Van Buren Bridge Relocation Study

Prepared for:

PreservationWORKS

Prepared by:

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8/3/2020

Contents

1 Executive Summary

The current, existing NW Van Buren Avenue Bridge, located in Corvallis, Oregon, is a steel through-truss bridge that came into use in 1913. The bridge crosses the Willamette River from City of Corvallis (Benton County) to Linn County on OR34/Highway 210EB, carrying a single lane of eastbound vehicular traffic. The bridge is scheduled for replacement sometime in the next three years, with a future design already established to increase vehicular traffic lanes.

New Replacement Bridge
Oregon Department of Transportation (ODOT) has a project for the replacement bridge. The design engineering firm for the new bridge is DOWL Engineers. The new replacement bridge has a similar alignment to the existing, making necessary the relocation or demolition of the existing steel truss bridge and approach spans.

Currently, ODOT is advertising the existing truss bridge for sale, with stipulated requirements for its relocation or demolition that allow the new proposed work to proceed unhindered by and free of the existing bridge ownership liabilities to ODOT.

The new replacement bridge project is funded by infrastructure resources made available through Oregon House Bill 2017, which may involve federal funding as well. DAP documents have been prepared, and currently, preparation of final design documents is underway. Stipulations of the funding may not allow offsetting cost savings, which may have been possible by use of the existing bridge as a detour bridge during construction of the new bridge or by reducing the multi-use aspects of the new bridge (pedestrian, bicycle, etc.).

Existing Bridge
The Van Buren Bridge has been determined to be eligible for listing in the National Register of Historic Places. The Corvallis community has expressed interest in seeing the bridge relocated and repurposed as a pedestrian and bicycle bridge.

The purpose of this report is to describe and quantify the effort required to perform the bridge relocation and repurposing without the advantage of offsetting costs. There are certain aspects of construction that have a dual purpose, benefiting both the new bridge construction as well as the relocation of the existing bridge. The shared costs associated with both new construction and relocation will be identified. Additionally, the report covers advantages of repurposing the historically significant existing bridge for public pedestrian and bicycle use.

Smith Monroe Gray Engineers, Inc. (SMG) and PreservationWORKS have compiled this report to provide concept details for the proposed bridge relocation and oversight on the new substructure design. In addition to this report, see appendix for SMG drawings showing the relocated bridge and moving operations.

SMG has considerable experience in construction engineering for bridge construction, demolition, jacking and lifting, and moving operations.

2 Existing Van Buren Bridge Background

The 1913 bridge (ODOT Bridge No. 02728) was built by Andrew J. Porter (Engineer) and the Coast Bridge Company. The bridge consists of 3 main truss spans: a Pratt through-truss, pinn-connected and riveted steel pivot span (or swing span) and a Parker through-truss pin connected span. The approach spans consist of a Warren pony truss and several timber trestles on the East approach and a modified steel structure connecting at 1st street on the West approach. The substructure consists of concrete river piers, abutment and wing walls, and one concrete pivot pier located at the center of the Pratt truss swing span.

The superstructure consists of timber stringers for the 17' curb-to-curb roadway, with panelized wood decking, topped with waterproof membrane and asphalt wearing surface. The bridge has been repainted and the deck surface replaced, along with other maintenance improvements, in the last 22 years, at an approximate cost of over $3,000,000. There currently exists a sidewalk structure appended to the south side of the trusses, constructed of wood stringers, wood plank deck and wood pedestrian guardrail.

This rare pin-connected swing span type bridge is historically significant and an example of bridge engineering and construction over navigable waterways in the early twentieth century.

3 Bridge Relocation Procedure

The proposed relocation site is 175 feet upstream (south) of the existing location (See Figure 1, below). The Parker truss span and Pratt truss swing span will slide by use of the project work bridge that is required for construction of the new bridge. Work bridge finger spans will be added to access installation of the new bridge location piers. These finger spans will also function as supports for the sliding process. The bridge slide process is as follows:

1. Steel support stands founded on the deck of the work bridge
2. Continuous slider beams placed on the steel stands
3. Jack trusses up off of the existing supports and placed on sled beams at piers 1, 2, and 4
4. At pier 3, cut openings through the existing walls at four locations to accept the slider and sled beam
5. Preload sled beams with the anticipated weight of the swing spans, rotating system, and top slab of Pier 3
6. Cut free top slab from the supporting cylindrical walls
7. Simultaneously pull all three truss spans along the slider beams to the new location
8. Jack spans off sled beams and lower down onto new support piers

