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April 6, 2021

Oklahoma Department of Transportation
Project Management Division
200 NE 21st Street
Oklahoma City, OK 73105

Re: JP 33873(07) US-70 over Lake Texoma (Roosevelt Bridge)
Phase 1 – Analysis of Existing Bridge

Scope of Services and Purpose of Memo

The Oklahoma Department of Transportation (ODOT) is proposing to correct the existing at-risk bridge on US-70 over Lake Texoma (Roosevelt Bridge) in Bryan and Marshall Counties. The existing bridge has been determined eligible for inclusion in the National Register of Historic Places (NRHP). In accordance with the Department of Transportation Act of 1966, a Section 4(f) alternatives analysis is required to show that there is no feasible and prudent alternative to reuse of the existing bridge prior to replacement. Prior to performing an alternative analysis, ODOT requested that Garver perform a detailed analysis of the existing bridge to better understand the feasibility of re-use alternatives.

ODOT requested that this analysis be based on data available at the time of scoping the project. This data includes the original construction plans, fracture critical inspection reports, underwater inspection reports and the data recon report. The analysis does not account for new geotechnical exploration or updated bridge inspection data. This additional data will be gathered during future stages of the project and will be appended as necessary into the final Section 4(f) alternative analysis report. This memo is not intended to be used as a fully documented Section 4(f) alternative analysis report but summarizes the analysis that was performed on the existing bridge identifying the conditions of the critical components of the existing bridge.

This memo is organized in the following sections:

- Scope of Services and Purpose of Memo
- Historic Significance of the Existing Bridge
- Analysis and Reporting
- Generalized Existing Condition (Specific to Bridge Location)
- Superstructure (Spans 1-70 and Spans 72-87)
- Superstructure - Truss Span (Span 71)
- Substructure
- Detailed Documents and Calculation Books (available upon request)

Historic Significance of the Existing Bridge

The Franklin D. Roosevelt Memorial Bridge (Roosevelt Bridge) over Lake Texoma is an 87-span bridge constructed in 1942. The bridge includes a Warren through-truss central span with polygonal top chord,. It was assessed as being eligible for the NRHP as part of the 2007 update of the “Spans of Time” Oklahoma Historic Bridges study.

In February 2020, Cox McLain Environmental Consulting (CMEC) completed an assessment of the boundaries and historic significance of the bridge as it relates to the NRHP eligibility criteria as defined in 36 CFR Part 60 and

as applied in National Register Bulletin 15 (**Attachment C**). Based on that analysis, the recommended NRHP boundary of the bridge includes the main Warren polygonal through-truss span, the 86 approach spans, all connected cantilevered power lines, and the steel pipe railing to its greatest extent. The earthen causeway to the bridge was constructed prior to the bridge and is not considered part of the historic property.

CMEC found that the bridge is eligible under Criterion C, as the only surviving example of a vehicular Warren through-truss span on Oklahoma's highway system with a polygonal top chord . The character-defining features for this bridge type are the diagonal members forming a "W" with triangles, the vertical members, the inclined end posts, and the curved top chord, as well as the struts and bracing of the portal features of the through-truss. The loss of these character-defining features would impair the bridge's ability to convey its significance under Criterion C.

Character-defining features unique to this bridge, unrelated to the bridge's subtype, are the concrete piers and bents comprising the substructure of the single main span and 86 approach spans, steel pipe railings, as well as the cantilevered powerlines on the truss and the 10 cantilevered electrical poles attached to the approach spans (2 east of the main span, 8 to its west). The bridge functioning as a truss is also character-defining. The loss of these character-defining features unrelated to the bridge's subtype would not inhibit the conveyance of significance under Criterion C.

CMEC also found the bridge to be eligible under Criterion A for its association with a major U.S. Army Corps of Engineers dam project. The bridge has associative significance with the important trend of water impoundment and the creation of dams and lakes across Oklahoma. In 1944 the U.S. Army Corps of Engineers constructed the hydroelectric dam over the Red River, backing up the Washita River, a tributary, and creating Lake Texoma. As a result, the Roosevelt Bridge was necessitated as a vehicular structure providing primary public access in the region and between the east and west sides of Lake Texoma, carrying the major thoroughfare of US-70. The Roosevelt Bridge began construction on dry land before the reservoir filling began in 1944. The bridge opened for traffic on June 21, 1945. It is significant as an example of a vehicular bridge created in direct response to the completion of a major water impoundment project, the Denison Dam. The main character-defining feature under Criterion A is the bridge's use as a vehicular crossing over a waterway. To retain Criterion A significance, the bridge must continue to provide a vehicular crossing as a major thoroughfare. Loss of material integrity would not automatically impact the bridge's Criterion A significance if it continues to serve its historical function.

Analysis and Reporting

The Roosevelt bridge was designed in the early 1940's, and as such, it was designed to accommodate loadings that were anticipated to be seen during the life of the structure. However, the AASHTO bridge design specifications have significantly evolved since the design of this structure including the weight of vehicular design loadings and the application of wind loadings, braking loadings and impact loadings. As discussed during the scoping of the project, in order to make appropriate comparisons, the analysis of this structure was performed in accordance with the current AASHTO LRFD Bridge Design Specifications to serve as a baseline to compare all re-use and replacement alternatives. Additional discussion throughout this memo regarding the impact of the current specifications will be referenced. Detailed calculations of all components of the bridge including an explanation of modeling assumptions are compiled and appended to this memo.

The analysis results of the calculations performed are expressed in terms of the component Performance Ratio (PR). The Performance Ratio (PR) of a component is a ratio of the required demand loading to the component capacity. In example, if a component has the capacity to support a 300kip loading but the demand loading is 850kip loading, the PR for that component would be 2.500 (850kip/300kip). Reporting PR allows the audience to

easily assess the magnitude of the deficiency of the component being studied. A summary of all PR associated with the structure can be found in **Attachment A** of this memo.

The PRs reported below are based on HL-93 vehicular loading, the standard loading for a new structure designed using the AASHTO LRFD specifications. This loading is applied using the "Strength I" load combination, which is equivalent to an inventory loading when compared to a bridge load rating. The inventory loading, as defined by the current AASHTO Manual for Bridge Evaluation, is the loading that can safely utilize the bridge for an indefinite period of time. The PRs also consider loading from the "Oklahoma Overload Vehicle", a standard design vehicle used by ODOT. The Oklahoma Overload Vehicle is applied using the "Strength II" load combination, which is equivalent to an operating loading when compared to a bridge load rating. The operating loading is the maximum permissible live load that can be placed on the bridge. It should be noted that the PRs reported below do not directly reflect the capability of the bridge to carry legal loading in its current state, they are presented only to compare the load capacity of the bridge to the capacity of a new structure designed to current specifications.

Generalized Existing Conditions (Specific to Bridge Location)

Although the scope of services for this specific task only includes the analysis of the existing bridge, in order to better assess the existing condition of the bridge, below are other components that define the conditions of the existing bridge.

- Bridge Vertical and Horizontal Clearances
    - The existing bridge has a substandard vertical clearance of 14'-9" (less than the standard vertical clearance of 16'-9"). This vertical clearance is at the top portal bracing of the truss span.
    - The existing clear roadway width is 24'-0" (less than the standard 40'-0" clear roadway for a 2-lane facility)

- Bridge Generalized Ratings
    - Structural Deficiency ("At-Risk")
        - A bridge is considered structurally deficient if significant load carrying elements of the structure are found to be in poor condition (rating of 4 or less) due to deterioration and/or damage. The Roosevelt bridge currently is considered "at-risk" of being structurally deficient due to a 5 rating of its superstructure and deck. Based on the conditions of the end floor beams after recent and ongoing blasting/painting operations, the likelihood of the Superstructure NBI rating lowering to a "4 – Poor Condition" is increased.
    - Sufficiency Rating
        - The sufficiency rating formula is a method of evaluating a bridge's sufficiency to remain in service, based on a combination of several factors including fields that describe its structural evaluation, functional obsolescence, and its essentiality to the public. The result of the formula is a percentage in which 100 percent represents an entirely sufficient bridge and zero percent represents an entirely insufficient or deficient bridge. The current sufficiency rating for this structure is 42.3.
    - Functionally Obsolete
        - Functionally obsolete bridges are those that do not have adequate lane widths, shoulder widths, or vertical clearances to serve current traffic demand. The Roosevelt Bridge is categorized as functionally obsolete due to its substandard deck width and the low vertical clearance of the truss opening.
    - Pedestrian Accommodations

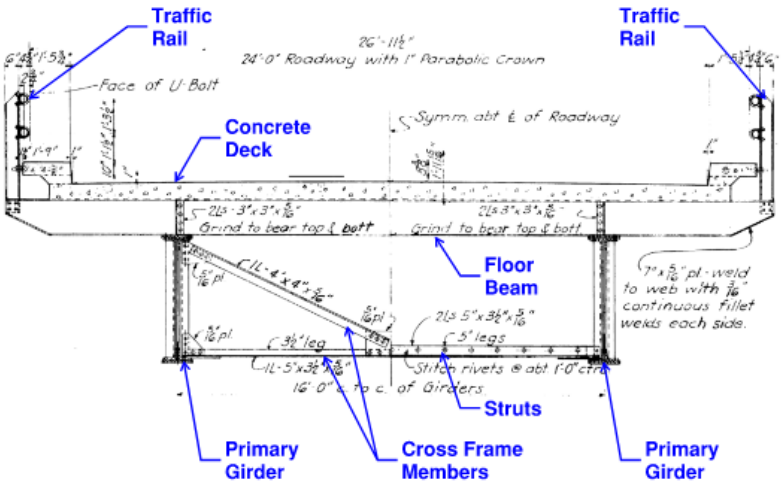
- The existing bridge has a 1’-9” raised curb on both sides of the bridge. Current Americans with Disabilities Act (ADA) Guidelines require a 3-foot minimum clear width for walking surfaces, with a recommended width of 5 feet. The lack of a safety railing between the raised sidewalk and the vehicular traffic lanes also discourages pedestrian traffic and poses a safety hazard to those pedestrians who do utilize the sidewalk.

Superstructure (Spans 1-70 and Spans 72-87)

The superstructure is composed of 87 spans inclusive of:

- 63 – 60’-1” steel stringer/girder approach spans
- 23 – 34’-0” steel stringer/girder approach spans (at tower bents)
- 1 – 250’ thru truss.

The approach spans are composed of a concrete deck supported on transverse, steel W-shape floor beams. The floor beams are tied to primary built-up, riveted, steel I-girders (two-girder system). The primary girders are braced at each floor beam with cross frames or struts. Traffic rails are connected to the steel floor beams and concrete deck curb. The figure below depicts the typical section of the approach spans.

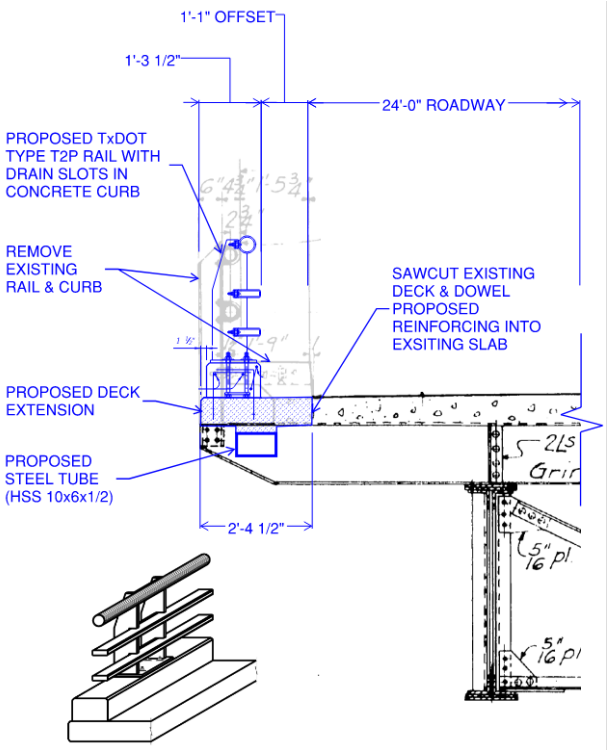


This section discusses the components, conditions, and analysis/recommendations for the steel stringer/girder approach spans. Subsequent sections will discuss the thru truss span.

- **Concrete Deck (PR = 4.113)**
  - Component Description
    - 24’ roadway width with 1’-9” wide curbs.
    - Deck thickness varies from 7 3/8” to 8 3/8”
  - Existing Condition
    - The deck generally has cracking, spalling, failed asphalt patching, abrasion, wear, & lifting throughout.
    - Deficiencies cause serviceability concerns for rideability and loose concrete of bridge soffit above navigable waterways.
  - Analysis & Recommendations

- The deck has a PR of 4.113. This means that, by current standards, the design loading exceeds the capacity of the deck by over 400%.
- For any selected alternative, it is recommended that the deck be replaced and appropriately reinforced to support loadings of today's design standards.

- **Metal Railing (PR = 19.4 assuming original design conditions)**
  - Component Description
    - Steel W-Shape posts anchored to the concrete curb and each floor beam.
    - 2 – longitudinal pipe rails
  - Existing Condition
    - The metal railing has been impacted multiple times and exhibits misalignment throughout.
    - Past experience has shown that this rail does not adequately re-direct vehicles.
    - Approximately 33% of connection locations are compromised due to sheared, missing, and/or failed connections resulting in complete loss of support capacity.
  - Analysis & Recommendations
    - The metal railing has not been crash tested per required current specifications and does not meet minimum pedestrian height requirements of 3.5'.
    - The anchor bolts that connect the railing to the bridge can support up to 2.8 kips of impact load (concrete breakout controls).
    - Based on the vehicular use of this bridge, to meet the desired specifications and level of reliability, the railing should be capable of resisting a TL-4 design force of 54kips. The existing railing cannot support the lowest level of vehicular impact force of a TL-1 (13.5 kips).
    - The metal hand railing has a performance ratio of 19.4 (assuming ideal connection conditions); however, due to the condition of the rails in a number of locations with missing bolts or severely damaged connections, it could be assumed that the performance ratio is effectively double that or worse.
    - There have been multiple instances of vehicular impacts resulting in complete failure of the barrier, including events where vehicles passed through the barrier.
    - A possible retrofit solution is presented in the figure to the right. This retrofit would provide a safer traffic barrier to protect vehicles; however, the impact forces transferred to the other superstructure elements (deck, floor beams, and primary girders) could cause costly and more frequent superstructure repairs. Further analysis of the superstructure would be required for proper deck, floor beam, and primary girder retrofits. A constructability and traffic control analysis would also be required.



