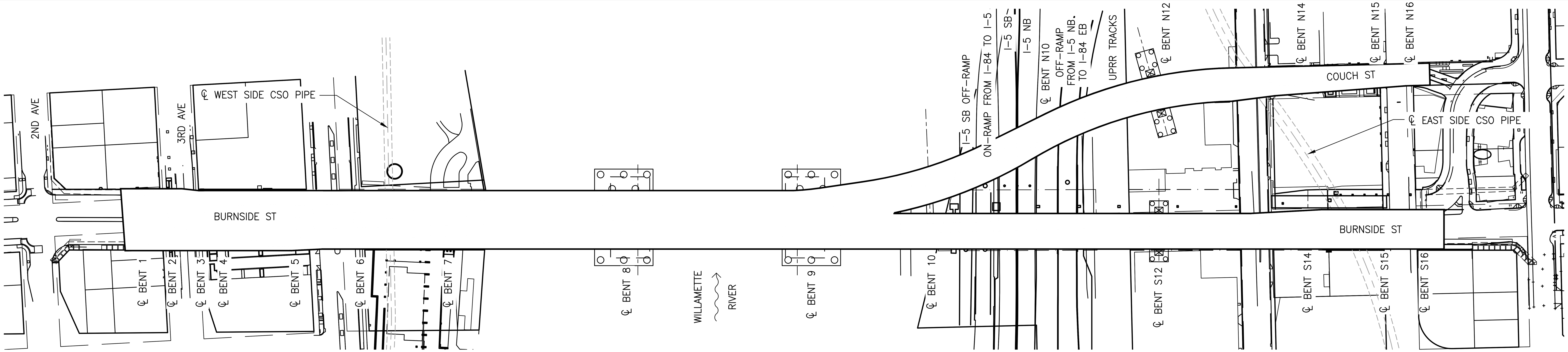
DESIGNED BY:
DRAFTED BY:
CHECKED BY:

REVISIONS

NO.	DATE:			