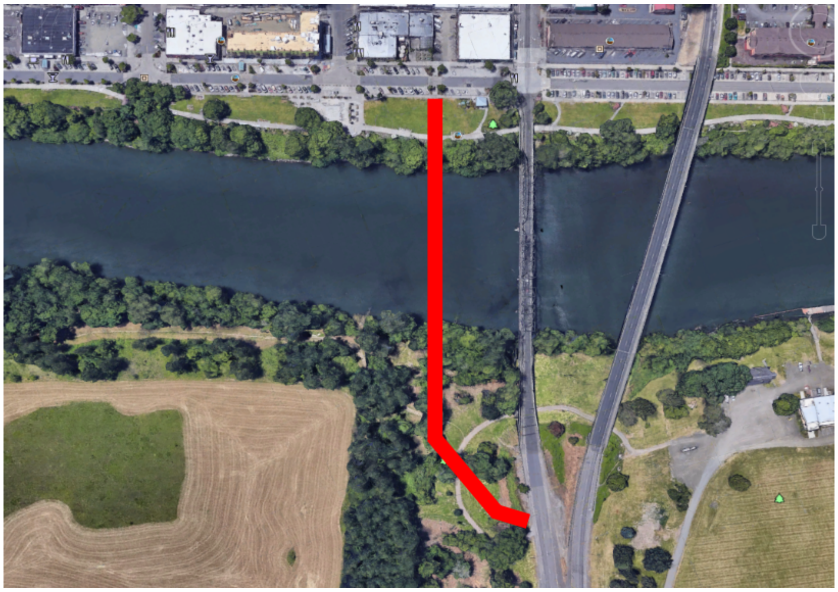


Figure 1: Location of Relocated Bridge

4 Final Configuration of Relocated Bridge

In the final relocated state, the bridge consists of the three moved truss spans, new East approach consisting of four 114 ft precast concrete box girder spans (which are currently available from an earlier ODOT project for only the cost of transport), and a new 30 ft concrete flat slab span at the west approach.

The relocated truss will bear on concrete columns founded on concrete shafts at Piers 2 and 3. Piers 1 and 4 will consist of driven pipe pile. The existing traffic guardrail will be modified to accommodate pedestrian guardrail requirements.

The East approach box girder spans are supported by pile-founded bents, and the new spans will receive a standard side-mounted steel pedestrian guardrail.

5 Benefits

The relocation and repurposing of the existing Parker truss span and Pratt truss swing spans has the following benefits:

- Reduced demo and disposal effort and cost

- Historical preservation of this rare pin-connected swing span truss bridge
- Pedestrian and bicycle use (separate from vehicular use)
- Construction cost savings by use of dual-purpose work bridge
- The relocation of the existing bridge has a lower deck elevation than the new bridge, allowing pedestrian and bicycle grades to be at a gentler incline and decline
- The proposed relocated alignment brings the bridge west approach into the river park area with grades blending to approach features of the new Van Buren Bridge as well as blending to existing park features to the south
- Navigational clearance is accounted for by reintroducing the original swing span, which allows bridge structure to remain at a lower elevation
- Deck elevations of the new Van Buren bridge and existing Harrison bridge are higher and therefore, the grades are steeper and longer than those of this proposed relocated bridge
- The two main vehicular bridges position pedestrian and bicycle traffic adjoining heavy highway traffic and noise
- River front activities would have the opportunity to use relocated bridge without highway traffic activity and noise
- The repurposed bridge is capable of carrying maintenance vehicles to maintain the bike path and parks at both sides of the river

6 Concerns

The concerns associated with this relocated bridge are in relation to the navigational clearance and existing as-built substructure drawings.

1. Consideration for providing a navigational clearance still exists, even with the unlikely event that a large vessel would be at this location on the river (the existing bridge has not been opened since 1960). Below is a list of the issues with opening the bridge in the rare event that a large vessel requires passage:
   - The relocation plan will not cause any change in the swing span support and rotational hardware. 1940 dated drawings indicate rollers at the Piers 2 and 4 supports were removed and replaced with fixed steel supports that incorporated steel shims. It is *assumed* ODOT had an opening procedure after 1940 that involved jacking at the Pier 2 and 4 supports to remove shims and allow the spans to swing free of the piers. The procedure for the new location would be the same. Therefore, the timeline from request for opening to actual opening would not change from that assumed to be currently in place.
   - Historic pictures indicate the bridge was opened using a removable capstan type device that personnel would operate. It is unknown if this device exists. Opening will most likely require winching from the new bridge or from anchored floats.

- Some portion of the swing span deck would require removal and replacement in the event of an opening.
- Costs to prepare the spans for an unlikely swing opening are estimated and included as a low-risk maintenance cost possibility.

2. Existing legible as-built drawings of the bridge substructure are required and shall be provided to verify assumptions made concerning dimensions and concrete reinforcing as follows:
    - The thickness and reinforcing of the concrete cylindrical walls of Pier 3
    - The thickness, diameter, and reinforcing of the top slab supporting the rotation hardware at Pier 3.
    - Details of the rotational hardware at Pier 3.
    - Dimensional details and reinforcing for Piers 1, 2, and 4.

7 Cost and Maintenance

The cost for preparing new seismic-resilient substructures, moving the truss spans, performing repair and upgrades, and construction of approach spans and ramps is estimated to be $6,000,000, which includes a 45% contingency. As mentioned previously, there are few offsetting costs, since using the existing bridge as a detour and/or reducing pedestrian/bicycle requirements on the new bridge were disallowed during the project programming phase. However, not having the cost of demolition and disposal is an actual cost savings to the project.