- **Floor Beams (PR = 2.140)**
  - Component Description
    - Steel W-Shape (W15x45) transverse beams with double angle bearing stiffeners at primary girder connections.
    - Spaced at 8'-7" (max).
    - Cantilever 6'-3 ¾" from centerline of primary girders.
  - Existing Condition
    - The intermediate floor beams exhibit section losses of 5% resulting in 1/8" section loss to top flange, full width.
    - The end floor beams have sections losses of up to 40% in the top flange (from top surface downward) and up to 10% in the webs. Both losses extend the full length of the beam. These losses will be updated when the field assessment is complete and results have compiled. Based on initial feedback from inspection personnel, the recent and ongoing blasting/painting operations have revealed more significant section loss in the end floor beam top flanges than prior inspections revealed.
  - Analysis & Recommendations
    - The floor beams have a performance ratio of 2.140 (flexural, positive moment controls).
      - This PR is based on previously noted existing conditions inclusive of generalized section loss percentages based on available data.
    - The current HL-93 vehicular loading is roughly 2 times heavier than the original designed vehicular loading. This increase in loading results in the insufficiencies in the performance ratio. The table below shows a comparison of multiple failure modes. As can be seen, the existing beams provide sufficient capacity for the failure modes investigated under the original design live load; however, there is insufficient capacity for current AASHTO LRFD HL-93 and the Oklahoma Overload (OK-OL) live load criteria. Note that this comparison does not incorporate existing section losses. Below is the PR summary table for reference.

Failure Mode	Units	Original Live Loading		HL-93/OK-OL	
		Value	PR	Value	PR
Positive Moment	kip-ft	174.7	0.80	355.7	1.73
Negative Moment	kip-ft	111.3	0.85	204.4	1.46
Shear	kip	59.1	0.62	113.9	1.18
Bearing Stiffener Axial	kip	82.0	0.86	153.0	1.61
Bearing Stiffener Rivets	kip	82.0	0.89	153.0	1.67

    - Basic floor beam improvements were studied. These improvements assume that the bridge typical section has not been modified. Additional information, including sketches of the retrofit option and the replacement option can be found in the detailed calculation books, available upon request. For either option, significant constructability challenges and traffic impacts will need to be considered.
      - Option 1 – Retrofit

        - This option assumes the addition of top cover plates, top/bottom flange angles and fill plates, web plates and additional bearing stiffeners.
        - An estimated weight of 1,200lbs per floor beam location is required.
    - Option 2 – Complete beam replacement
        - This option assumes a new W16x57 floor beam with bearing stiffeners.
        - An estimated weight of 1,663lbs per floor beam location is required.

- **Primary Girders (Plate Girders) (PR = 1.283)**
    - Component Description
        - Approximately 54” deep, built-up, riveted I-girders.
        - Web plates with double angle flanges and cover plates.
        - Spaced at 16’-0” center to center.
        - Double angle bearing stiffeners and intermediate stiffeners.
    - Existing Conditions
        - Top Flange (Double Angles & Cover Plates)
            - The top flange has plug welds which is a Fatigue Category E’. This category is suggestive of potential fatigue concerns. The beam ends have isolated 1/4” max deep (1/8” average) pitting & surface corrosion. Multiple beams have cracked welds in utility support attachments in compression zones (top flange) and do not significantly affect capacity.
        - Bottom Flange (Double Angles & Cover Plates)
            - The bottom flange has plug welds which is akin to a Fatigue Category E’ but is not specifically defined in current fatigue criteria. This category is suggestive of potential fatigue concerns. The beam ends have isolated 1/4” max deep (1/8” average) pitting & surface corrosion.
        - Web
            - The beam ends have isolated 1/4” max (1/8” average) deep pitting & surface corrosion at the ends adjacent to the bearings However, the loss is typically beyond the bearing and does not significantly impact the beam shear capacity.
    - Analysis & Recommendations
        - 4 types of primary girders for the project were analyzed:
            - 60’-1” Spans (G-60, as referenced in calculations, typ.)
            - 34’-0” Spans without Utility Towers (G-34)
            - 34’-0” Spans with Utility Towers; Girder 1 (G-34T1)
            - 34’-0” Spans with Utility Towers; Girder 2 (G-34T2)
        - Performance ratios are provided for each;
            - Primary Girders (G-60); PR = 1.283
            - Primary Girders (G-34); PR = 1.231
            - Primary Girders (G-34T1); PR = 1.190
            - Primary Girders (G-34T2); PR = 1.183
        - Primary girder basic retrofits were studied including cover plates for the top and bottom flanges to improve moment capacity, additional bearing stiffeners to improve bearing capacity, and web stiffeners to improve shear capacity where required. These retrofits assume that the bridge typical section has not been modified. Additional information, including sketches of the retrofit can found in the requested calculation books. Significant constructability changes and traffic impacts will need to be considered. Estimated steel weights for each girder type are summarized below:
            - Primary Girders (G-60): 912.9 lbs per girder
            - Primary Girders (G-34): 910.7 lbs per girder
            - Primary Girders (G-34T1): 402.2 lbs per girder

- Primary Girders (G-34T2): 590.1 lbs per girder

- **Cross Bracing (PR = 0.141)**
  - Heavy pack rust with section loss (including through holes) with adjacent knife edging at many end panels adjacent to piers. Rehab item but does not impact primary member capacity.
  - The cross bracing has a PR of 0.141.

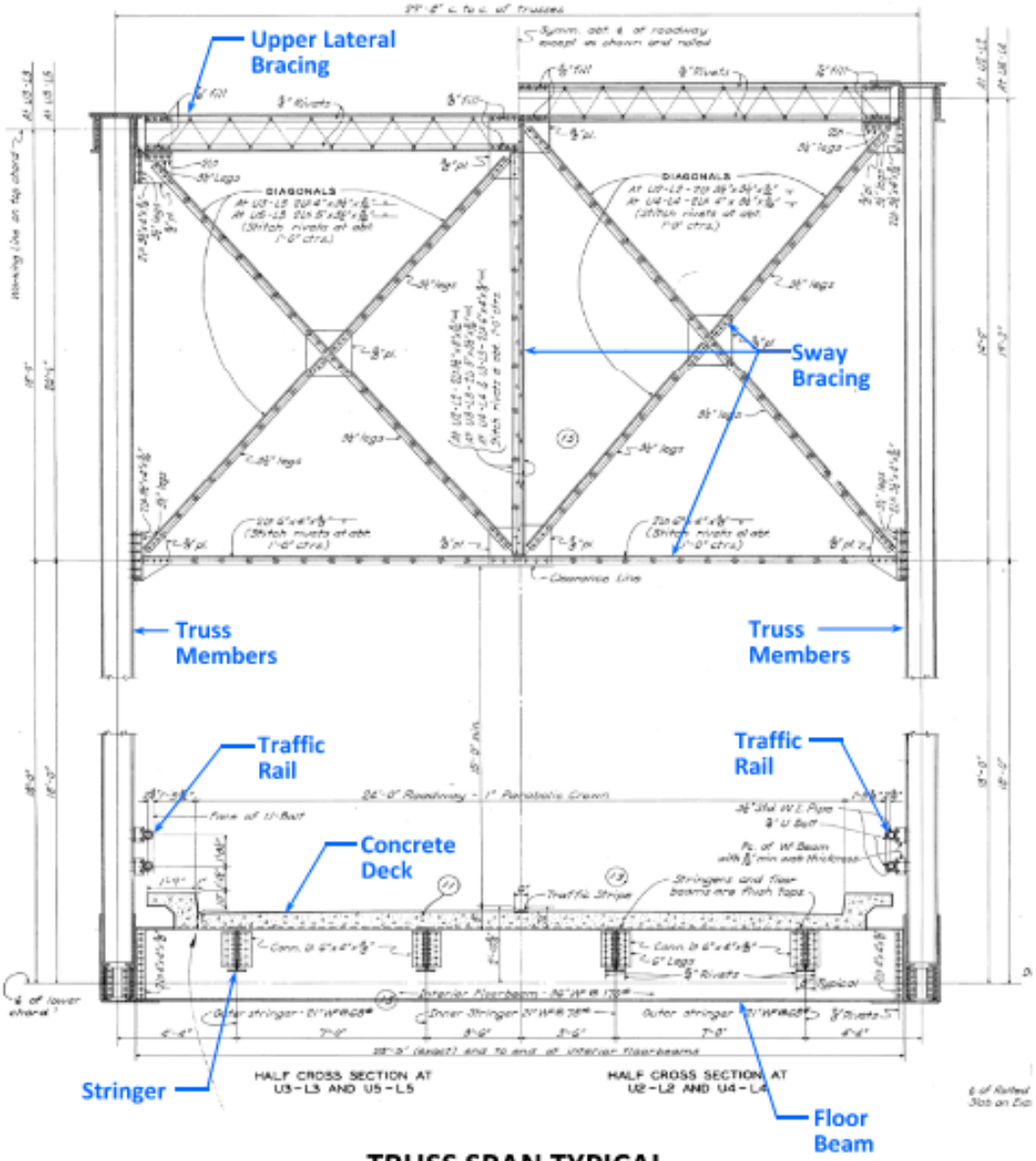
- **Utility Tower Frame (PR = 1.071)**
  - The utility towers exhibit cracks in the connected bracket welds.
  - The utility towers have a PR of 1.071 (Rivet Capacity controls)

- **Joints**
  - For any selected alternative, it is recommended that all expansion and fixed joints be replaced with the deck replacement.
  - Expansion Joints
    - The expansion joints have cracking and spalling throughout. The abutments do not have sufficient expansion capability due to inward rotation/translation. Bents and Towers do not have the required expansion capability throughout.
  - Fixed Joints
    - General – Joint filler has failed at all joint allowing free-flow of water (0% reduction)

- **Bearings**
  - Expansion Bearings
    - Multiple anchor bolts have sheared bolts resulting in 100% reduction in capacity.
    - Alignment
      - Support No. 16/Forward Span/North girder – Shifted to east 1/2”
      - Support No. 31/Forward Span/South girder – Shifted to east 3/8”
      - Support No. 54/Forward Span/North girder – Shifted to east 1/2”
      - Support No. 66/Forward Span/South girder – Shifted to east 1/2”
  - Fixed Bearings
    - Multiple anchor bolts have sheared bolts resulting in 100% reduction in capacity.

Superstructure - Truss Span (Span 71)

This section discusses the condition of the thru truss span, including the truss main members, gusset plates, floor beams, stringers, and wind bracing members. Forces in the truss main members were calculated using a two-dimensional plane frame model, assuming pin connections at the joints. Live loads were distributed to the trusses using the lever rule and applied at nodes to correspond with the transverse floor beam locations. Forces in the upper and lower lateral bracing were calculated by applying wind loads on the upper and lower portions of the truss to separate two-dimensional frame models. Floor beam and stringer loads were calculated by applying moving loads to a two-dimensional grillage model of the floor system. The end connections of the floor beams and stringers were assumed to act as pinned shear connections.



TRUSS SPAN TYPICAL SECTION

- **Upper Chord (PR = 0.79)**
  - Upper chord truss members consist of double-channel members with a riveted cover plate linking the top flanges and riveted lacing connecting the bottom flanges.
  - The upper chord members exhibit minor surface corrosion, producing in no appreciable reduction in member capacity.

- **Lower Chord (PR = 0.79)**
  - Lower chord truss members consist of double-channel members with riveted batten plates connecting the top and bottom flanges.
  - The lower chord members exhibit minor corrosion. A 5% reduction in member capacity is included in the performance ratio to account for minor, isolated loss of section.
  - A 2½" crack is present in one of the lower chord batten plates. Because the batten plate is attached to the low chord with a riveted connection, this crack is unable to propagate into the main members.

- **Truss Web Members (Verticals and Diagonals) (PR = 0.90)**
  - Verticals consist of I-shaped rolled members, diagonals consist of I-shaped rolled members or built-up members consisting of and I-shape riveted to double channels.
  - Some verticals are misaligned due to traffic impact to a maximum magnitude of ¼" longitudinal & ¾" transverse. Verticals are either tension members or zero-force, so no capacity reduction is included.
  - Some cracks have been observed in fillet welds between zero-force verticals and fill plates. As these members are zero-force, no reduction is included.

- **End Posts (PR = 0.64)**
  - End posts consist of double-channel members with a riveted cover plate linking the top flanges and riveted lacing connecting the bottom flanges.
  - The end posts exhibit minor corrosion. A 5% reduction in member capacity is included in the performance ratio to account for minor, isolated loss of section.

- **Lower Lateral Bracing (PR = 0.55)**
  - Lower lateral bracing diagonals consist of double angle members placed in an X-configuration in each bay.
  - The lower lateral diagonals exhibit minor surface corrosion, producing no appreciable reduction in member capacity.

- **Sway Bracing (PR = 0.37)**
  - The lower strut of the sway bracing was previously damaged by traffic impact and replaced at a higher elevation to increase vertical clearance.
  - The upper (original) portion of the sway braces exhibit minor surface corrosion, producing in no appreciable reduction in member capacity.

- **Upper Lateral Bracing (PR = 0.23)**
  - Upper chord lateral brace diagonals consist of double angle members placed in an X-configuration in each bay.
  - The upper lateral diagonal exhibit minor surface corrosion, producing in no appreciable reduction in member capacity.

- **End Portals (PR = N/A, repair recommended)**
  - The portal bracing has been damaged by vehicular impact. The bottom inboard angle of the west portal exhibits several local kinks due to vehicle collision damage near the roadway centerline.

  - The condition does not require immediate repair because the portal frame still effectively braces the end posts.
  - Repair or replacement of the end portal frames is recommended if the bridge is to be rehabilitated.

- **Gusset Plates (PR = 0.983)**
  - Plates are bowed out of plane up to 1/8” due to pack rust.
  - Minor corrosion is visible along the horizontal shear plane of the lower chord gussets (at the top of the chord member). A 1/16” reduction is included in the performance ratio calculation.

- **Stringer (PR = 1.297)**
  - Some stringer copes are overcut up to 1/8”, with accompanying cracks up to 3/8” long.
  - No significant section loss is evident.

- **Floor Beams (PR = 1.148)**
  - The floor beams exhibit moderate corrosion in the top flange. A 5% reduction in member capacity is included in the performance ratio to account for the loss of section.

- **Rivet Connections, Floor Beams and Stringers (PR = 0.818)**
  - No significant section loss at connections; however, pack rust between the connection angles and the floor beam web is occurring and should be addressed as part of rehabilitation of the existing superstructure.

- **Truss Bearings (PR = 0.952)**
  - No significant section loss is evident.

Substructure

The Roosevelt bridge is supported by a series of bents, towers, wall piers and abutments. There are 88 total support lines, consisting of 40 bents (2 column frames), 23 towers (4 column system), 2-column piers with web walls (supporting the truss span) and 2 abutments. Of the 88 support line locations, the as-built construction plan set combines these support lines into 29 uniquely detailed groups consisting of 1-story, 2-story, 3-story and 4-story structures. To appropriately analyze the bridge, these constructed groupings were condensed into 19 modeling groups. Detailed calculation books are available for all 19 model groups with the explanation of performance ratios for all applicable structural components. The below table shows the modeling grouping based on structure type, height and number of stories.