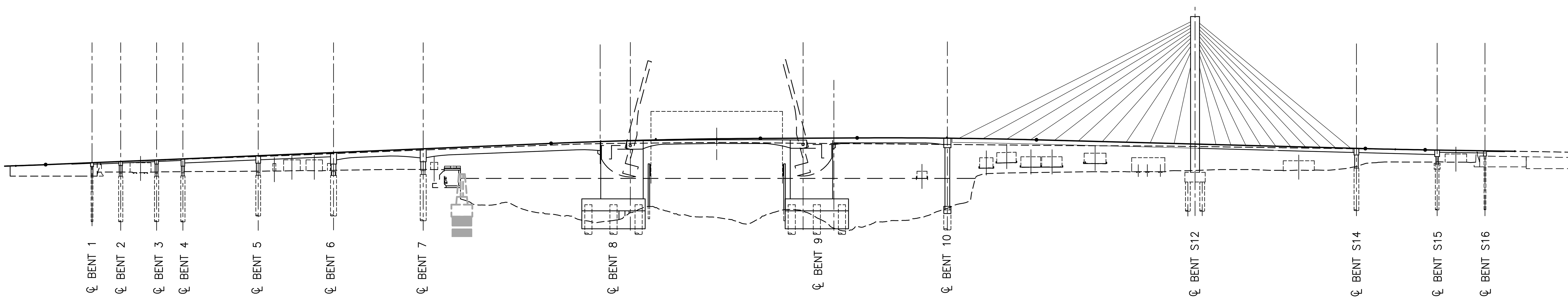
Sheet No.
T03

Appendix D. Couch Extension with East Approach Long-span Plan Sheets



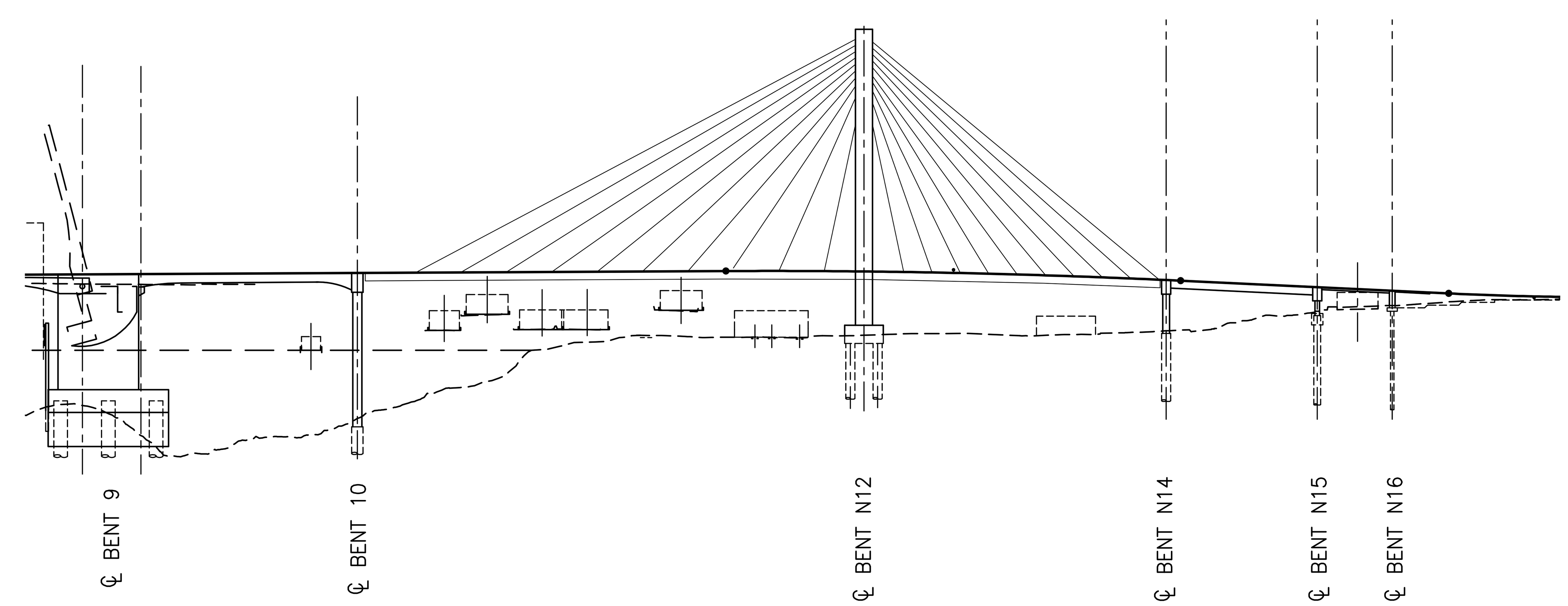
PLAN

SCALE: 1"=100'



ELEVATION

SCALE: 1"=100'



PARTIAL ELEVATION

DEVELOPED ALONG COUCH ST.
SCALE: 1"=100'

CONCEPTUAL PLANS
FEBRUARY 2020

Earthquake Ready Burnside Bridge

Replacement Movable Bridge (Bascule) With Coach Connection – East Approach Long Span

MULTNOMAH COUNTY

PROJECT NO.:

DATE:

MULTNOMAH COUNTY
DEPARTMENT OF COMMUNITY SERVICES
TRANSPORTATION DIVISION
1620 S.E. 190th AVE. PORTLAND, ORE. 97233-5999

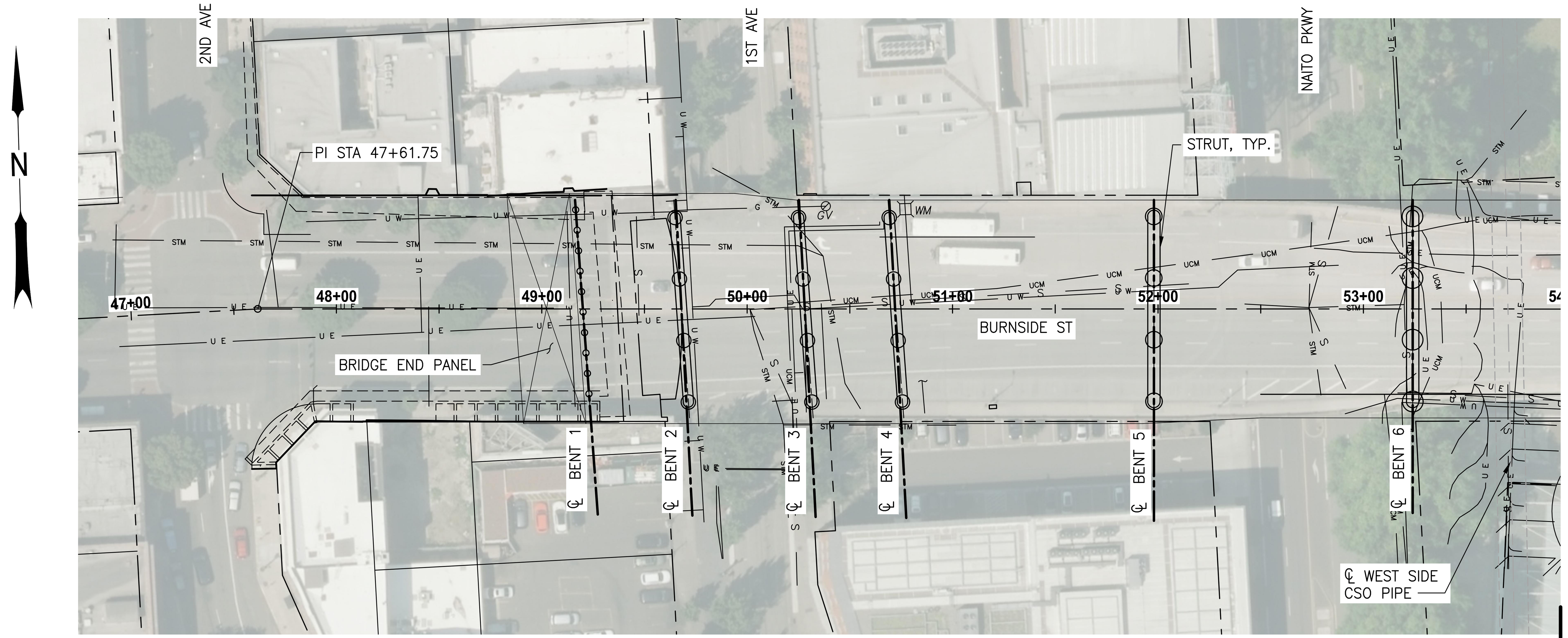
IAN B. CANNON P.E.   COUNTY ENGINEER

DESIGNED BY:
DRAFTED BY:
CHECKED BY:

REVISIONS

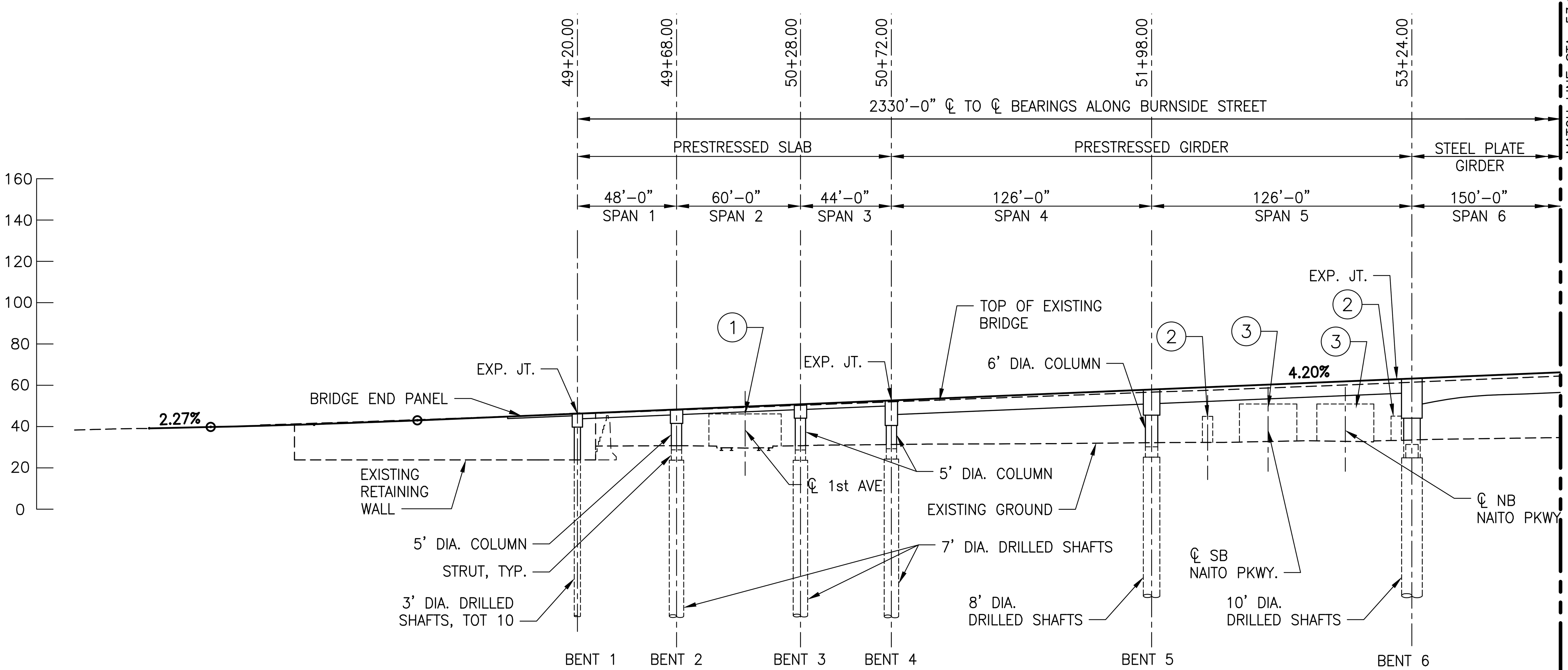
NO	DATE:				