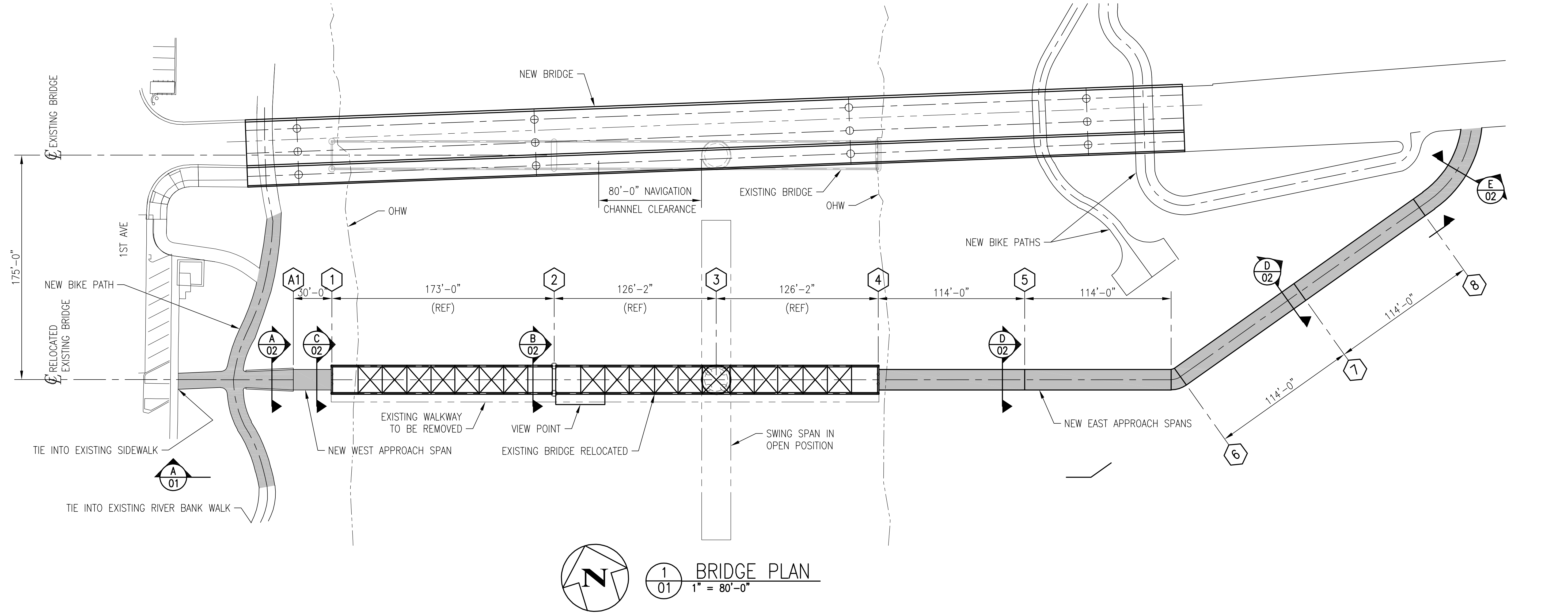
The bridge is sound for its proposed intended use of pedestrian and bicycle access. The bridge is currently load rated at 80,000 lb GVW for vehicular use (20,000 lb single axle; 34,000 lb tandem). For uniform loading, the bridge has been designed for 100 psf live loading, which exceeds current AASHTO live loading pedestrian/bicycle requirements. Some members may require upgrade and are included in repurposing costs. Findings from coupon analysis on the existing steel show weldable, ductile, and not exceptionally fatigue-prone steel. Due to maintenance and improvements in the last 22 years (costing approximately $3,000,000), the bridge structure requires minimal maintenance in the near future.

8 Conclusion

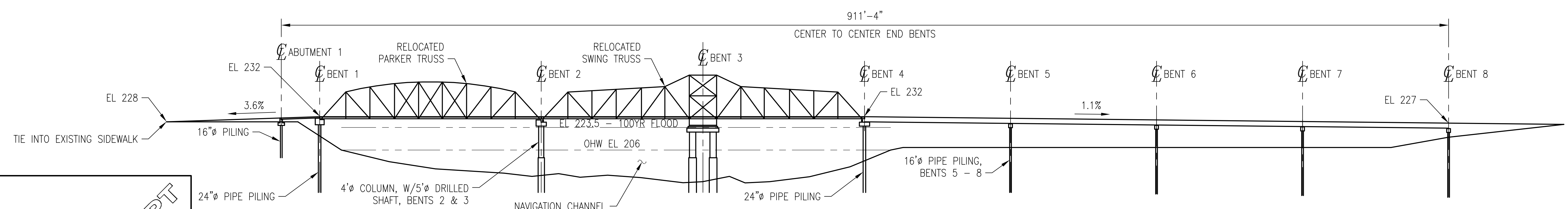
The benefits of relocating and repurposing the existing Van Buren truss spans make this project feasible from the perspective of costs and future use of the bridge. The project will provide a very friendly pedestrian crossing in terms of profile grades and elevation change when compared to the proposed new bridge.

Considering maintenance, repurposing other bridges as part of the “Rails to trails” program has shown that historical steel truss bridges can be preserved and perform for many decades with minimal coating maintenance if they are kept free of debris.