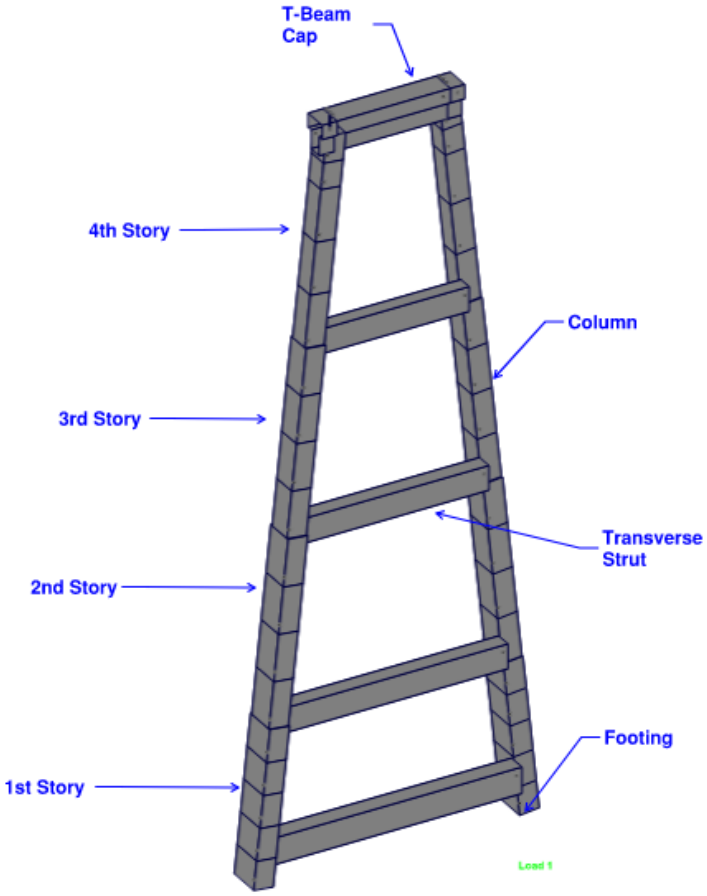
Designation	Type	Included Bent Groups	Height (ft)	# Stories
B59	Bent	B - 2 - 59	59	2
B67	Bent	B - 2 - 67	67	2
B83	Bent	B - 3 - 79, B - 3 - 83	83	3
B87	Bent	B - 3 - 87	87	3
B90	Bent	B - 3 - 89A, B - 3 - 89B, B - 3 - 90	90	3
B93	Bent	B - 3 - 91A, B - 3 - 91B, B - 3 - 93	93	3
B94	Bent	B - 3 - 94	94	3
B109	Bent	B - 4 - 109	109	4
T31	Tower	T - 1 - 31	31	1
T55	Tower	T - 2 - 55	55	2
T76	Tower	T - 3 - 76	76	3
T87	Tower	T - 3 - 86, T - 3 - 87	87	3
T93	Tower	T - 3 - 89A, T - 3 - 89B, T - 3 - 90, T - 3 - 91A, T - 3 - 91B, T - 3 - 93	93	3
T95	Tower	T - 3 - 95	95	3
T100	Tower	T - 3 - 100	100	3
P	Truss Pier	P - 17 & 18	102.75	1
A1	Abutment	A - 1 & 2	51	2
A88	Abutment	A - 88	--	--

- Existing Conditions
  - Abutment
    - Both abutments have Rotations/Translation inwards with the backwall touching the deck. The grout pads have cracking and spalling resulting in the undermining of the anchor plates (Range: 5/8” to 7”). Steel shim bars have been stitch welded to the majority of most heavily undermined grout pads. The wingwalls have exposed back-face due to erosion.
  - Bent
    - The grout pads have cracking and spalling resulting in undermining of the anchor plates (Range: 1/8” to 4”). Steel shim bars have been stitch welded to the majority of most heavily undermined grout pads.
  - Tower
    - The grout pads have cracking and spalling resulting in undermining of the anchor plates (Range: 1/8” to 4”). Steel shim bars have been stitch welded to the majority of most heavily undermined grout pads.

- Columns have experience minor abrasion from wave action but no reduction in capacity is necessary.
- Select pier caps have local spalling that should be addressed in rehabilitation (Bent No. 72) – Spall 32”Lx3”Wx6”H.

Bents

- Analysis and Recommendations
  - General Bent Information
    - Bents are 2 column frame systems that support 4 superstructure bearings as shown on the figure on the right.
    - There are 40 bent unit locations ranging from 1-story to 4-stories. Of these 40 bent unit locations, 8 models were created and analyzed to capture the capacity of the system.
    - Detailed calculations can be provided as requested.
    - Performance Ratios are provided for the 8 analyzed models below. The following PR color key is utilized.



PR Color Key
Black: PR < 1.00
Purple: 1.00 < PR < 1.10
Orange: 1.10 < PR < 1.50
Red: PR > 1.50

    - Capacity Checks (Additional clarity provided in detailed calculations)
      - ‘Axial Capacity’ checks AASHTO 5.6.4.4 and AASHTO 5.6.6.
      - ‘Flexural Capacity’ checks bi-axial flexural strength per AASHTO 5.6.2.
      - ‘Flexural Other’ checks minimum flexural steel per AASHTO 5.6.2.
      - ‘Shear & Torsion Capacity’ checks combined shear and torsion per AASHTO 5.7.
      - ‘Shear & Torsion Other’ checks minimum longitudinal reinforcement, minimum shear reinforcement and maximum spacing limits per AASHTO 5.7.
        - ‘Shear & Torsion Other’ checks are required design limits per the current bridge design specifications but do not necessarily correlate with sub-standard capacities. Additional discussion is warranted.

The following sections of the Memo reports the controlling Performance Ratio for the above capacity checks per the structural component. Additional rating details can be found in **Attachment A** and in the detailed calculation books, available upon request.

Model Bent 59 - 59-foot tall, 2 story bent
Applicable to 1 location - Bent 83

Substructure Element		Axial Capacity, A		Flexural Capacity, M	Flexural Other, Mo	Shear & Torsion Capacity, V	Shear & Torsion Other, Vo	Controlling Capacity
		Tension	Comp.					
Columns	Controlling PR:	N/A	0.270	1.111	0.599	0.168	1.237	Vo
Transverse Struts	Controlling PR:	N/A	0.008	0.539	0.289	0.337	0.580	Vo
Foundation	Max Pile Rxn:	11.540 k	62.340 k	N/A	N/A	N/A	N/A	

Model Bent 67 - 67-foot tall, 2 story bent
Applicable to 2 locations - Bent 5 & 82

Substructure Element		Axial Capacity, A		Flexural Capacity, M	Flexural Other, Mo	Shear & Torsion Capacity, V	Shear & Torsion Other, Vo	Controlling Capacity
		Tension	Comp.					
Columns	Controlling PR:	N/A	0.280	1.357	0.602	0.522	1.947	Vo
Transverse Struts	Controlling PR:	N/A	0.011	0.625	0.297	0.394	1.669	Vo
Foundation	Max Pile Rxn:	16.944 k	90.521 k	N/A	N/A	N/A	N/A	

Model Bent 83 - 83-foot tall, 3 story bent
Applicable to 2 locations - Bent 78 & 79

Substructure Element		Axial Capacity, A		Flexural Capacity, M	Flexural Other, Mo	Shear & Torsion Capacity, V	Shear & Torsion Other, Vo	Controlling Capacity
		Tension	Comp.					
Columns	Controlling PR:	N/A	0.267	0.959	0.573	0.453	2.225	Vo
Transverse Struts	Controlling PR:	N/A	0.009	0.578	0.289	0.359	0.626	Vo
Foundation	Max Pile Rxn:	16.190 k	63.518 k	N/A	N/A	N/A	N/A	

Model Bent 87 - 87-foot tall, 3 story bent
Applicable to 3 locations - Bent 38, 74 & 75

Substructure Element		Axial Capacity, A		Flexural Capacity, M	Flexural Other, Mo	Shear & Torsion Capacity, V	Shear & Torsion Other, Vo	Controlling Capacity
		Tension	Comp.					
Columns	Controlling PR:	N/A	0.267	1.002	0.570	0.525	2.225	Vo
Transverse Struts	Controlling PR:	0.004	0.205	0.276	0.250	3.527	1.669	V
Foundation	Max Pile Rxn:	18.521 k	66.465 k	N/A	N/A	N/A	N/A	

Model Bent 90 - 90-foot tall, 3 story bent
Applicable to 16 location - Bent 8, 9, 13, 16, 19, 22, 23, 26, 27, 30, 35, 39, 58, 59, 62 & 63

Substructure Element		Axial Capacity, A		Flexural Capacity, M	Flexural Other, Mo	Shear & Torsion Capacity, V	Shear & Torsion Other, Vo	Controlling Capacity
		Tension	Comp.					
Columns	Controlling PR:	N/A	0.267	1.196	0.591	0.483	2.364	Vo
Transverse Struts	Controlling PR:	N/A	0.012	0.611	0.305	0.379	1.669	Vo
Foundation	Max Pile Rxn:	19.703 k	68.039 k	N/A	N/A	N/A	N/A	

Model Bent 93 - 93-foot tall, 3 story bent
Applicable to 10 locations - Bents 12, 31, 34, 43, 46, 47, 50, 51, 66 & 67

Substructure Element		Axial Capacity, A		Flexural Capacity, M	Flexural Other, Mo	Shear & Torsion Capacity, V	Shear & Torsion Other, Vo	Controlling Capacity
		Tension	Comp.					
Columns	Controlling PR:	N/A	0.260	0.914	0.523	0.407	2.086	Vo
Transverse Struts	Controlling PR:	N/A	0.011	0.631	0.307	0.391	1.669	Vo
Foundation	Max Pile Rxn:	24.463 k	79.813 k	N/A	N/A	N/A	N/A	

Model Bent 94 - 94-foot tall, 3 story bent
Applicable to 2 locations - Bent 70 & 71

Substructure Element		Axial Capacity, A		Flexural Capacity, M	Flexural Other, Mo	Shear & Torsion Capacity, V	Shear & Torsion Other, Vo	Controlling Capacity
		Tension	Comp.					
Columns	Controlling PR:	N/A	0.260	0.866	0.521	0.103	0.872	Vo
Transverse Struts	Controlling PR:	N/A	0.012	0.632	0.302	0.391	1.669	Vo
Foundation	Max Pile Rxn:	19.637 k	69.602 k	N/A	N/A	N/A	N/A	

Model Bent 109 - 109-foot tall, 4 story bent
Applicable to 3 location - Bent 42, 54 & 55

Substructure Element		Axial Capacity, A		Flexural Capacity, M	Flexural Other, Mo	Shear & Torsion Capacity, V	Shear & Torsion Other, Vo	Controlling Capacity
		Tension	Comp.					
Columns	Controlling PR:	N/A	0.267	1.074	0.609	0.596	2.642	Vo
Transverse Struts	Controlling PR:	N/A	0.010	0.612	0.297	0.380	1.669	Vo
Foundation	Max Pile Rxn:	35.590 k	109.174 k	N/A	N/A	N/A	N/A	

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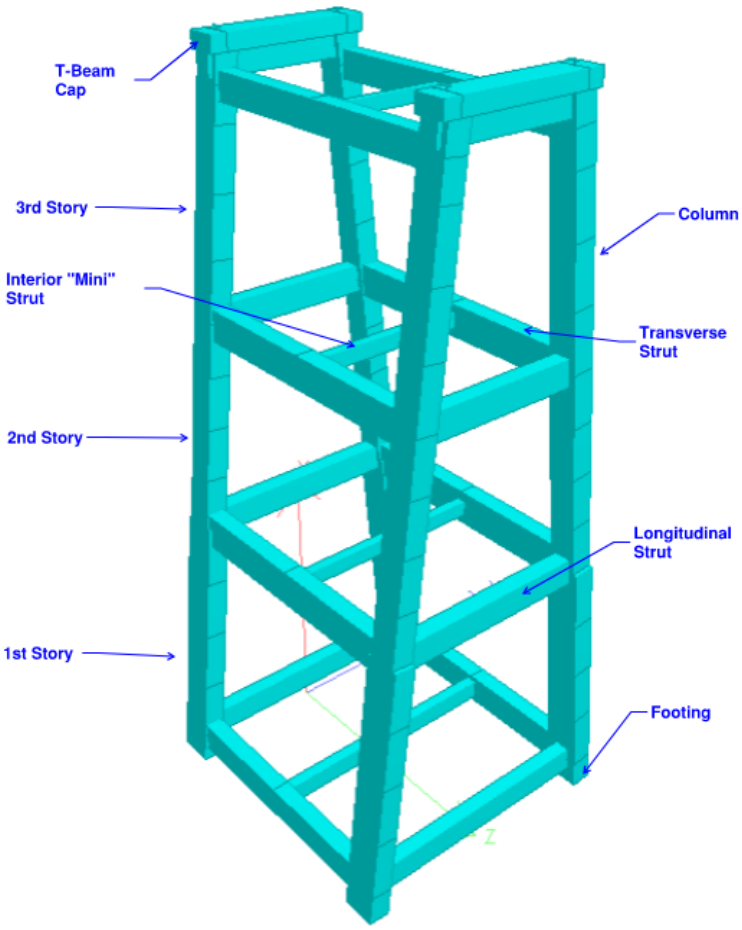
Towers

General Tower Information

- Towers are 4 column systems that support 8 superstructure bearings as shown on the figure on the right.
- There are 23 tower unit locations ranging from 1-story to 3-stories. Of these 23 tower unit locations, 7 models were created and analyzed to capture the capacity of the system.
- Detailed calculations can be provided as requested.
- Performance Ratios are provided for the 7 analyzed models below. The following PR color key is utilized.



PR Color Key
Black: PR < 1.00
Purple: 1.00 < PR < 1.10
Orange: 1.10 < PR < 1.50
Red: PR > 1.50

- Capacity Checks (Additional clarity provided in detailed calculations)
  - 'Axial Capacity' checks AASHTO 5.6.4.4 and AASHTO 5.6.6.
  - 'Flexural Capacity' checks bi-axial flexural strength per AASHTO 5.6.2.
  - 'Flexural Other' checks minimum flexural steel per AASHTO 5.6.2.
  - 'Shear & Torsion Capacity' checks combined shear and torsion per AASHTO 5.7.
  - 'Shear & Torsion Other' checks minimum longitudinal reinforcement, minimum shear reinforcement and maximum spacing limits per AASHTO 5.7.
    - 'Shear & Torsion Other' checks are required design limits per the current bridge design specifications but do not necessarily correlate with sub-standard capacities. Additional discussion is warranted.

The following sections of the Memo reports the controlling Performance Ratio for the above capacity check per the structural component. Additional rating details can be found in **Attachment A** and in the detailed calculation books, available upon request.