Sheet No. EX01



PLAN

SCALE: 1"=40'



ELEVATION

SCALE: 1"=40'

CLEARANCE ENVELOPE LEGEND

1	LRT	15'-6"
2	PEDESTRIAN	12'-0"
3	CITY STREET	18'-0"
4	NAVIGATION	220'-0" W x UNLIMITED H
5	HIGHWAY	17'-4"
6	UPRR	23'-6"
7	CITY STREET @ 3rd AVE	13'-8"

CONCEPTUAL PLANS
FEBRUARY 2020

Earthquake Ready Burnside Bridge

Replacement Movable Bridge (Bascule) With Couch Connection – East Approach Long Span

MULTNOMAH COUNTY

DATE:

PROJECT NO.:

MULTNOMAH COUNTY
DEPARTMENT OF COMMUNITY SERVICES
TRANSPORTATION DIVISION
1620 S.E. 190th AVE. PORTLAND, ORE. 97233-5999

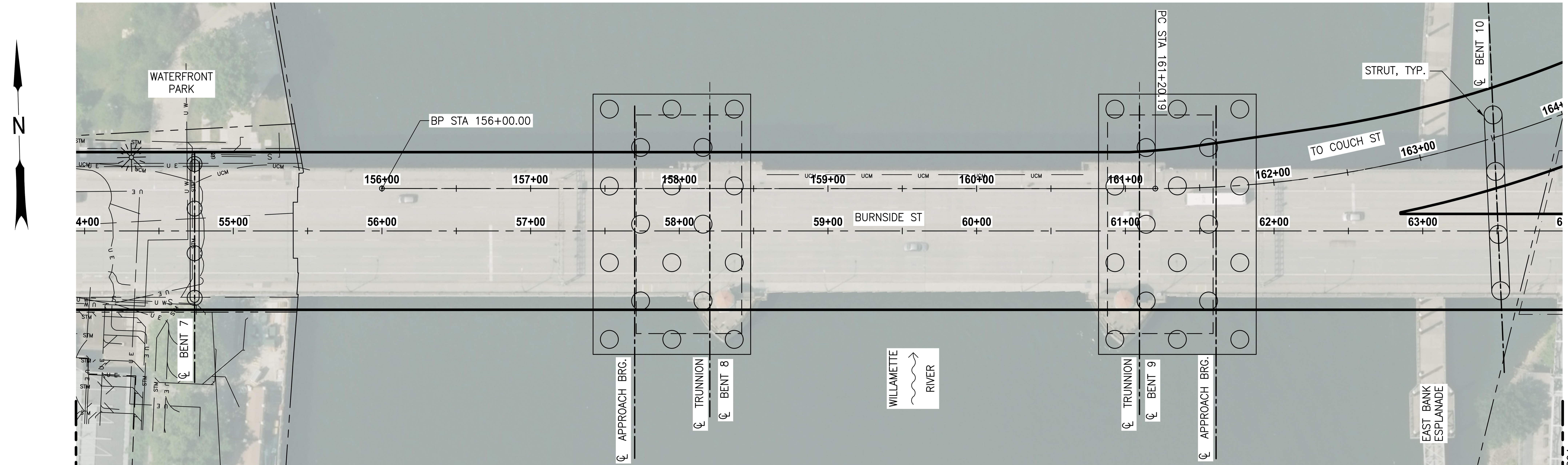
IAN B. CANNON P.E.
COUNTY ENGINEER

DESIGNED BY:
DRAFTED BY:
CHECKED BY:

REVISIONS

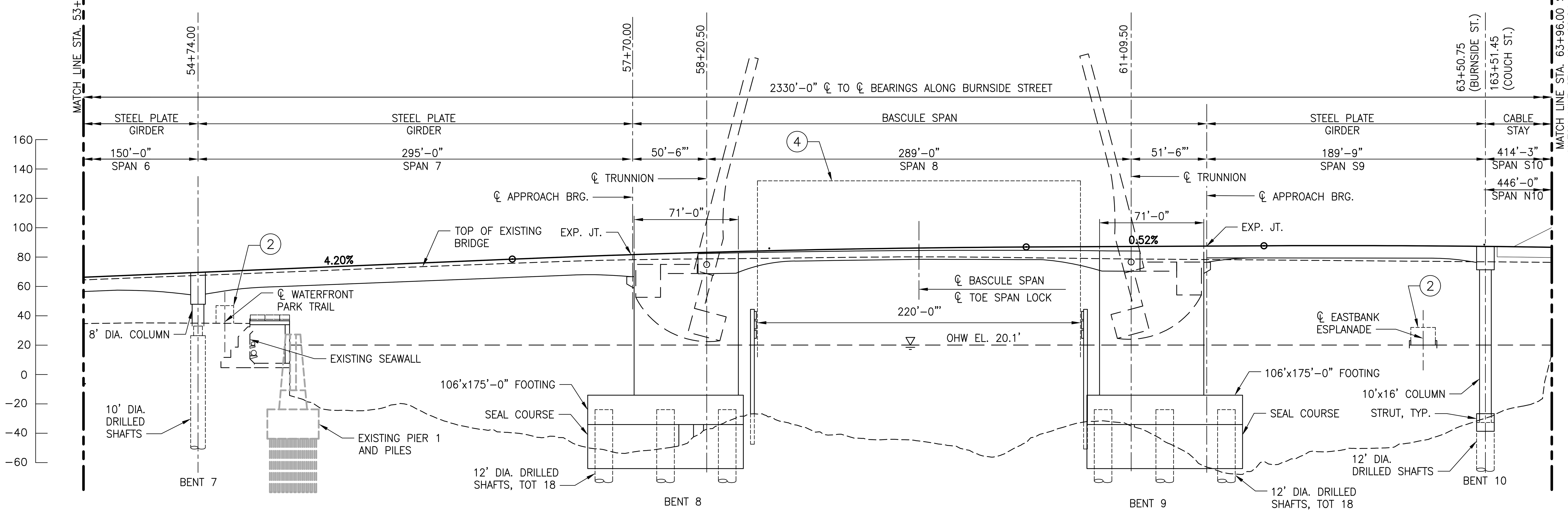
NO DATE:

Sheet No.
EX03



PLAN

SCALE: 1"=40'



ELEVATION

SCALE: 1"=40'

NOTE:
EASTBOUND BRIDGE ELEVATION SHOWN, FOR WESTBOUND BRIDGE SEE SHEET BR05.

CLEARANCE ENVELOPE LEGEND

1	LRT	15'-6"	5	HIGHWAY	17'-4"
2	PEDESTRIAN	12'-0"	6	UPRR	23'-6"
3	CITY STREET	18'-0"	7	CITY STREET @ 3rd AVE	13'-8"
4	NAVIGATION	220'-0" W x UNLIMITED H			

CONCEPTUAL PLANS
FEBRUARY 2020

Earthquake Ready Burnside Bridge

Replacement Movable Bridge (Bascule) With Couch Connection - East Approach Long Span

MULTNOMAH COUNTY

DATE:

PROJECT NO.:

MULTNOMAH COUNTY
DEPARTMENT OF COMMUNITY SERVICES
TRANSPORTATION DIVISION
1620 S.E. 190th AVE. PORTLAND, ORE. 97233-5999

IAN B. CANNON P.E.