9 Appendix



1 / 01 BRIDGE PLAN
1" = 80'-0"



A / 01 BRIDGE ELEVATION
1" = 80'-0"

DRAFT CONCEPT
RELOCATION STUDY

SYM.	REVISIONS	BY	DATE	CHK'D
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VAN BUREN BRIDGE REPLACEMENT

BRIDGE RELOCATION CONCEPT
PLAN

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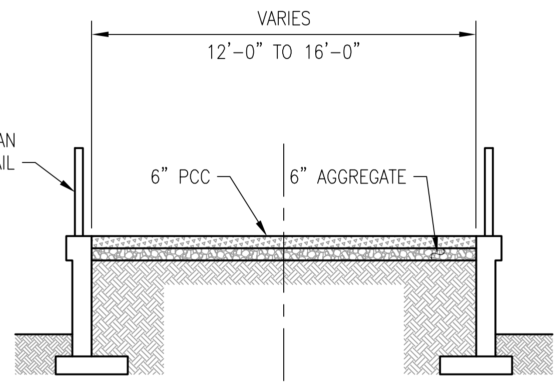

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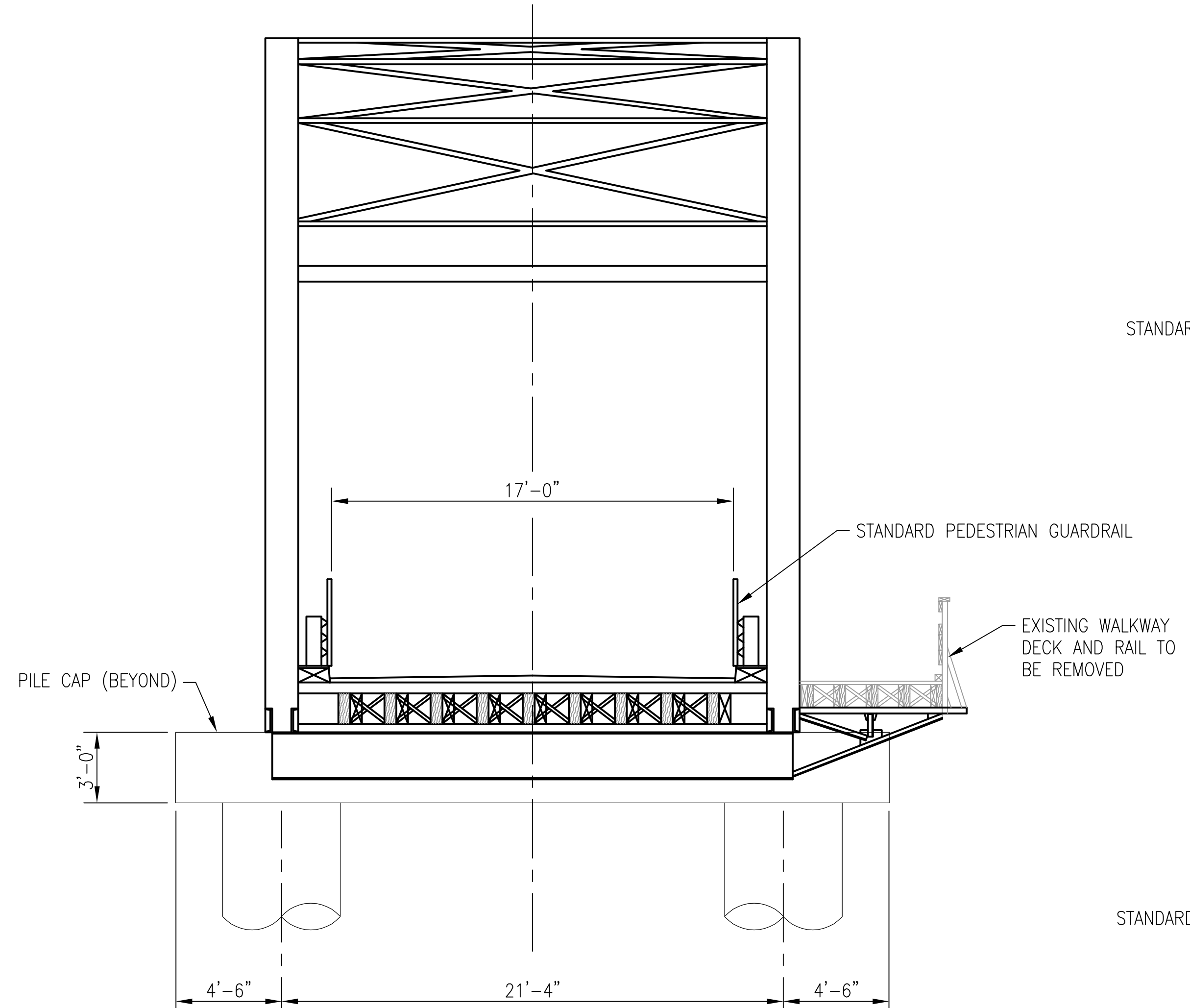