Model Tower T31 - 31-foot tall, 1 story tower
Applicable to 2 locations - Bent 86 & 87

Substructure Element		Axial Capacity, A		Flexural Capacity, M	Flexural Other, Mo	Shear & Torsion Capacity, V	Shear & Torsion Other, Vo	Controlling Capacity
		Tension	Comp.					
Columns	Controlling PR:	N/A	0.251	0.370	0.434	0.159	0.208	Mo
Transverse Struts	Controlling PR:	N/A	0.008	0.241	0.289	0.157	0.172	Mo
Longitudinal Struts	Controlling PR:	N/A	0.009	1.031	0.430	0.403	1.669	Vo
Interior ("Mini") Struts	Controlling PR:	N/A	0.002	0.357	0.393	0.097	0.231	Mo
Foundation	Spread; Max Soil Pressure = 5.041ksi			N/A	N/A	N/A	N/A	

Model Tower T55 - 55-foot tall, 2 story tower
Applicable to 4 locations - Bent 3, 4, 84 & 85

Substructure Element		Axial Capacity, A		Flexural Capacity, M	Flexural Other, Mo	Shear & Torsion Capacity, V	Shear & Torsion Other, Vo	Controlling Capacity
		Tension	Comp.					
Columns	Controlling PR:	N/A	0.327	0.598	0.587	0.465	1.947	Vo
Transverse Struts	Controlling PR:	N/A	0.009	0.670	0.368	0.346	1.112	Vo
Longitudinal Struts	Controlling PR:	0.005	0.010	1.176	0.288	0.492	1.112	M
Interior ("Mini") Struts	Controlling PR:	N/A	0.003	0.512	0.567	0.132	0.375	Mo
Foundation	Max Pile Rxn:	3.909 k	60.596 k	N/A	N/A	N/A	N/A	

Model Tower T76 - 76-foot tall, 3 story tower
Applicable to 2 locations - Bent 80 & 81

Substructure Element		Axial Capacity, A		Flexural Capacity, M	Flexural Other, Mo	Shear & Torsion Capacity, V	Shear & Torsion Other, Vo	Controlling Capacity
		Tension	Comp.					
Columns	Controlling PR:	N/A	0.321	0.370	0.414	0.158	0.312	Mo
Transverse Struts	Controlling PR:	N/A	0.010	0.622	0.306	0.394	1.669	Vo
Longitudinal Struts	Controlling PR:	0.006	0.007	0.670	0.317	0.366	0.467	M
Interior ("Mini") Struts	Controlling PR:	N/A	0.004	0.607	0.562	0.187	0.427	M
Foundation	Max Pile Rxn:	3.026 k	75.479 k	N/A	N/A	N/A	N/A	

Model Tower T87 - 87-foot tall, 3 story tower
Applicable to 6 locations - Bents 20, 21, 36, 37, 76 & 77

Substructure Element		Axial Capacity, A		Flexural Capacity, M	Flexural Other, Mo	Shear & Torsion Capacity, V	Shear & Torsion Other, Vo	Controlling Capacity
		Tension	Comp.					
Columns	Controlling PR:	N/A	0.336	0.465	0.480	0.162	0.431	Mo
Transverse Struts	Controlling PR:	N/A	0.013	0.748	0.313	0.444	1.877	Vo
Longitudinal Struts	Controlling PR:	0.007	0.008	0.734	0.314	0.401	1.877	Vo
Interior ("Mini") Struts	Controlling PR:	N/A	0.004	0.731	0.582	0.215	0.486	M
Foundation	Max Pile Rxn:	3.110 k	63.674 k	N/A	N/A	N/A	N/A	

Model Tower T93 - 93-foot tall, 3 story tower
Applicable to 26 locations - Bent 6, 7, 10, 11, 14, 15, 24, 25, 28, 29, 32, 33, 44, 45, 48, 49, 52, 53, 60, 61, 64, 65, 68, 69, 72 & 73

Substructure Element		Axial Capacity, A		Flexural Capacity, M	Flexural Other, Mo	Shear & Torsion Capacity, V	Shear & Torsion Other, Vo	Controlling Capacity
		Tension	Comp.					
Columns	Controlling PR:	N/A	0.348	0.509	0.509	0.164	0.320	Mo
Transverse Struts	Controlling PR:	N/A	0.013	0.691	0.274	0.450	1.251	Vo
Longitudinal Struts	Controlling PR:	0.004	0.007	0.457	0.203	0.346	0.366	M
Interior ("Mini") Struts	Controlling PR:	N/A	0.004	0.803	0.585	0.234	0.531	M
Foundation	Max Pile Rxn:	3.982 k	66.414 k	N/A	N/A	N/A	N/A	

Model Tower T95 - 95-foot tall, 3 story tower
Applicable to 2 locations - Bent 56 & 57

Substructure Element		Axial Capacity, A		Flexural Capacity, M	Flexural Other, Mo	Shear & Torsion Capacity, V	Shear & Torsion Other, Vo	Controlling Capacity
		Tension	Comp.					
Columns	Controlling PR:	N/A	0.280	0.392	0.445	0.134	0.321	Mo
Transverse Struts	Controlling PR:	N/A	0.013	0.649	0.266	0.446	1.669	Vo
Longitudinal Struts	Controlling PR:	0.003	0.007	0.432	0.199	0.319	0.293	M
Interior ("Mini") Struts	Controlling PR:	N/A	0.004	0.787	0.461	0.229	0.520	M
Foundation	Max Pile Rxn:	0.665k	55.584k	N/A	N/A	N/A	N/A	

Model Tower T100 - 100-foot tall, 3 story tower
Applicable to 2 locations - Bent 40 & 41

Substructure Element		Axial Capacity, A		Flexural Capacity, M	Flexural Other, Mo	Shear & Torsion Capacity, V	Shear & Torsion Other, Vo	Controlling Capacity
		Tension	Comp.					
Columns	Controlling PR:	N/A	0.294	0.395	0.444	0.134	0.320	Mo
Transverse Struts	Controlling PR:	N/A	0.015	0.817	0.287	0.473	1.877	Vo
Longitudinal Struts	Controlling PR:	0.006	0.009	0.688	0.311	1.151	3.337	Vo
Interior ("Mini") Struts	Controlling PR:	N/A	0.004	0.828	0.581	0.239	0.548	M
Foundation	Max Pile Rxn:	2.366 k	58.294 k	N/A	N/A	N/A	N/A	

Abutments

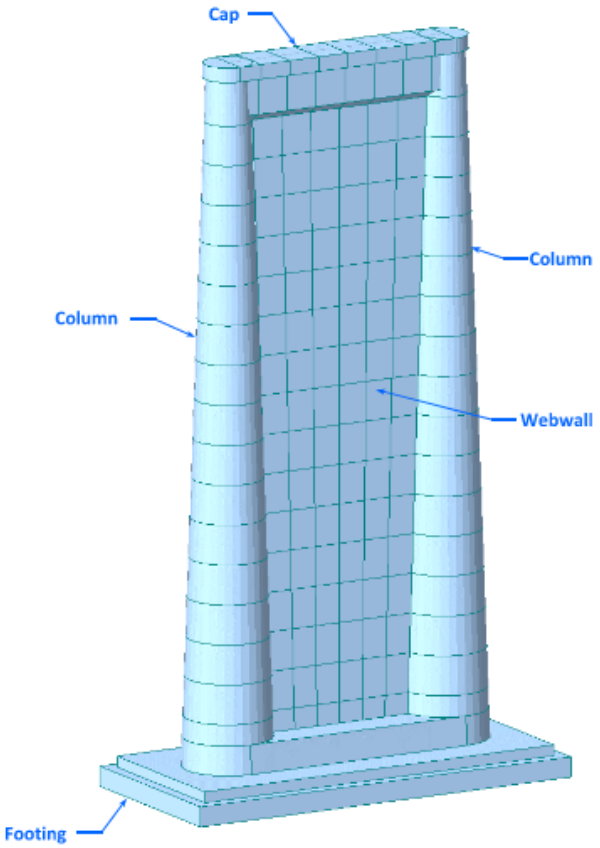
Model Abutment A1 - 51-foot tall, 2 story tower
Applicable to 2 locations - Bent 1 & 2

Substructure Element		Axial Capacity, A		Flexural Capacity, M	Flexural Other, Mo	Shear & Torsion Capacity, V	Shear & Torsion Other, Vo	Controlling Capacity
		Tension	Comp.					
Columns	Controlling PR:	N/A	0.321	0.357	0.414	0.153	0.313	Mo
Transverse Struts	Controlling PR:	N/A	0.010	0.622	0.306	0.394	1.669	Vo
Longitudinal Struts	Controlling PR:	0.006	0.007	0.670	0.317	0.366	0.487	M
Interior ("Mini") Struts	Controlling PR:	N/A	0.004	0.607	0.562	N/A	0.430	M

- Model Abutment A88
  - Applicable to 1 location – Bent 88
  - Abutment shows signs of movement
  - Spread footing abutment
  - Performance ratios
    - Allowable pressure = 1.50 ksf
    - Cohesion = 1.00 ksf
    - Overturning Factor of Safety = 1.34
    - Sliding, PR = 1.33 (assumed 1.00 ksf cohesion)
    - Bearing Pressure, PR = 1.70 (assumed 1.50 ksf allowable pressure)
    - Backwall Shear, PR = 0.09
    - Backwall Flexure, PR = 0.03
    - Heel Shear, PR = 0.10
    - Toe Shear, PR = 0.12
    - Toe Flexure, PR = 0.08

Truss Piers

Piers 17 and 18 consist of two tapered circular reinforced concrete columns linked by a reinforced concrete webwall (as shown on the figure to the right). A concrete cap spans between the columns and is supported by the webwall. The webwall and columns rest on a common footing, supported by concrete piles. Loads for the pier components were calculated using a finite element model, with the columns, cap and footing modeled using beam elements and the webwall modeled using plate elements. Pile loads are calculated assuming the pile group acts as a rigid unit.

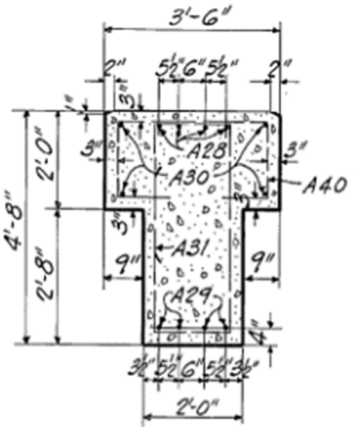


- **Pier 17 (PR = 0.995)**
  - No deficiencies were noted.
  - Columns, PR = 0.618
  - Cap = 0.995
  - Web Wall, PR = 0.346
  - Footing, PR = 0.694
  - Piles, PR = 0.649

- **Pier 18 (PR = 0.990)**
  - No deficiencies were noted.
  - Columns, PR = 0.483
  - Cap = 0.990
  - Web Wall, PR = 0.346
  - Footing, PR = 0.635
  - Piles, PR = 0.750

T-Beam Caps

There are three different sizes of T-beam caps for the bents, towers, and Abutment 1. All T-beam caps are 4’-8” deep but have varying stem widths ranging from 2’-0” to 2’-9”. Because the girder bearings bear directly on the columns, little moment and shear must be carried by the T-beam caps; only the moment and shear induced by lateral movement must be resisted. The maximum performance ratio of any of the T-beams is 0.774.



SECTION A-A

Calculation Books

Garver has compiled detailed calculation books that document the analysis that was performed. The calculations are available upon request.

Summary

The purpose of this structural evaluation was to assess the condition of the existing bridge prior to development of re-use alternatives. The evaluation was based on available data at the time and used the current LRFD Bridge Design Specifications as a baseline for comparison purposes. Because of the evolution of the AASHTO Bridge Design Specifications, many existing bridge components do not meet current standard levels of capacity or reliability. Additionally, the extent of deterioration to the structural components are impacting the bridge. To easily assess the magnitude of the deficiencies, the analysis results were expressed in terms of Performance Ratio. However, Performance Ratios reported do not directly correlate with the capability of the bridge to carry legal loadings in its current condition.

At the convenience of the Department, Garver is prepared to discuss the findings of this memo and discuss the next steps of the project. Please let us know if you have any questions or concerns.

Sincerely,
GARVER

Matthew Youngblood, P.E., S.E.
Garver - Project Manager

Attachments: Attachment A – Detailed Load Rating Summaries
Attachment B – Existing Bridge Data
Attachment C – Historical Assessment of the Roosevelt Memorial Bridge over Lake Texoma

L:\2020\20T03060 - ODOT CI-2262 US-70 Roosevelt Bridge\Design\Bridge\Project Management\Executive Summary\JP33873(07)_US-70 over Lake Texoma (Roosevelt Bridge)_Analysis of Existing Bridge.docm

Attachment A

GARVER	Project	US-70 Roosevelt Bridge	ORIGINATED BY:	SHH	DATE:	3/1/2021
	Job No.	20T03060	REVISED BY:	SHH	DATE:	3/4/2021
	Subject	Model B59 Performance Ratio Summary				
	Path	\\garverinc.local\gdata\Projects\2020\20T03060 - ODOT CI-2262 US-70 Roosevelt Bridge\Design\Bridge\Phase I\Alt 1\Model 1\Sub\Types\B59\[B59 PR Summary.xlsm]Model 1 - PR				

Model 1 - Existing Condition (No Reduction) Performance Ratio Summary

PR Color Key
Black: PR < 1.00
Purple: 1.00 < PR < 1.10
Orange: 1.10 < PR < 1.50
Red: PR > 1.50

Controlling Capacity Key
A+: Tension
A-: Compression
M: Flexural Capacity
Mo: Flexural Other
V: Shear & Torsion Capacity
Vo: Shear and Torsion Other

Note
PR = 1/CDR
*Includes minimum flexural steel.
**Includes minimum steel, maximum spacing, and longitudinal reinforcing checks.

Substructure Element		Axial Capacity		Flexural Capacity	Flexural Other	Shear & Torsion Capacity	Shear & Torsion Other	Controlling Capacity
		Tension	Comp.					
Columns	**Controlling PR:**	*N/A*	**0.270**	***1.111***	**0.599**	**0.168**	***1.237***	**Vo**
1st Story	CDR:	--	3.699	0.900	1.668	5.950	0.808	Vo
2nd Story	CDR:	--	3.772	1.797	1.880	11.102	2.296	M
Transverse Struts	**Controlling PR:**	*N/A*	**0.008**	**0.539**	**0.289**	**0.337**	**0.580**	**Vo**
1st Story (Mem. 25)	CDR:	--	124.578	3.841	3.828	5.986	5.717	Mo
2nd Story (Mem. 24)	CDR:	--	226.376	1.856	3.460	2.971	1.724	Vo
Longitudinal Struts	**Controlling PR:**	*N/A*	*N/A*	*N/A*	*N/A*	*N/A*	*N/A*	
Interior ("Mini") Struts	**Controlling PR:**	*N/A*	*N/A*	*N/A*	*N/A*	*N/A*	*N/A*	
T-Beams	**Controlling PR:**	*N/A*	*N/A*	*N/A*	*N/A*	*N/A*	*N/A*	
Foundation	**Max Pile Rxn:**	**11.540 k**	**62.340 k**	*N/A*	*N/A*	*N/A*	*N/A*	

GARVER	Project	US-70 Roosevelt Bridge	ORIGINATED BY:	SHH	DATE:	3/1/2021
	Job No.	20T03060	REVISED BY:	SHH	DATE:	3/4/2021
	Subject	Model B67 Performance Ratio Summary				
	Path	\\garverinc.local\gdata\Projects\2020\20T03060 - ODOT CI-2262 US-70 Roosevelt Bridge\Design\Bridge\Phase I\Alt 1\Model 1\Sub\Types\B67\[B67 PR Summary.xlsm]Model 1 - PR				

Model 1 - Existing Condition (No Reduction) Performance Ratio Summary

PR Color Key
Black: PR < 1.00
Purple: 1.00 < PR < 1.10
Orange: 1.10 < PR < 1.50
Red: PR > 1.50

Controlling Capacity Key
A+: Tension
A-: Compression
M: Flexural Capacity
Mo: Flexural Other
V: Shear & Torsion Capacity
Vo: Shear and Torsion Other

Note
PR = 1/CDR
*Includes minimum flexural steel.
**Includes minimum steel, maximum spacing, and longitudinal reinforcing checks.