COUNTY ENGINEER

DESIGNED BY:

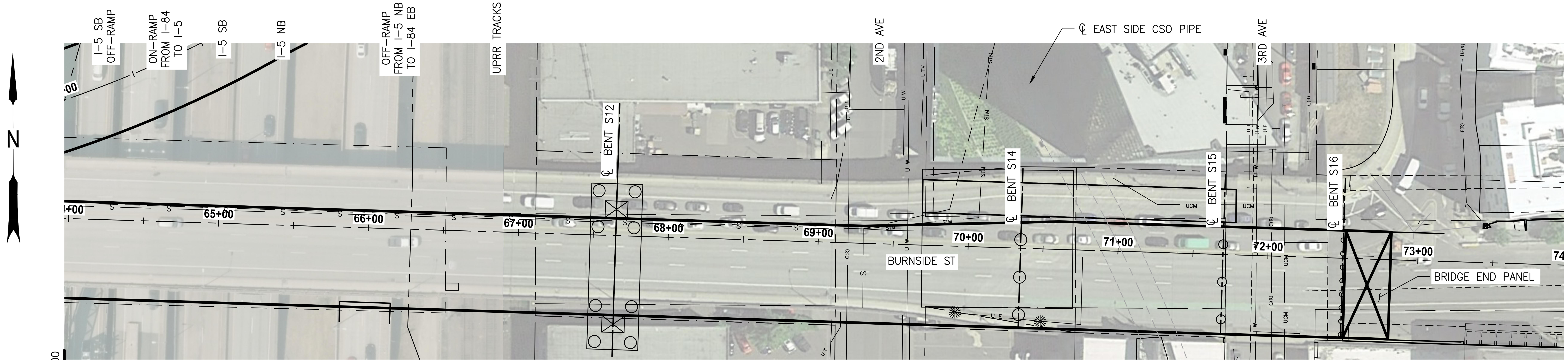
DRAFTED BY:

CHECKED BY:

REVISIONS

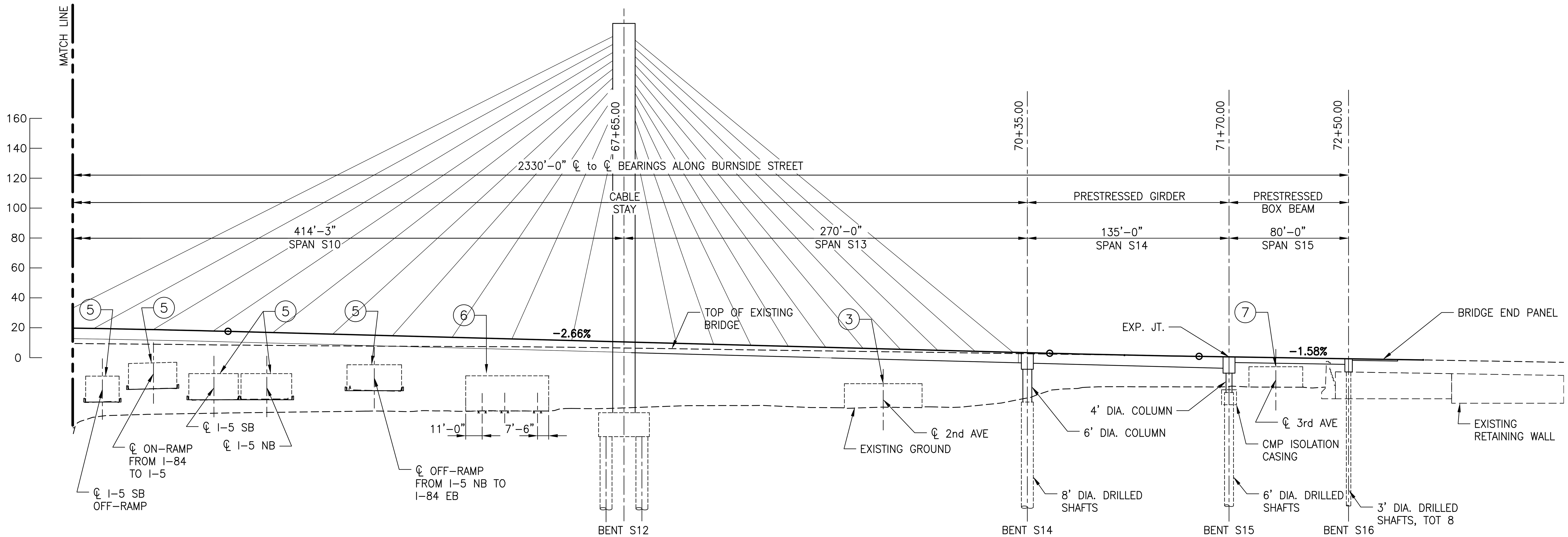
NO | DATE:

Sheet No.
EX04



PLAN

SCALE: 1"=40'



ELEVATION

SCALE: 1"=40'

NOTE:
EASTBOUND BRIDGE ELEVATION SHOWN, FOR WESTBOUND BRIDGE SEE BR05.

CLEARANCE ENVELOPE LEGEND

1	LRT	15'-6"
2	PEDESTRIAN	12'-0"
3	CITY STREET	18'-0"
4	NAVIGATION	220'-0" W x UNLIMITED H
5	HIGHWAY	17'-4"
6	UPRR	23'-6"
7	CITY STREET @ 3rd AVE	13'-8"

CONCEPTUAL PLANS
FEBRUARY 2020

Earthquake Ready Burnside Bridge

Replacement Movable Bridge (Bascule) With Couch Connection – East Approach Long Span

MULTNOMAH COUNTY

DATE:

PROJECT NO.:

MULTNOMAH COUNTY
DEPARTMENT OF COMMUNITY SERVICES
TRANSPORTATION DIVISION
1620 S.E. 190th AVE. PORTLAND, ORE. 97233-5999

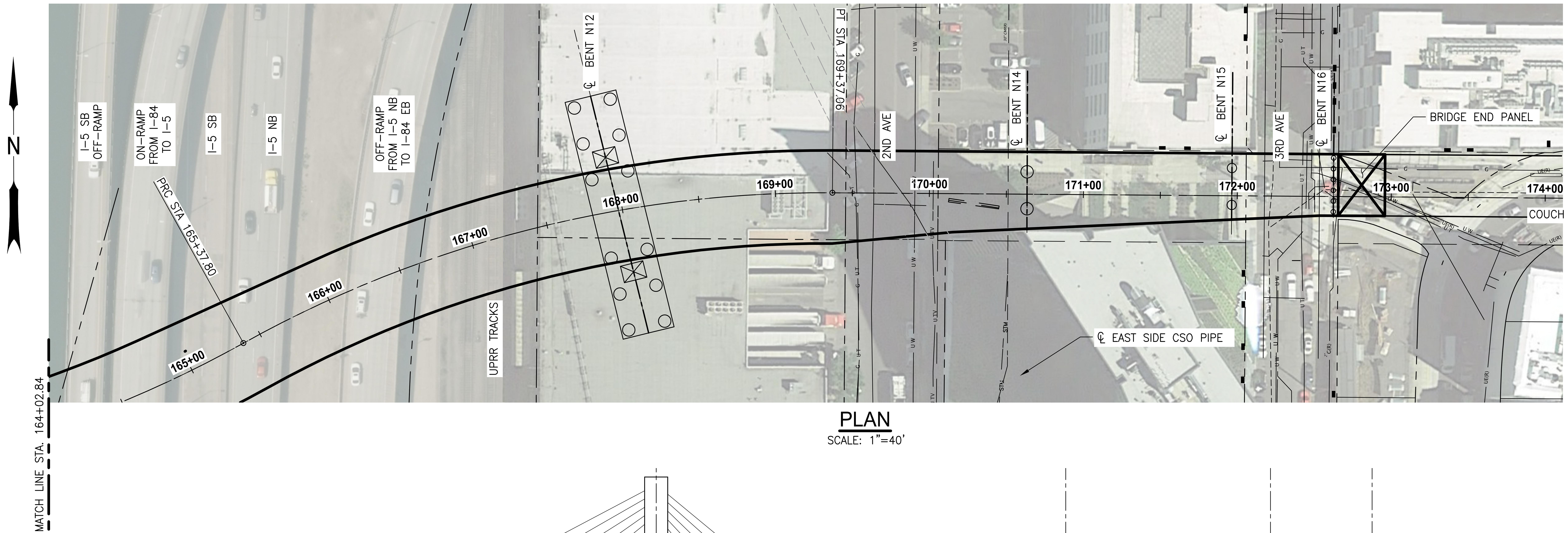
IAN B. CANNON P.E. COUNTY ENGINEER

DESIGNED BY: DRAFTED BY: CHECKED BY:

REVISIONS

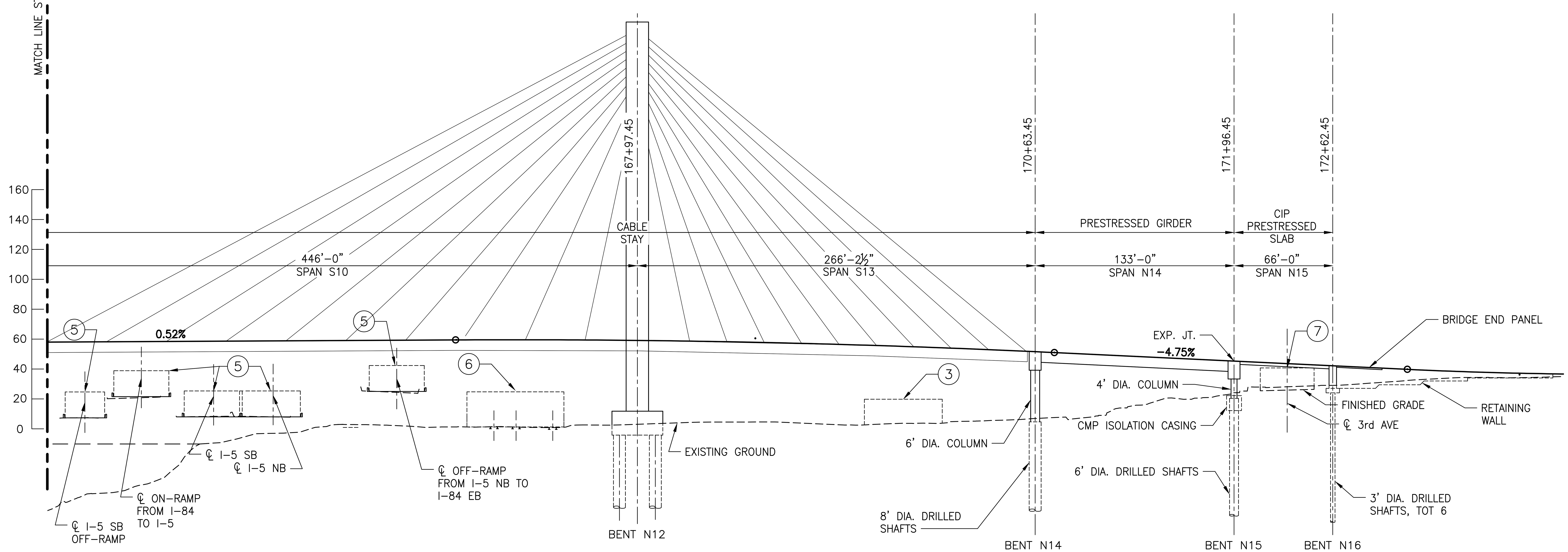
NO DATE:

Sheet No.
EX05



PLAN

SCALE: 1"=40'



DEVELOPED ELEVATION

SCALE: 1"=40'

NOTE:
WESTBOUND BRIDGE ELEVATION SHOWN, FOR EASTBOUND BRIDGE, SEE BR04.

CLEARANCE ENVELOPE LEGEND

1	LRT	15'-6"	5	HIGHWAY	17'-4"
2	PEDESTRIAN	12'-0"	6	UPRR	23'-6"
3	CITY STREET	18'-0"	7	CITY STREET @ 3rd AVE	13'-8"
4	NAVIGATION	220'-0" W x UNLIMITED H			

CONCEPTUAL PLANS
FEBRUARY 2020

Earthquake Ready Burnside Bridge

Replacement Movable Bridge (Bascule) With Couch Connection – East Approach Long Span

MULTNOMAH COUNTY

PROJECT NO.:

DATE:

MULTNOMAH COUNTY
DEPARTMENT OF COMMUNITY SERVICES
TRANSPORTATION DIVISION
1620 S.E. 190th AVE. PORTLAND, ORE. 97233-5999

IAN B. CANNON P.E. COUNTY ENGINEER

DESIGNED BY:
DRAFTED BY:
CHECKED BY:

REVISIONS

NO DATE:

Sheet No.
EX07