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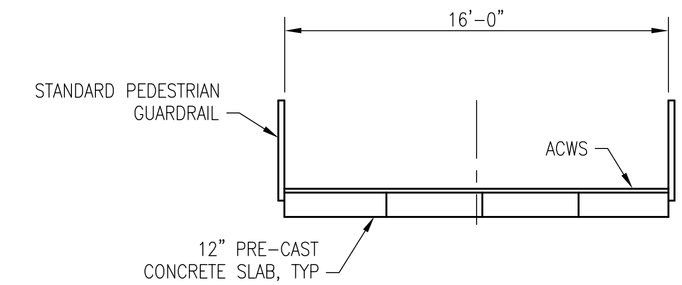

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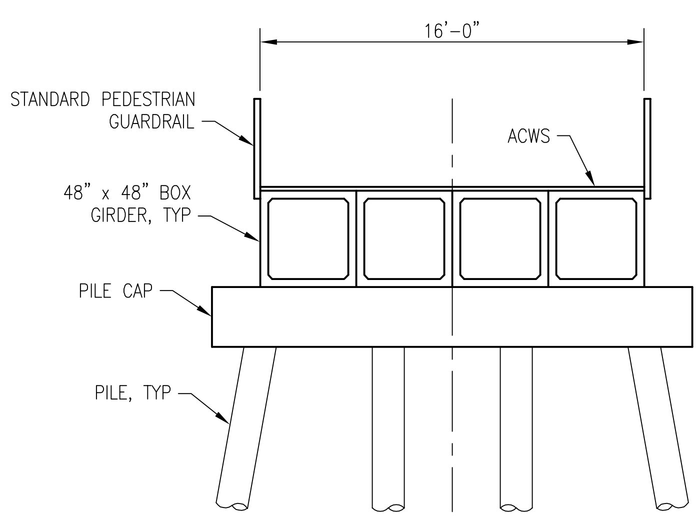

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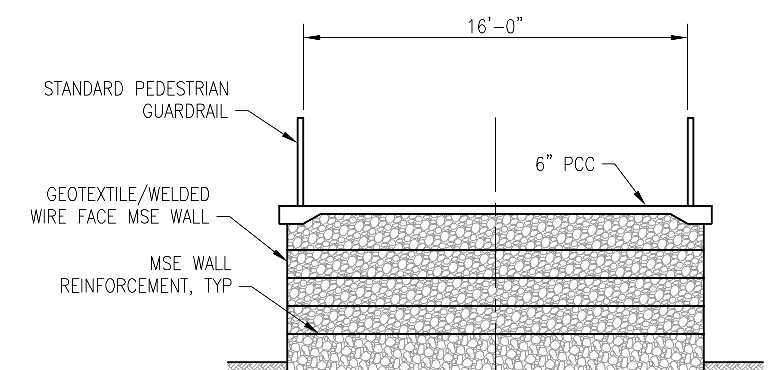

E SECTION
02 1/8" = 1'-0"

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BRIDGE RELOCATION CONCEPT
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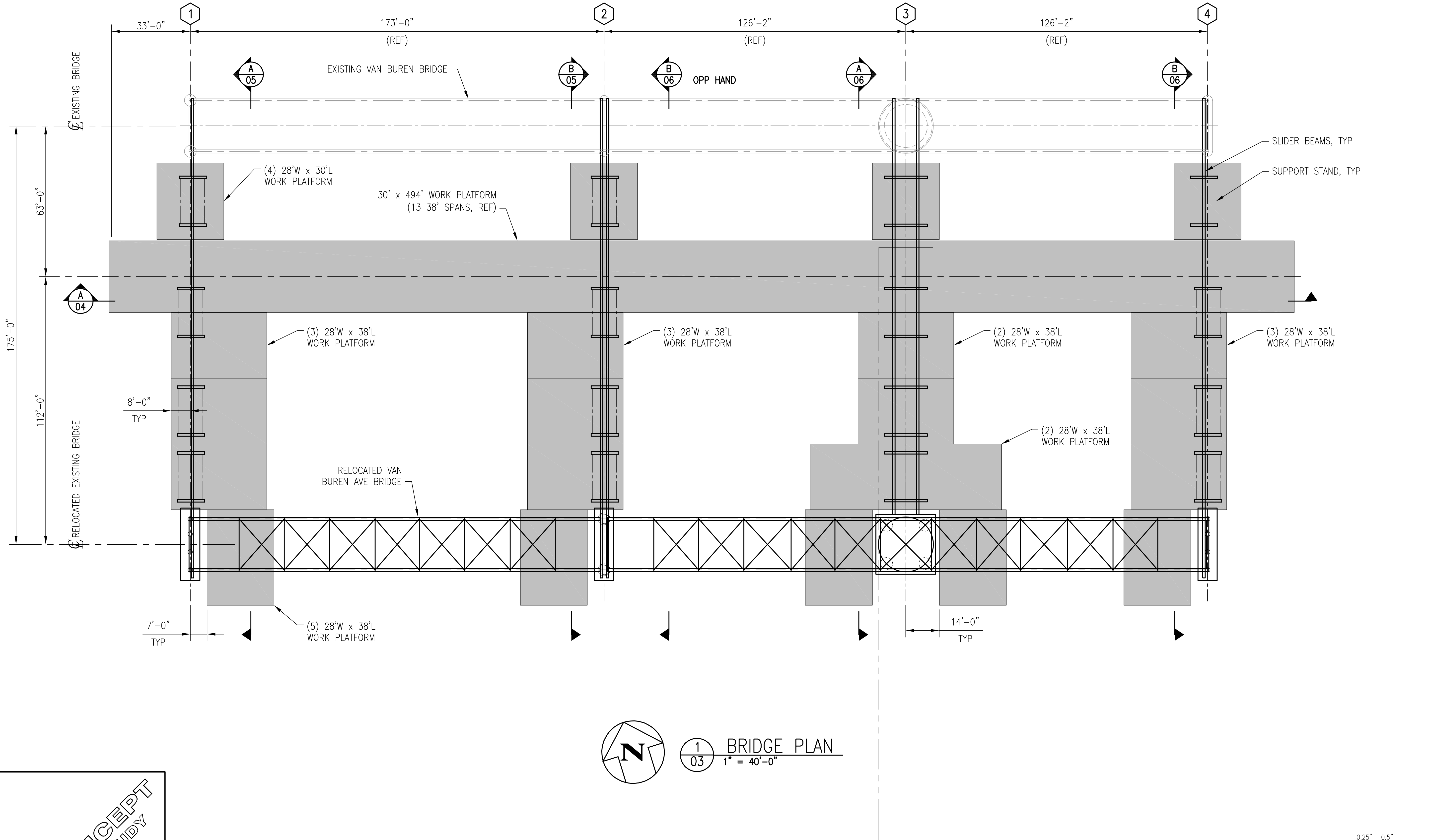
0.25" 0.5" 1"
1:1