Substructure Element		Axial Capacity		Flexural Capacity	Flexural Other	Shear & Torsion Capacity	Shear & Torsion Other	Controlling Capacity
		Tension	Comp.					
Columns	**Controlling PR:**	*N/A*	**0.280**	***1.357***	**0.602**	**0.522**	***1.947***	**Vo**
1st Story	CDR:	--	3.573	0.737	1.661	1.915	0.514	Vo
2nd Story	CDR:	--	3.772	1.737	1.922	11.173	2.164	M
Transverse Struts	**Controlling PR:**	*N/A*	**0.011**	**0.625**	**0.297**	**0.394**	***1.669***	**Vo**
1st Story (Mem. 25)	CDR:	--	92.135	3.103	3.850	5.117	4.758	M
2nd Story (Mem. 24)	CDR:	--	221.328	1.600	3.363	2.537	0.599	Vo
Longitudinal Struts	**Controlling PR:**	*N/A*	*N/A*	*N/A*	*N/A*	*N/A*	*N/A*	
Interior ("Mini") Struts	**Controlling PR:**	*N/A*	*N/A*	*N/A*	*N/A*	*N/A*	*N/A*	
T-Beams	**Controlling PR:**	*N/A*	*N/A*	*N/A*	*N/A*	*N/A*	*N/A*	
Foundation	**Max Pile Rxn:**	**16.944 k**	**90.521 k**	*N/A*	*N/A*	*N/A*	*N/A*	
Bent No. 5	Max Pile Rxn:	16.282 k	90.521 k	--	--	--	--	
Bent No. 82	Max Pile Rxn:	16.944 k	68.771 k	--	--	--	--	

GARVER	Project	US-70 Roosevelt Bridge	ORIGINATED BY:	CLB	DATE:	3/1/2021
	Job No.	20T03060	REVISED BY:	__	DATE:	__
	Subject	Model B83 Performance Ratio Summary				
	Path	\\garverinc.local\gdata\Projects\2020\20T03060 - ODOT CI-2262 US-70 Roosevelt Bridge\Design\Bridge\Phase I\Alt 1\Model 1\Sub\Types\B83\[Capacity.xlsm]Model 1 - PR				

Model 1 - Existing Condition (No Reduction) Performance Ratio Summary

PR Color Key
Black: PR < 1.00
Purple: 1.00 < PR < 1.10
Orange: 1.10 < PR < 1.50
Red: PR > 1.50

Controlling Capacity Key
A+: Tension
A-: Compression
M: Flexural Capacity
Mo: Flexural Other
V: Shear & Torsion Capacity
Vo: Shear and Torsion Other

Note
PR = 1/CDR
*Includes minimum flexural steel.
**Includes minimum steel, maximum spacing, and longitudinal reinforcing checks.

Substructure Element		Axial Capacity		Flexural Capacity	Flexural Other	Shear & Torsion Capacity	Shear & Torsion Other	Controlling Capacity
		Tension	Comp.					
Columns	**Controlling PR:**	*N/A*	**0.267**	**0.959**	**0.573**	**0.453**	***2.225***	**Vo**
1st Story	CDR:	--	3.882	1.147	2.312	2.207	0.449	Vo
2nd Story	CDR:	--	3.857	1.043	1.746	2.208	0.514	Vo
3rd Story	CDR:	--	3.750	1.976	2.186	10.583	3.181	M
Transverse Struts	**Controlling PR:**	*N/A*	**0.009**	**0.578**	**0.289**	**0.359**	**0.626**	**Vo**
1st Story (Mem. 34)	CDR:	--	107.2	3.862	4.034	5.383	5.472	M
2nd Story (Mem. 33)	CDR:	--	219.6	1.937	3.579	3.414	2.266	M
3rd Story (Mem. 32)	CDR:	--	211.6	1.729	3.459	2.782	1.597	Vo
Longitudinal Struts	**Controlling PR:**	*N/A*	*N/A*	*N/A*	*N/A*	*N/A*	*N/A*	
Interior ("Mini") Struts	**Controlling PR:**	*N/A*	*N/A*	*N/A*	*N/A*	*N/A*	*N/A*	
T-Beams	**Controlling PR:**	*N/A*	*N/A*	*N/A*	*N/A*	*N/A*	*N/A*	
Foundation	**Max Pile Rxn:**	**16.190 k**	**63.518 k**	*N/A*	*N/A*	*N/A*	*N/A*	

A+	*A-*	*M*	*Mo*	*V*	*Vo*

Attachment A

GARVER	Project	US-70 Roosevelt Bridge	ORIGINATED BY:	DPE	DATE:	3/1/2021
	Job No.	20T03060	REVISED BY:	__	DATE:	__
	Subject	Model B87 Performance Ratio Summary				
	Path	L:\2020\20T03060 - ODOT CI-2262 US-70 Roosevelt Bridge\Design\Bridge\Phase I\Alt 1\Model 1\Sub\Types\B87\[B87 Capacity.xlsm]Model 1 - PR				

Model 1 - Existing Condition (No Reduction) Performance Ratio Summary

PR Color Key
Black: PR < 1.00
Purple: 1.00 < PR < 1.10
Orange: 1.10 < PR < 1.50
Red: PR > 1.50

Controlling Capacity Key
A+: Tension
A-: Compression
M: Flexural Capacity
Mo: Flexural Other
V: Shear & Torsion Capacity
Vo: Shear and Torsion Other

Note
PR = 1/CDR
*Includes minimum flexural steel.
**Includes minimum steel, maximum spacing, and longitudinal reinforcing checks.

Substructure Element		Axial Capacity		Flexural Capacity	Flexural Other	Shear & Torsion Capacity	Shear & Torsion Other	Controlling Capacity
		Tension	Comp.					
Columns	**Controlling PR:**	*N/A*	**0.267**	***1.002***	**0.570**	**0.525**	***2.225***	**Vo**
1st Story	CDR:	--	3.816	1.060	2.133	1.904	0.449	Vo
2nd Story	CDR:	--	3.844	0.998	1.753	2.078	0.514	Vo
3rd Story	CDR:	--	3.750	1.934	2.032	10.595	2.458	M
Transverse Struts	**Controlling PR:**	**0.004**	**0.205**	**0.276**	**0.250**	***3.527***	***1.669***	**V**
1st Story (Mem. 34)	CDR:	--	93.495	3.618	4.015	5.140	5.190	M
2nd Story (Mem. 33)	CDR:	--	4.875	25.712	21.480	15.471	--	A-
3rd Story (Mem. 32)	CDR:	250.954	914.291	4.784	3.997	0.284	0.599	V
Longitudinal Struts	**Controlling PR:**	*N/A*	*N/A*	*N/A*	*N/A*	*N/A*	*N/A*	
Interior ("Mini") Struts	**Controlling PR:**	*N/A*	*N/A*	*N/A*	*N/A*	*N/A*	*N/A*	
T-Beams	**Controlling PR:**	*N/A*	*N/A*	*N/A*	*N/A*	*N/A*	*N/A*	
Foundation	**Controlling PR:**	*N/A*	*N/A*	*N/A*	*N/A*	*N/A*	*N/A*	

A+	*A-*	*M*	*Mo*	*V*	*Vo*

GARVER	Project	US-70 Roosevelt Bridge	ORIGINATED BY:	ZMB	DATE:	3/1/2021
	Job No.	20T03060	REVISED BY:	__	DATE:	__
	Subject	Model B90 Performance Ratio Summary				
	Path	C:\Users\ZMBrinlee\Desktop\B90\[Capacity_B90.xlsm]Model 1 - PR				

Model 1 - Existing Condition (No Reduction) Performance Ratio Summary

PR Color Key
Black: PR < 1.00
Purple: 1.00 < PR < 1.10
Orange: 1.10 < PR < 1.50
Red: PR > 1.50

Controlling Capacity Key
A+: Tension
A-: Compression
M: Flexural Capacity
Mo: Flexural Other
V: Shear & Torsion Capacity
Vo: Shear and Torsion Other

Note
PR = 1/CDR
*Includes minimum flexural steel.
**Includes minimum steel, maximum spacing, and longitudinal reinforcing checks.

Substructure Element		Axial Capacity		Flexural Capacity	Flexural Other	Shear & Torsion Capacity	Shear & Torsion Other	Controlling Capacity
		Tension	Comp.					
Columns	**Controlling PR:**	*N/A*	**0.267**	***1.196***	**0.591**	**0.483**	***2.364***	**Vo**
1st Story	CDR:	--	3.753	0.836	1.791	2.070	0.423	Vo
2nd Story	CDR:	--	3.929	1.000	1.692	2.160	0.496	Vo
3rd Story	CDR:	--	3.740	1.871	2.003	10.345	2.881	M
Transverse Struts	**Controlling PR:**	*N/A*	**0.012**	**0.611**	**0.305**	**0.379**	***1.669***	**Vo**
1st Story (Mem. 34, 74)	CDR:	--	85.491	2.872	3.283	5.202	4.301	M
2nd Story (Mem. 33, 73)	CDR:	--	205.886	1.712	3.578	3.053	1.937	M
3rd Story (Mem. 32, 72)	CDR:	--	203.937	1.637	3.394	2.637	0.599	Vo
Longitudinal Struts	**Controlling PR:**	*N/A*	*N/A*	*N/A*	*N/A*	*N/A*	*N/A*	
Interior ("Mini") Struts	**Controlling PR:**	*N/A*	*N/A*	*N/A*	*N/A*	*N/A*	*N/A*	
T-Beams	**Controlling PR:**	*N/A*	*N/A*	*N/A*	*N/A*	*N/A*	*N/A*	
Foundation	**Controlling PR:**	**19.703 k**	**68.039 k**	*N/A*	*N/A*	*N/A*	*N/A*	
Bent 9	Max Pile Rxn:	19.703 k	68.039 k	--	--	--	--	

A+	*A-*	*M*	*Mo*	*V*	*Vo*

GARVER	Project	US-70 Roosevelt Bridge	ORIGINATED BY:	SHH	DATE:	3/1/2021
	Job No.	20T03060	REVISED BY:	SHH	DATE:	3/4/2021
	Subject	Model B93 Performance Ratio Summary				
	Path	\\garverinc.local\gdata\Projects\2020\20T03060 - ODOT CI-2262 US-70 Roosevelt Bridge\Design\Bridge\Phase I\Alt 1\Model 1\Sub\Types\B93\[B93 PR Summary.xlsm]Model 1 - PR				

Model 1 - Existing Condition (No Reduction) Performance Ratio Summary

PR Color Key
Black: PR < 1.00
Purple: 1.00 < PR < 1.10
Orange: 1.10 < PR < 1.50
Red: PR > 1.50

Controlling Capacity Key
A+: Tension
A-: Compression
M: Flexural Capacity
Mo: Flexural Other
V: Shear & Torsion Capacity
Vo: Shear and Torsion Other

Note
PR = 1/CDR
*Includes minimum flexural steel.
**Includes minimum steel, maximum spacing, and longitudinal reinforcing checks.

Substructure Element		Axial Capacity		Flexural Capacity	Flexural Other	Shear & Torsion Capacity	Shear & Torsion Other	Controlling Capacity
		Tension	Comp.					
Columns	**Controlling PR:**	*N/A*	**0.260**	**0.914**	**0.523**	**0.407**	***2.086***	**Vo**
1st Story	CDR:	--	4.040	1.094	2.180	9.552	1.054	Vo
2nd Story	CDR:	--	4.189	1.282	1.913	2.460	0.479	Vo
3rd Story	CDR:	--	3.849	2.126	2.227	10.567	2.809	M
Transverse Struts	**Controlling PR:**	*N/A*	**0.011**	**0.631**	**0.307**	**0.391**	***1.669***	**Vo**
1st Story (Mem. 34)	CDR:	--	87.756	3.905	4.606	5.096	5.681	M
2nd Story (Mem. 33)	CDR:	--	194.207	1.673	3.705	2.972	1.897	M
3rd Story (Mem. 32)	CDR:	--	196.717	1.584	3.255	2.557	0.599	Vo
Longitudinal Struts	**Controlling PR:**	*N/A*	*N/A*	*N/A*	*N/A*	*N/A*	*N/A*	
Interior ("Mini") Struts	**Controlling PR:**	*N/A*	*N/A*	*N/A*	*N/A*	*N/A*	*N/A*	
T-Beams	**Controlling PR:**	*N/A*	*N/A*	*N/A*	*N/A*	*N/A*	*N/A*	
Foundation	**Max Pile Rxn:**	**24.463 k**	**79.813 k**	*N/A*	*N/A*	*N/A*	*N/A*	
Bent 34 South Footing	Max Pile Rxn:	24.463 k	79.813 k	--	--	--	--	
All Other Footings	Max Pile Rxn:	20.936 k	69.733 k	--	--	--	--	

GARVER	Project	US-70 Roosevelt Bridge	ORIGINATED BY:	DPE	DATE:	3/1/2021
	Job No.	20T03060	REVISED BY:	__	DATE:	__
	Subject	Model B94 Performance Ratio Summary				
	Path	L:\2020\20T03060 - ODOT CI-2262 US-70 Roosevelt Bridge\Design\Bridge\Phase I\Alt 1\Model 1\Sub\Types\B94\[B94 Capacity.xlsm]Model 1 - PR				

Model 1 - Existing Condition (No Reduction) Performance Ratio Summary

PR Color Key
Black: PR < 1.00
Purple: 1.00 < PR < 1.10
Orange: 1.10 < PR < 1.50
Red: PR > 1.50

Controlling Capacity Key
A+: Tension
A-: Compression
M: Flexural Capacity
Mo: Flexural Other
V: Shear & Torsion Capacity
Vo: Shear and Torsion Other

Note
PR = 1/CDR
*Includes minimum flexural steel.
**Includes minimum steel, maximum spacing, and longitudinal reinforcing checks.

Substructure Element		Axial Capacity		Flexural Capacity	Flexural Other	Shear & Torsion Capacity	Shear & Torsion Other	Controlling Capacity
		Tension	Comp.					
Columns	**Controlling PR:**	*N/A*	**0.260**	**0.866**	**0.521**	**0.103**	**0.872**	**Vo**
1st Story	CDR:	--	4.022	1.155	2.163	9.666	1.147	Vo
2nd Story	CDR:	--	4.189	1.282	1.921	10.370	1.327	M
3rd Story	CDR:	--	3.849	2.125	2.222	10.568	2.809	M
Transverse Struts	**Controlling PR:**	*N/A*	**0.012**	**0.632**	**0.302**	**0.391**	***1.669***	**Vo**
1st Story (Mem. 34)	CDR:	--	84.561	3.874	4.651	5.047	5.606	M
2nd Story (Mem. 33)	CDR:	--	195.094	1.646	3.581	2.924	1.855	M
3rd Story (Mem. 32)	CDR:	--	196.791	1.582	3.316	2.555	0.599	Vo
Longitudinal Struts	**Controlling PR:**	*N/A*	*N/A*	*N/A*	*N/A*	*N/A*	*N/A*	
Interior ("Mini") Struts	**Controlling PR:**	*N/A*	*N/A*	*N/A*	*N/A*	*N/A*	*N/A*	
T-Beams	**Controlling PR:**	*N/A*	*N/A*	*N/A*	*N/A*	*N/A*	*N/A*	
Foundation	**Controlling PR:**	**19.637**	**69.602**	*N/A*	*N/A*	*N/A*	*N/A*	

A+	*A-*	*M*	*Mo*	*V*	*Vo*

GARVER	Project	US-70 Roosevelt Bridge	ORIGINATED BY:	CLB	DATE:	3/1/2021
	Job No.	20T03060	REVISED BY:	__	DATE:	__
	Subject	Model B109 Performance Ratio Summary				
	Path	\\garverinc.local\gdata\Projects\2020\20T03060 - ODOT CI-2262 US-70 Roosevelt Bridge\Design\Bridge\Phase I\Alt 1\Model 1\Sub\Types\B109\[Capacity.xlsm]Model 1 - PR				

Model 1 - Existing Condition (No Reduction) Performance Ratio Summary

PR Color Key
Black: PR < 1.00
Purple: 1.00 < PR < 1.10
Orange: 1.10 < PR < 1.50
Red: PR > 1.50

Controlling Capacity Key
A+: Tension
A-: Compression
M: Flexural Capacity
Mo: Flexural Other
V: Shear & Torsion Capacity
Vo: Shear and Torsion Other

Note
PR = 1/CDR
*Includes minimum flexural steel.
**Includes minimum steel, maximum spacing, and longitudinal reinforcing checks.

Substructure Element		Axial Capacity		Flexural Capacity	Flexural Other	Shear & Torsion Capacity	Shear & Torsion Other	Controlling Capacity
		Tension	Comp.					
Columns	**Controlling PR:**	*N/A*	**0.267**	***1.074***	**0.609**	**0.596**	***2.642***	**Vo**
1st Story	CDR:	--	3.958	1.166	2.812	1.691	0.379	Vo
2nd Story	CDR:	--	4.071	0.931	1.900	1.677	0.423	Vo
3rd Story	CDR:	--	3.929	0.941	1.641	1.779	0.496	Vo
4th Story	CDR:	--	3.739	1.700	2.394	2.770	0.599	Vo
Transverse Struts	**Controlling PR:**	*N/A*	**0.010**	**0.612**	**0.297**	**0.380**	***1.669***	**Vo**
1st Story (Mem. 34, 74)	CDR:	--	98.601	4.029	4.075	5.132	5.489	M
2nd Story (Mem. 33, 73)	CDR:	--	142.374	1.980	3.556	3.730	2.941	M
3rd Story (Mem. 32, 72)	CDR:	--	202.823	1.649	3.480	2.941	1.841	M
4th Story (Mem. 32, 72)	CDR:	--	204.519	1.635	3.370	2.633	0.599	Vo
Longitudinal Struts	**Controlling PR:**	*N/A*	*N/A*	*N/A*	*N/A*	*N/A*	*N/A*	
Interior ("Mini Struts")	**Controlling PR:**	*N/A*	*N/A*	*N/A*	*N/A*	*N/A*	*N/A*	
T-Beams	**Controlling PR:**	*N/A*	*N/A*	*N/A*	*N/A*	*N/A*	*N/A*	
Foundation	**Max Pile Rxn:**	**35.590 k**	**109.174 k**	*N/A*	*N/A*	*N/A*	*N/A*	
Support 42 L	Max Pile Rxn:	35.322	109.174					
Support 42 R	Max Pile Rxn:	35.590	88.711					
Support 55	Max Pile Rxn:	30.879	78.793					

Notes:
Bottom Channel Negative Moment not checked. Looked at worst case of Positive and Negative Demand with Positive Capacity.
Axial for Top and Bottom Channels looked at with combined flexture. PR for flexture accounts for the Axial/Flexural Capacity.

A+	*A-*	*M*	*Mo*	*V*	*Vo*

GARVER	Project	US-70 Roosevelt Bridge	ORIGINATED BY:	DPE	DATE:	3/1/2021
	Job No.	20T03060	REVISED BY:	__	DATE:	__
	Subject	Model T31 Performance Ratio Summary				
	Path	L:\2020\20T03060 - ODOT CI-2262 US-70 Roosevelt Bridge\Design\Bridge\Phase I\Alt 1\Model 1\Sub\Types\T31\[T31 Capacity.xlsm]Model 1 - PR				

Model 1 - Existing Condition (No Reduction) Performance Ratio Summary

PR Color Key
Black: PR < 1.00
Purple: 1.00 < PR < 1.10
Orange: 1.10 < PR < 1.50
Red: PR > 1.50

Controlling Capacity Key
A+: Tension
A-: Compression
M: Flexural Capacity
Mo: Flexural Other
V: Shear & Torsion Capacity
Vo: Shear and Torsion Other

Note
PR = 1/CDR
*Includes minimum flexural steel.
**Includes minimum steel, maximum spacing, and longitudinal reinforcing checks.

Substructure Element		Axial Capacity		Flexural Capacity	Flexural Other	Shear & Torsion Capacity	Shear & Torsion Other	Controlling Capacity
		Tension	Comp.					
Columns	**Controlling PR:**	*N/A*	**0.251**	**0.370**	**0.434**	**0.159**	**0.208**	**Mo**
1st Story	CDR:	--	3.977	2.701	2.304	6.297	4.812	Mo
Transverse Struts	**Controlling PR:**	*N/A*	**0.008**	**0.241**	**0.289**	**0.157**	**0.172**	**Mo**
1st Story (Mem. 16, 38)	CDR:	--	129.736	4.146	3.463	6.361	5.817	Mo
Longitudinal Struts	**Controlling PR:**	*N/A*	**0.009**	***1.031***	**0.430**	**0.403**	***1.669***	**Vo**
1st Story (Mem. 49 - 52)	CDR:	--	121.247	2.261	2.833	4.225	3.190	M
Top (Mem. 45 - 48)	CDR:	--	111.248	0.970	2.327	2.484	0.599	Vo
Interior ("Mini") Struts	**Controlling PR:**	*N/A*	**0.002**	**0.357**	**0.393**	**0.097**	**0.231**	**Mo**
1st Story (Mem. 54)	CDR:	--	791.373	5.792	4.839	10.566	7.375	Mo
Top (Mem. 53)	CDR:	--	454.488	2.799	2.545	10.342	4.328	Mo
T-Beams	**Controlling PR:**	*N/A*	*N/A*	*N/A*	*N/A*	*N/A*	*N/A*	
Foundation	**Controlling PR:**	*N/A*	*N/A*	*N/A*	*N/A*	*N/A*	*N/A*	

A+	*A-*	*M*	*Mo*	*V*	*Vo*

GARVER	Project	US-70 Roosevelt Bridge	ORIGINATED BY:	ZMB	DATE:	3/1/2021
	Job No.	20T03060	REVISED BY:	__	DATE:	__
	Subject	Model T55 Performance Ratio Summary				
	Path	C:\Users\ZMBrinlee\Desktop\T55\[Capacity_T55.xlsm]Model 1 - PR				

Model 1 - Existing Condition (No Reduction) Performance Ratio Summary

PR Color Key
Black: PR < 1.00
Purple: 1.00 < PR < 1.10
Orange: 1.10 < PR < 1.50
Red: PR > 1.50

Controlling Capacity Key
A+: Tension
A-: Compression
M: Flexural Capacity
Mo: Flexural Other
V: Shear & Torsion Capacity
Vo: Shear and Torsion Other

Note
PR = 1/CDR
*Includes minimum flexural steel.
**Includes minimum steel, maximum spacing, and longitudinal reinforcing checks.

Substructure Element		Axial Capacity		Flexural Capacity	Flexural Other	Shear & Torsion Capacity	Shear & Torsion Other	Controlling Capacity
		Tension	Comp.					
Columns	**Controlling PR:**	*N/A*	**0.327**	**0.598**	**0.587**	**0.465**	***1.947***	**Vo**
1st Story	CDR:	--	3.054	1.755	1.754	4.284	1.671	Vo
2nd Story	CDR:	--	4.222	1.671	1.703	2.148	0.514	Vo
Transverse Struts	**Controlling PR:**	*N/A*	**0.009**	**0.670**	**0.368**	**0.346**	***1.112***	**Vo**
1st Story	CDR:	--	117.478	3.541	3.693	6.151	5.298	M
2nd Story	CDR:	--	133.554	1.493	2.718	2.889	0.899	Vo
Longitudinal Struts	**Controlling PR:**	**0.005**	**0.010**	***1.176***	**0.288**	**0.492**	***1.112***	**M**
1st Story	CDR:	--	100.408	2.292	3.473	4.210	3.576	M
2nd Story	CDR:	208.713	1652.486	0.964	3.662	2.034	0.899	Vo
Top	CDR:	--	136.495	0.851	3.497	2.134	0.899	M
Interior ("Mini") Struts	**Controlling PR:**	*N/A*	**0.003**	**0.512**	**0.567**	**0.132**	**0.375**	**Mo**
1st Story	CDR:	--	923.684	6.772	5.658	11.432	9.892	Mo
2nd Story	CDR:	--	337.835	1.954	1.764	7.564	2.665	Mo
Top	CDR:	--	360.561	2.304	2.214	9.817	3.619	Mo
T-Beams	**Controlling PR:**	*N/A*	*N/A*	*N/A*	*N/A*	*N/A*	*N/A*	
Foundation	**Controlling PR:**	**3.909 k**	**60.596 k**	*N/A*	*N/A*	*N/A*	*N/A*	
Bent 3	Max Pile Rxn:	1.176 k	39.673 k	--	--	--	--	
Bent 4	Max Pile Rxn:	3.909 k	60.596 k	--	--	--	--	

A+	*A-*	*M*	*Mo*	*V*	*Vo*

Attachment A

GARVER	Project	US-70 Roosevelt Bridge	ORIGINATED BY:	SHH	DATE:	3/1/2021
	Job No.	20T03060	REVISED BY:		DATE:	
	Subject	Model T76 Performance Ratio Summary				
	Path	\\garverinc.local\gdata\Projects\2020\20T03060 - ODOT CI-2262 US-70 Roosevelt Bridge\Design\Bridge\Phase I\Alt 1\Model 1\Sub\Types\T76\[T76 Performance Ratio Summary.xlsm]Model 1 - PR				

Model 1 - Existing Condition (No Reduction) Performance Ratio Summary

PR Color Key
Black: PR < 1.00
Purple: 1.00 < PR < 1.10
Orange: 1.10 < PR < 1.50
Red: PR > 1.50

Controlling Capacity Key
M+: Positive Moment
M-: Negative Moment
R: Rivets
V: Shear
A: Axial

Note
PR = 1/CDR
*Includes minimum flexural steel.
**Includes minimum steel, maximum spacing, and longitudinal reinforcing checks.

Substructure Element		Axial Capacity		Flexural Capacity	Flexural Other	Shear & Torsion Capacity	Shear & Torsion Other	Controlling Capacity
		Tension	Comp.					
Columns	**Controlling PR:**	*N/A*	**0.321**	**0.370**	**0.414**	**0.158**	**0.312**	**Mo**
1st Story	CDR:	--	3.117	2.699	2.434	6.312	3.871	Mo
2nd Story	CDR:	--	3.684	2.852	2.415	8.127	3.203	Mo
3rd Story	CDR:	--	4.479	2.798	2.491	7.737	3.738	Mo
Transverse Struts	**Controlling PR:**	*N/A*	**0.010**	**0.622**	**0.306**	**0.394**	***1.669***	**Vo**
1st Story (Mem. 34, 74)	CDR:	--	95.750	3.054	3.838	5.146	4.691	M
2nd Story (Mem. 33, 73)	CDR:	--	166.618	1.609	3.663	2.746	1.686	M
3rd Story (Mem. 32, 72)	CDR:	--	143.958	1.611	3.266	2.536	0.599	Vo
Longitudinal Struts	**Controlling PR:**	**0.006**	**0.007**	**0.670**	**0.317**	**0.366**	**0.467**	**M**
1st Story (Mem. 93 - 96)	CDR:	--	151.930	2.922	4.020	4.570	4.344	M
2nd Story (Mem. 89 - 92)	CDR:	16661.695	474.673	1.719	3.344	3.007	2.472	M
3rd Story (Mem. 85 - 88)	CDR:	164.275	2643.751	1.493	3.158	2.733	2.143	M
Top (Mem. 81 - 84)	CDR:	--	140.410	1.730	3.746	3.155	2.664	M
Interior ("Mini") Struts	**Controlling PR:**	*N/A*	**0.004**	**0.607**	**0.562**	**0.187**	**0.427**	**M**
1st Story (Mem. 100)	CDR:	--	655.771	2.791	2.583	6.600	3.921	Mo
2nd Story (Mem. 99)	CDR:	--	269.652	1.648	2.223	5.355	2.407	M
3rd Story (Mem. 98)	CDR:	--	277.198	1.688	1.779	5.693	2.342	M
Top (Mem. 97)	CDR:	--	321.929	2.179	2.395	8.316	3.383	M
T-Beams	**Controlling PR:**	*N/A*	*N/A*	*N/A*	*N/A*	*N/A*	*N/A*	
Foundation	**Max Pile Rxn:**	**3.026 k**	**75.479 k**	*N/A*	*N/A*	*N/A*	*N/A*	
Bent 80 South Footing	Max Pile Rxn:	0.828 k	64.180 k					
Bent 80 North Footing	Max Pile Rxn:	1.540 k	62.019 k					
Bent 81 South Footing	Max Pile Rxn:	3.026 k	73.592 k					
Bent 81 North Footing	Max Pile Rxn:	2.353 k	75.479 k					

GARVER	Project	US-70 Roosevelt Bridge	ORIGINATED BY:	ZMB	DATE:	3/1/2021
	Job No.	20T03060	REVISED BY:	__	DATE:	__
	Subject	Model T87 Performance Ratio Summary				
	Path	C:\Users\ZMBrinlee\Desktop\[Capacity_T87 All.xlsm]Model 1 - PR				

Model 1 - Existing Condition (No Reduction) Performance Ratio Summary

PR Color Key
Black: PR < 1.00
Purple: 1.00 < PR < 1.10
Orange: 1.10 < PR < 1.50
Red: PR > 1.50

Controlling Capacity Key
A+: Tension
A-: Compression
M: Flexural Capacity
Mo: Flexural Other
V: Shear & Torsion Capacity
Vo: Shear and Torsion Other

Note
PR = 1/CDR
*Includes minimum flexural steel.
**Includes minimum steel, maximum spacing, and longitudinal reinforcing checks.