1 / 03 BRIDGE PLAN
1" = 40'-0"

0.25" 0.5" 1"
1:1

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BRIDGE RELOCATION CONCEPT
WORK TRESTLE PLAN

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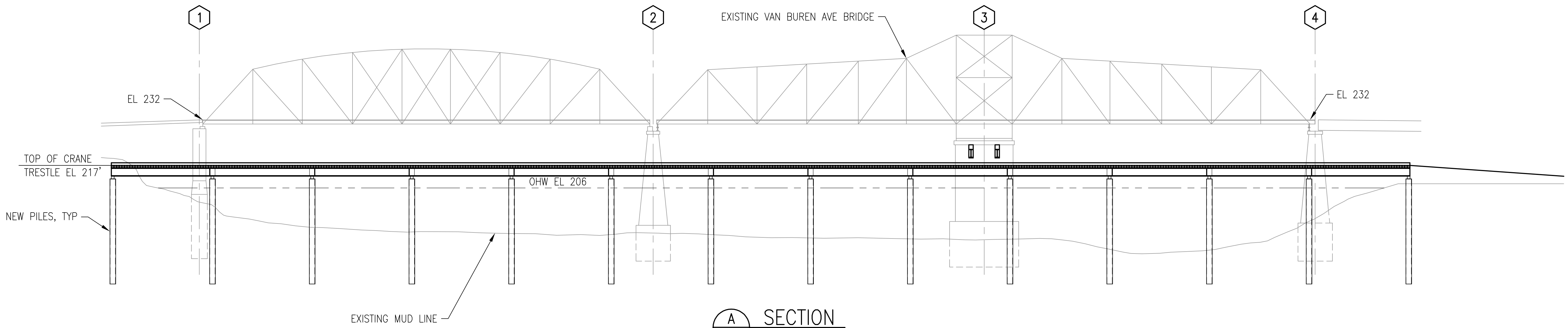

A/04 SECTION
1" = 40'-0"

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RELOCATION STUDY

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BRIDGE RELOCATION CONCEPT
ELEVATION