Substructure Element		Axial Capacity		Flexural Capacity	Flexural Other	Shear & Torsion Capacity	Shear & Torsion Other	Controlling Capacity
		Tension	Comp.					
Columns	**Controlling PR:**	*N/A*	**0.336**	**0.465**	**0.480**	**0.162**	**0.431**	**Mo**
1st Story	CDR:	--	2.980	2.152	2.100	6.163	2.414	Mo
2nd Story	CDR:	--	3.639	2.325	2.083	7.704	2.322	Mo
3rd Story	CDR:	--	4.519	2.794	2.497	8.011	3.089	Mo
Transverse Struts	**Controlling PR:**	*N/A*	**0.013**	**0.748**	**0.313**	**0.444**	***1.877***	**Vo**
1st Story	CDR:	--	74.949	2.663	3.660	4.655	4.137	M
2nd Story	CDR:	--	154.077	1.337	3.540	2.294	0.533	Vo
3rd Story	CDR:	--	138.976	1.436	3.199	2.251	0.599	Vo
Longitudinal Struts	**Controlling PR:**	**0.007**	**0.008**	**0.734**	**0.314**	**0.401**	***1.877***	**Vo**
1st Story (Mem. 93 - 96)	CDR:	--	126.092	2.645	4.016	4.231	3.937	M
2nd Story (Mem. 89 - 92)	CDR:	837.379	637.654	1.444	3.387	2.535	0.533	Vo
3rd Story (Mem. 85 - 88)	CDR:	143.756	3357.221	1.363	3.183	2.494	0.599	Vo
Top (Mem. 81 - 84)	CDR:	--	153.060	1.658	3.726	3.034	2.485	M
Interior ("Mini") Struts	**Controlling PR:**	*N/A*	**0.004**	**0.731**	**0.582**	**0.215**	**0.486**	**M**
1st Story (Mem. 100)	CDR:	--	597.781	2.369	2.574	5.874	3.391	M
2nd Story (Mem. 99)	CDR:	--	272	1.369	2.075	4.640	2.058	M
3rd Story (Mem. 98)	CDR:	--	278.109	1.526	1.720	5.209	2.132	M
Top (Mem. 97)	CDR:	--	321.292	2.072	2.348	8.089	3.280	M
T-Beams	**Controlling PR:**	*N/A*	*N/A*	*N/A*	*N/A*	*N/A*	*N/A*	
Foundation	**Controlling PR:**	**3.110 k**	**63.674 k**	*N/A*	*N/A*	*N/A*	*N/A*	
Tower 20/21	Max Pile Rxn:	3.110 k	63.674 k	--	--	--	--	

A+	*A-*	*M*	*Mo*	*V*	*Vo*

Attachment A

GARVER	Project	US-70 Roosevelt Bridge	ORIGINATED BY:	CLB	DATE:	3/1/2021
	Job No.	20T03060	REVISED BY:	__	DATE:	__
	Subject	Model T93 Performance Ratio Summary				
	Path	L:\2020\20T03060 - ODOT CI-2262 US-70 Roosevelt Bridge\Design\Bridge\Phase I\Alt 1\Model 1\Sub\Types\T93\[Capacity.xlsm]Model 1 - PR				

Model 1 - Existing Condition (No Reduction) Performance Ratio Summary

PR Color Key
Black: PR < 1.00
Purple: 1.00 < PR < 1.10
Orange: 1.10 < PR < 1.50
Red: PR > 1.50

Controlling Capacity Key
A+: Tension
A-: Compression
M: Flexural Capacity
Mo: Flexural Other
V: Shear & Torsion Capacity
Vo: Shear and Torsion Other

Note
PR = 1/CDR
*Includes minimum flexural steel.
**Includes minimum steel, maximum spacing, and longitudinal reinforcing checks.

Substructure Element		Axial Capacity		Flexural Capacity	Flexural Other	Shear & Torsion Capacity	Shear & Torsion Other	Controlling Capacity
		Tension	Comp.					
Columns	**Controlling PR:**	*N/A*	**0.348**	**0.509**	**0.509**	**0.164**	**0.320**	**Mo**
1st Story	CDR:	--	2.874	1.965	1.965	6.108	3.417	Mo
2nd Story	CDR:	--	3.532	2.303	2.132	7.205	3.333	Mo
3rd Story	CDR:	--	4.400	2.520	2.239	8.146	3.123	Mo
Transverse Struts	**Controlling PR:**	*N/A*	**0.013**	**0.691**	**0.274**	**0.450**	***1.251***	**Vo**
1st Story (Mem. 34, 74)	CDR:	--	75.063	3.572	5.452	4.937	5.656	M
2nd Story (Mem. 33, 73)	CDR:	--	153.679	1.447	4.124	2.224	0.799	Vo
3rd Story (Mem. 32, 72)	CDR:	--	138.349	1.525	3.654	2.496	0.899	Vo
Longitudinal Struts	**Controlling PR:**	**0.004**	**0.007**	**0.457**	**0.203**	**0.346**	**0.366**	**M**
1st Story (Mem. 93 - 96)	CDR:	--	136.777	4.269	6.341	4.673	6.517	M
2nd Story (Mem. 89 - 92)	CDR:	1269.734	767.735	2.299	5.209	2.890	2.732	M
3rd Story (Mem. 85 - 88)	CDR:	276.043	246.981	2.187	5.029	2.915	3.247	M
Top (Mem. 81 - 84)	CDR:	--	180.845	2.301	4.920	3.109	3.326	M
Interior ("Mini") Struts	**Controlling PR:**	*N/A*	**0.004**	**0.803**	**0.585**	**0.234**	**0.531**	**M**
1st Story (Mem. 100)	CDR:	--	576.839	2.411	2.850	5.524	3.531	M
2nd Story (Mem. 99)	CDR:	--	271.888	1.245	2.057	4.272	1.885	M
3rd Story (Mem. 98)	CDR:	--	276.144	1.393	1.708	4.800	1.961	M
Top (Mem. 97)	CDR:	--	314.138	1.988	2.443	8.283	1.997	M
T-Beams	**Controlling PR:**	*N/A*	*N/A*	*N/A*	*N/A*	*N/A*	*N/A*	
Foundation	**Controlling PR:**	**3.982 k**	**66.414 k**	*N/A*	*N/A*	*N/A*	*N/A*	
Support No. 32	Max Pile Rxn:	0.000	65.032					
Support No. 33	Max Pile Rxn:	3.982	66.414					

A+	*A-*	*M*	*Mo*	*V*	*Vo*

GARVER	Project	US-70 Roosevelt Bridge	ORIGINATED BY:	DPE	DATE:	3/1/2021
	Job No.	20T03060	REVISED BY:	__	DATE:	__
	Subject	Model T95 Performance Ratio Summary				
	Path	L:\2020\20T03060 - ODOT CI-2262 US-70 Roosevelt Bridge\Design\Bridge\Phase I\Alt 1\Model 1\Sub\Types\T95\[T95 Capacity.xlsm]Model 1 - PR				

Model 1 - Existing Condition (No Reduction) Performance Ratio Summary

PR Color Key
Black: PR < 1.00
Purple: 1.00 < PR < 1.10
Orange: 1.10 < PR < 1.50
Red: PR > 1.50

Controlling Capacity Key
A+: Tension
A-: Compression
M: Flexural Capacity
Mo: Flexural Other
V: Shear & Torsion Capacity
Vo: Shear and Torsion Other

Note
PR = 1/CDR
*Includes minimum flexural steel.
**Includes minimum steel, maximum spacing, and longitudinal reinforcing checks.

Substructure Element		Axial Capacity		Flexural Capacity	Flexural Other	Shear & Torsion Capacity	Shear & Torsion Other	Controlling Capacity
		Tension	Comp.					
Columns	**Controlling PR:**	*N/A*	**0.280**	**0.392**	**0.445**	**0.134**	**0.321**	**Mo**
1st Story	CDR:	--	3.565	3.716	3.254	7.495	6.406	Mo
2nd Story	CDR:	--	3.894	2.556	2.249	7.435	5.511	Mo
2nd Story*	CDR:	--	4.656	2.988	2.612	9.899	3.781	Mo
3rd Story	CDR:	--	4.933	2.552	2.338	7.904	3.113	Mo
Transverse Struts	**Controlling PR:**	*N/A*	**0.013**	**0.649**	**0.266**	**0.446**	***1.669***	**Vo**
1st Story (Mem. 34, 74)	CDR:	--	75.301	4.612	6.030	5.399	7.924	M
2nd Story (Mem. 33, 73)	CDR:	--	151.177	2.039	5.256	2.552	2.161	M
3rd Story (Mem. 32, 72)	CDR:	--	140.965	1.540	3.759	2.240	0.599	Vo
Longitudinal Struts	**Controlling PR:**	**0.003**	**0.007**	**0.432**	**0.199**	**0.319**	**0.293**	**M**
1st Story (Mem. 93 - 96)	CDR:	--	153.320	4.645	6.190	5.780	7.566	M
2nd Story (Mem. 89 - 92)	CDR:	--	1139.838	2.656	5.273	3.866	4.117	M
3rd Story (Mem. 85 - 88)	CDR:	323.580	16248.775	2.535	5.201	3.165	3.902	M
Top (Mem. 81 - 84)	CDR:	--	177.973	2.317	5.036	3.135	3.415	M
Interior ("Mini") Struts	**Controlling PR:**	*N/A*	**0.004**	**0.787**	**0.461**	**0.229**	**0.520**	**M**
1st Story (Mem. 100)	CDR:	--	624.965	4.337	3.917	7.612	6.586	Mo
2nd Story (Mem. 99)	CDR:	--	247.393	1.270	2.179	4.368	1.922	M
3rd Story (Mem. 98)	CDR:	--	243.488	1.627	2.168	5.272	2.413	M
Top (Mem. 97)	CDR:	--	322.890	1.897	2.396	7.473	2.990	M
T-Beams	**Controlling PR:**	*N/A*	*N/A*	*N/A*	*N/A*	*N/A*	*N/A*	
Foundation	**Controlling Load:**	**0.665k**	**55.584k**	*N/A*	*N/A*	*N/A*	*N/A*	
Bent 57	Pile Reaction:	0.665k	55.584k					
Bent 56	Pile Reaction:	0.000k	48.462k					

A+	*A-*	*M*	*Mo*	*V*	*Vo*

GARVER	Project	US-70 Roosevelt Bridge	ORIGINATED BY:	ZMB	DATE:	3/1/2021
	Job No.	20T03060	REVISED BY:	__	DATE:	__
	Subject	Model T100 Performance Ratio Summary				
	Path	C:\Users\ZMBrinlee\Desktop\T100\[Capacity_T100.xlsm]Model 1 - PR				

Model 1 - Existing Condition (No Reduction) Performance Ratio Summary

PR Color Key
Black: PR < 1.00
Purple: 1.00 < PR < 1.10
Orange: 1.10 < PR < 1.50
Red: PR > 1.50

Controlling Capacity Key
A+: Tension
A-: Compression
M: Flexural Capacity
Mo: Flexural Other
V: Shear & Torsion Capacity
Vo: Shear and Torsion Other

Note
PR = 1/CDR
*Includes minimum flexural steel.
**Includes minimum steel, maximum spacing, and longitudinal reinforcing checks.

Substructure Element		Axial Capacity		Flexural Capacity	Flexural Other	Shear & Torsion Capacity	Shear & Torsion Other	Controlling Capacity
		Tension	Comp.					
Columns	**Controlling PR:**	*N/A*	**0.294**	**0.395**	**0.444**	**0.134**	**0.320**	**Mo**
1st Story	CDR:	--	3.400	3.403	2.940	7.482	4.667	Mo
2nd Story	CDR:	--	3.598	2.579	2.272	7.441	3.723	Mo
3rd Story	CDR:	--	4.403	2.534	2.253	7.887	3.129	Mo
Transverse Struts	**Controlling PR:**	*N/A*	**0.015**	**0.817**	**0.287**	**0.473**	***1.877***	**Vo**
1st Story (Mem. 34, 74)	CDR:	--	67.566	2.973	3.676	5.545	4.721	M
2nd Story (Mem. 33, 73)	CDR:	--	134.876	1.224	3.485	2.115	0.533	Vo
3rd Story (Mem. 32, 72)	CDR:	--	141.356	1.534	3.786	2.229	0.599	Vo
Longitudinal Struts	**Controlling PR:**	**0.006**	**0.009**	**0.688**	**0.311**	***1.151***	***3.337***	**Vo**
1st Story (Mem. 93 - 96)	CDR:	--	117.442	2.604	3.789	0.868	0.300	Vo
2nd Story (Mem. 89 - 92)	CDR:	--	2308.112	1.454	3.213	1.729	1.065	Vo
3rd Story (Mem. 85 - 87)	CDR:	180.753	7914.263	1.475	3.616	2.610	2.073	M
Top (Mem. 81 - 84)	CDR:	--	159.807	1.609	3.737	2.943	2.308	M
Interior ("Mini") Struts	**Controlling PR:**	*N/A*	**0.004**	**0.828**	**0.581**	**0.239**	**0.548**	**M**
1st Story (Mem. 100)	CDR:	--	579.150	3.768	3.913	7.074	5.852	M
2nd Story (Mem. 99)	CDR:	--	250.345	1.208	2.148	4.176	1.834	M
3rd Story (Mem. 98)	CDR:	--	232.969	1.286	1.720	4.474	1.825	M
Top (Mem. 97)	CDR:	--	316.590	1.901	2.366	7.487	3.002	M
T-Beams	**Controlling PR:**	*N/A*	*N/A*	*N/A*	*N/A*	*N/A*	*N/A*	
Foundation	**Max Pile Rxn:**	**2.366 k**	**58.294 k**	*N/A*	*N/A*	*N/A*	*N/A*	
Bent 40	Max Pile Rxn:	1.001 k	50.541 k	--	--	--	--	
Bent 41	Max Pile Rxn:	2.366 k	58.294 k	--	--	--	--	

A+	*A-*	*M*	*Mo*	*V*	*Vo*

GARVER	Project	US-70 Roosevelt Bridge	ORIGINATED BY:	JWM	DATE:	3/5/2021
	Job No.	20T03060	REVISED BY:	__	DATE:	__
	Subject	Substructure - T-Beam Cap Performance Ratio Summary				
	Path	L:\2020\20T03060 - ODOT CI-2262 US-70 Roosevelt Bridge\Design\Bridge\Phase I\Alt 1\Model 1\Sub\Types\T-Beams\[T Beam PR Summary.xlsm]Model 1 - PR				

Model 1 - Existing Condition (No Reduction) Performance Ratio Summary

PR Color Key
Black: PR < 1.00
Purple: 1.00 < PR < 1.10
Orange: 1.10 < PR < 1.50
Red: PR > 1.50