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0.25" 0.5" 1"
1:1

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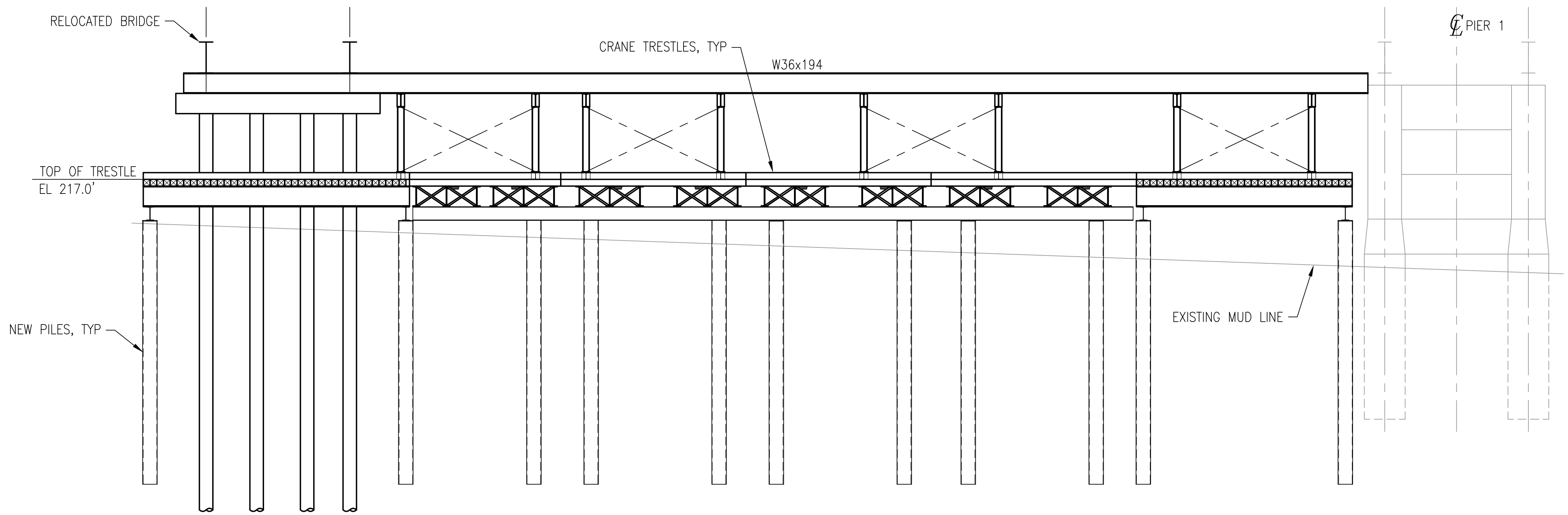

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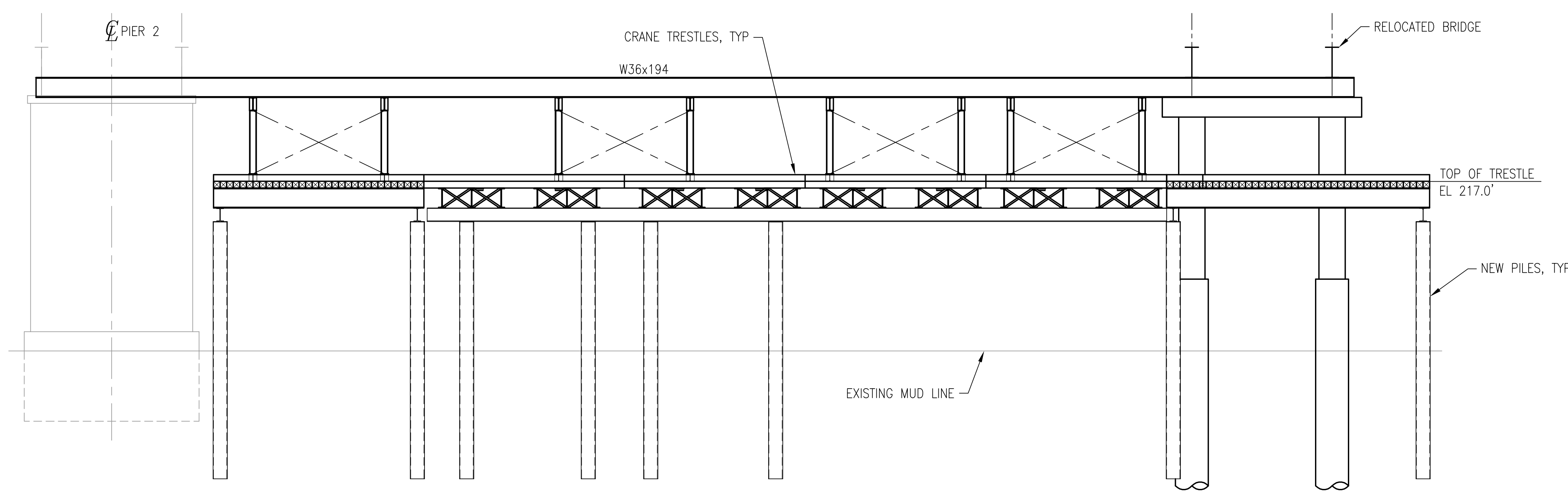

B/05 SECTION – PIER 2
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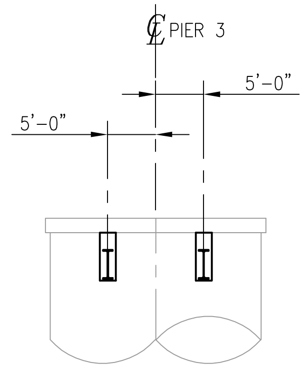

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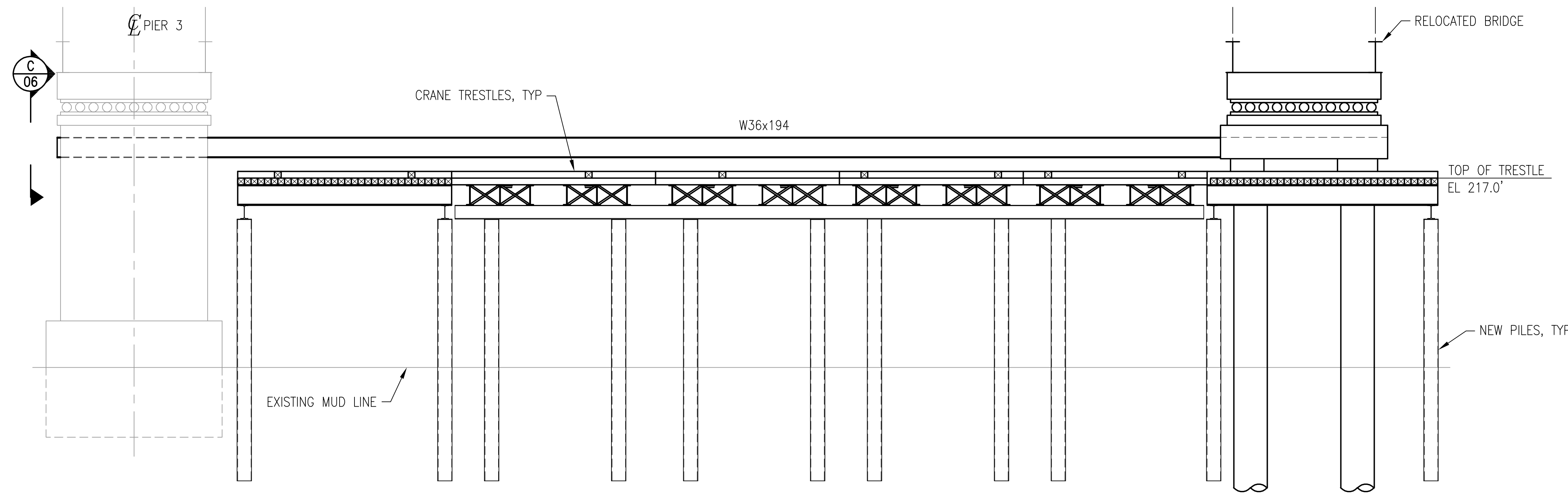

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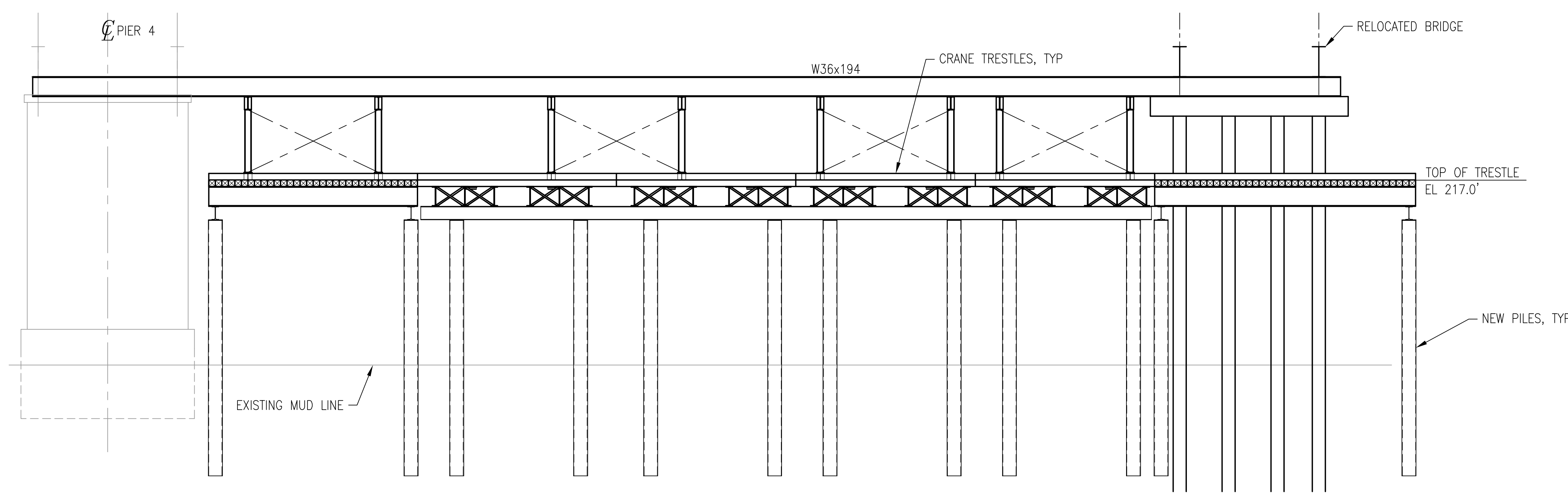

B/06 SECTION – PIER 4
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PROJECT ESTIMATED COSTS

CONSTRUCTION COST		
New Construction		
New River Substructures	$	1,002,394
West Approach	$	252,105
East Approach	$	766,401
New Repurpose Work/Slide Bridge	$	682,400
Slide Move	$	739,000
	$	3,442,300
45% Contingency	$	1,549,035
Design Engineering	$	600,000
Construct. Services	$	350,000
	$	5,941,335
	$6 Million	
DEMOLISION COST		
Necessary Demolition		
Substructure	$	455,000
Trestle Approach Demo	$	82,000
Pier Containment Coffer	$	129,000
	$	666,000
Avoided Demo (Possible Cost Credit)		
River Span Trusses Demo	$	790,000

MAINTENANCE COSTS WILL BE FORTHCOMING