Controlling Capacity Key
M+: Positive Moment
V: Shear

Superstructure Element	Member Shape	Moment Capacity	Shear Capacity	Controlling Capacity
Bent T-Beams	**Controlling PR:**	**0.774**	**0.209**	**M**
B59	T-Beam Type B	0.690	0.194	M
B67	T-Beam Type B	0.695	0.196	M
B83	T-Beam Type B	0.732	0.202	M
B87	T-Beam Type B	0.732	0.202	M
B90	T-Beam Type B	0.753	0.206	M
B93	T-Beam Type B	0.774	0.209	M
B94	T-Beam Type B	0.774	0.209	M
B109	T-Beam Type B	0.753	0.206	M
Tower T-Beams	**Controlling PR:**	**0.743**	**0.195**	**M**
T31	T-Beam Type T	0.529	0.159	M
T55	T-Beam Type T	0.655	0.180	M
T76	T-Beam Type T	0.659	0.181	M
T87	T-Beam Type T	0.683	0.185	M
T93	T-Beam Type T	0.742	0.195	M
T95	T-Beam Type T	0.743	0.195	M
T97	T-Beam Type T	0.742	0.195	M
T100	T-Beam Type T	0.743	0.195	M
Abutment T-Beams	**Controlling PR:**	**0.000**	**0.000**	**M**
A1	T-Beam Type A	0.000	0.000	M

GARVER	Project	US-70 Roosevelt Bridge	ORIGINATED BY:	JWM	DATE:	3/5/2021
	Job No.	20T03060	REVISED BY:	__	DATE:	__
	Subject	Substructure - Foundation Performance Ratio Summary				
	Path	L:\2020\20T03060 - ODOT CI-2262 US-70 Roosevelt Bridge\Design\Bridge\Phase I\Alt 1\Model 1\Sub\Foundations\[Foundation PR Summary.xlsm]Model 1 - PR				

Model 1 - Existing Condition (No Reduction) Performance Ratio Summary

PR Color Key
Black: PR < 1.00
Purple: 1.00 < PR < 1.10
Orange: 1.10 < PR < 1.50
Red: PR > 1.50

Controlling Capacity Key
M+: Positive Moment
V: Shear

Controlling Capacity Key
Capacities taken as the design loads given in the as-builts

Superstructure Element	Member Shape	Axial Capacity (Tons)	Axial Demand (Tons)	PR
Abutment Foundations	**Controlling PR:**			**0.694**
A1	Concrete Pile	40.000	27.765	0.694
A88	Spread Footing	0.000	0.000	*N/A*
Bent Foundations	**Controlling PR:**			***2.022***
B59T	Timber Pile	27.000	25.055	0.928
B59C	Concrete Pile	40.000	31.170	0.779
B67T	Timber Pile	27.000	26.450	0.980
B67C	Concrete Pile	40.000	45.250	***1.131***
B83	Timber Pile	27.000	34.925	***1.294***
B87	Timber Pile	27.000	33.235	***1.231***
B90	Timber Pile	27.000	30.300	***1.122***
B93	Concrete Pile	40.000	39.900	0.998
B94	Timber Pile	27.000	34.800	***1.289***
B109	Timber Pile	27.000	54.585	***2.022***
Tower Foundations	**Controlling PR:**			***1.398***
T31	Spread Footing	0.000	0.000	*N/A*
T55T	Timber Pile	27.000	26.940	0.998
T55C	Concrete Pile	40.000	30.300	0.758
T76	Timber Pile	27.000	37.740	***1.398***
T87	Timber Pile	27.000	31.835	***1.179***
T93	Timber Pile	27.000	33.205	***1.230***
T95	Timber Pile	27.000	27.800	***1.030***
T100	Timber Pile	27.000	27.765	***1.028***

Attachment A

GARVER	Project	US-70 Roosevelt Bridge	ORIGINATED BY:	BDE	DATE:	3/1/2021
	Job No.	20T03060	REVISED BY:	_	DATE:	_
	Subject	Truss Span Performance Ratio Summary				
	Path	L:\2020\20T03060 - ODOT CI-2262 US-70 Roosevelt Bridge\Drawings\SUBMT\3-5-2021\[Truss Span Superstructure Performance Ratio Summary - rev 3-4V2.xlsm]Model 1 - PR				

Model 1 - Existing Condition (No Reduction) Performance Ratio Summary

PR Color Key
Black: PR < 1.00
Purple: 1.00 < PR < 1.10
Orange: 1.10 < PR < 1.50
Red: PR > 1.50

Controlling Capacity Key
M+: Positive Moment
M-: Negative Moment
R: Rivets
V: Shear
A: Axial

Superstructure Element	Member Shape	Flexural Capacity		Rivet Capacity	Shear Capacity	Axial Capacity	Controlling Capacity
		Positive Moment	Negative Moment				
Concrete Deck	**Controlling PR:**	**0.997**	***1.148***	**0.000**	**0.000**	**0.000**	**M-**
Interior Bay	8" Slab	0.997	***1.148***	*N/A*	*N/A*	*N/A*	M-
Overhang	8" Slab	*N/A*	0.657	*N/A*	*N/A*	*N/A*	M-
Floor Beams	**Controlling PR:**	***1.090***	**0.000**	**0.818**	**0.476**	**0.000**	**M+**
Interior	36WF, CB211 (Hist.)	***1.090***	*N/A*	*N/A*	*N/A*	*N/A*	M+
End	36WF, CB361 (Hist.)	0.896	*N/A*	*N/A*	*N/A*	*N/A*	M+
Int. FB Connection	L4"x4"x3/8"	*N/A*	*N/A*	*N/A*	0.476	*N/A*	V
End FB Connection	L4"x4"x3/8"	*N/A*	*N/A*	*N/A*	0.217	*N/A*	V
Rivets	7/8"	*N/A*	*N/A*	0.818	*N/A*	*N/A*	R
Stringers	**Controlling PR:**	***1.297***	**0.000**	**0.724**	**0.425**	**0.000**	**M+**
Interior	21WF, CB211 (Hist.)	***1.297***	*N/A*	*N/A*	*N/A*	*N/A*	M+
Exterior	21WF, CB211 (Hist.)	***1.219***	*N/A*	*N/A*	*N/A*	*N/A*	M+
Interior Connection	L6"x4"x3/8"	*N/A*	*N/A*	*N/A*	0.425	*N/A*	V
Exterior Connection	L6"x4"x3/8"	*N/A*	*N/A*	*N/A*	0.375	*N/A*	V
Rivets	3/4"	*N/A*	*N/A*	0.724	*N/A*	*N/A*	R
Truss Members	**Controlling PR:**	**0.000**	**0.000**	**0.000**	**0.000**	**0.983**	**A**
Lower Chord	Built Up	*N/A*	*N/A*	*N/A*	*N/A*	0.753	A
Upper Chord	Built Up	*N/A*	*N/A*	*N/A*	*N/A*	0.792	A
Web Members	Built Up	*N/A*	*N/A*	*N/A*	*N/A*	0.902	A
Gusset Plates LC	1/2" Plate	*N/A*	*N/A*	*N/A*	*N/A*	0.983	A
Gusset Plates UC	1/2" Plate	*N/A*	*N/A*	*N/A*	*N/A*	0.983	A
Truss Bearings	Rockers & Bolsters	*N/A*	*N/A*	*N/A*	*N/A*	0.911	A
Truss Bracing	**Controlling PR:**	**0.000**	**0.000**	**0.000**	**0.000**	**0.549**	**A**
Upper Lateral	2L6"x4"x3/8"	*N/A*	*N/A*	*N/A*	*N/A*	0.231	A
Top Struts	2x2L5"x3 1/2"x5/16"	*N/A*	*N/A*	*N/A*	*N/A*	0.369	A
Lower Lateral L0-L2	2L4"x3"x1/2"	*N/A*	*N/A*	*N/A*	*N/A*	0.549	A
Lower Lateral L2-L5	2L4"x3"x1/2"	*N/A*	*N/A*	*N/A*	*N/A*	0.477	A

GARVER	Project	US-70 Roosevelt Bridge	ORIGINATED BY:	BDE	DATE:	3/1/2021
	Job No.	20T03060	REVISED BY:	_	DATE:	_
	Subject	Truss Span Performance Ratio Summary				
	Path	L:\2020\20T03060 - ODOT CI-2262 US-70 Roosevelt Bridge\Drawings\SUBMT\3-5-2021\[Truss Span Superstructure Performance Ratio Summary - rev 3-4V2.xlsm]Model 2 - PR				

Model 2 - Existing Condition (With Reduction) Performance Ratio Summary

PR Color Key
Black: PR < 1.00
Purple: 1.00 < PR < 1.10
Orange: 1.10 < PR < 1.50
Red: PR > 1.50

Controlling Capacity Key
M+: Positive Moment
M-: Negative Moment
R: Rivets
V: Shear
A: Axial

Superstructure Element	Member Shape	Flexural Capacity		Rivet Capacity	Shear Capacity	Axial Capacity	Controlling Capacity
		Positive Moment	Negative Moment				
Concrete Deck	**Controlling PR:**	**0.997**	***1.148***	**0.000**	**0.000**	**0.000**	**M-**
Interior Bay	8" Slab	0.997	***1.148***	*N/A*	*N/A*	*N/A*	M-
Overhang	8" Slab	*N/A*	0.657	*N/A*	*N/A*	*N/A*	M-
Floor Beams	**Controlling PR:**	***1.148***	**0.000**	**0.818**	**0.476**	**0.000**	**M+**
Interior	36WF, CB211 (Hist.)	***1.148***	*N/A*	*N/A*	*N/A*	*N/A*	M+
End	36WF, CB361 (Hist.)	0.944	*N/A*	*N/A*	*N/A*	*N/A*	M+
Int. FB Connection	L4"x4"x3/8"	*N/A*	*N/A*	*N/A*	0.476	*N/A*	V
End FB Connection	L4"x4"x3/8"	*N/A*	*N/A*	*N/A*	0.217	*N/A*	V
Rivets	7/8"	*N/A*	*N/A*	0.818	*N/A*	*N/A*	R
Stringers	**Controlling PR:**	***1.297***	**0.000**	**0.724**	**0.425**	**0.000**	**M+**
Interior	21WF, CB211 (Hist.)	***1.297***	*N/A*	*N/A*	*N/A*	*N/A*	M+
Exterior	21WF, CB211 (Hist.)	***1.219***	*N/A*	*N/A*	*N/A*	*N/A*	M+
Interior Connection	L6"x4"x3/8"	*N/A*	*N/A*	*N/A*	0.425	*N/A*	V
Exterior Connection	L6"x4"x3/8"	*N/A*	*N/A*	*N/A*	0.375	*N/A*	V
Rivets	3/4"	*N/A*	*N/A*	0.724	*N/A*	*N/A*	R
Truss Members	**Controlling PR:**	**0.000**	**0.000**	**0.000**	**0.000**	**0.983**	**A**
Lower Chord	Built Up	*N/A*	*N/A*	*N/A*	*N/A*	0.792	A
Upper Chord	Built Up	*N/A*	*N/A*	*N/A*	*N/A*	0.792	A
Web Members	Built Up	*N/A*	*N/A*	*N/A*	*N/A*	0.902	A
Gusset Plates LC	1/2" Plate	*N/A*	*N/A*	*N/A*	*N/A*	0.983	A
Gusset Plates UC	1/2" Plate	*N/A*	*N/A*	*N/A*	*N/A*	0.983	A
Truss Bearings	Rockers & Bolsters	*N/A*	*N/A*	*N/A*	*N/A*	0.911	A
Truss Bracing	**Controlling PR:**	**0.000**	**0.000**	**0.000**	**0.000**	**0.549**	**A**
Upper Lateral	2L6"x4"x3/8"	*N/A*	*N/A*	*N/A*	*N/A*	0.231	A
Top Struts	2x2L5"x3 1/2"x5/16"	*N/A*	*N/A*	*N/A*	*N/A*	0.369	A
Lower Lateral L0-L2	2L4"x3"x1/2"	*N/A*	*N/A*	*N/A*	*N/A*	0.549	A
Lower Lateral L2-L5	2L4"x3"x1/2"	*N/A*	*N/A*	*N/A*	*N/A*	0.477	A

GARVER	Project	US-70 Roosevelt Bridge	ORIGINATED BY:	BDE	DATE:	3/1/2021
	Job No.	20T03060	REVISED BY:	_	DATE:	_
	Subject	Truss Span Performance Ratio Summary				
	Path	L:\2020\20T03060 - ODOT CI-2262 US-70 Roosevelt Bridge\Drawings\SUBMT\3-5-2021\[Truss Span Superstructure Performance Ratio Summary - rev 3-4V2.xlsm]Model 3 - PR				

Model 3 - Retrofit Performance Ratio Summary

PR Color Key
Black: PR < 1.00
Purple: 1.00 < PR < 1.10
Orange: 1.10 < PR < 1.50
Red: PR > 1.50

Controlling Capacity Key
M+: Positive Moment
M-: Negative Moment
R: Rivets
V: Shear
A: Axial

Superstructure Element	Member Shape	Flexural Capacity		Rivet Capacity	Shear Capacity	Axial Capacity	Controlling Capacity
		Positive Moment	Negative Moment				
Concrete Deck	**Controlling PR:**	**0.997**	***1.148***	**0.000**	**0.000**	**0.000**	**M-**
Interior Bay	8" Slab	0.997	***1.148***	*N/A*	*N/A*	*N/A*	M-
Overhang	8" Slab	*N/A*	0.657	*N/A*	*N/A*	*N/A*	M-
Floor Beams	**Controlling PR:**	**0.944**	**0.000**	**0.818**	**0.476**	**0.000**	**M+**
Interior	36WF, CB211 (Hist.)	0.848	*N/A*	*N/A*	*N/A*	*N/A*	M+
End	36WF, CB361 (Hist.)	0.944	*N/A*	*N/A*	*N/A*	*N/A*	M+
Int. FB Connection	L4"x4"x3/8"	*N/A*	*N/A*	*N/A*	0.476	*N/A*	V
End FB Connection	L4"x4"x3/8"	*N/A*	*N/A*	*N/A*	0.217	*N/A*	V
Rivets	7/8"	*N/A*	*N/A*	0.818	*N/A*	*N/A*	R
Stringers	**Controlling PR:**	**0.958**	**0.000**	**0.724**	**0.425**	**0.000**	**M+**
Interior	21WF, CB211 (Hist.)	0.903	*N/A*	*N/A*	*N/A*	*N/A*	M+
Exterior	21WF, CB211 (Hist.)	0.958	*N/A*	*N/A*	*N/A*	*N/A*	M+
Interior Connection	L6"x4"x3/8"	*N/A*	*N/A*	*N/A*	0.425	*N/A*	V
Exterior Connection	L6"x4"x3/8"	*N/A*	*N/A*	*N/A*	0.375	*N/A*	V
Rivets	3/4"	*N/A*	*N/A*	0.724	*N/A*	*N/A*	R
Truss Members	**Controlling PR:**	**0.000**	**0.000**	**0.000**	**0.000**	**0.983**	**A**
Lower Chord	Built Up	*N/A*	*N/A*	*N/A*	*N/A*	0.792	A
Upper Chord	Built Up	*N/A*	*N/A*	*N/A*	*N/A*	0.792	A
Web Members	Built Up	*N/A*	*N/A*	*N/A*	*N/A*	0.902	A
Gusset Plates LC	1/2" Plate	*N/A*	*N/A*	*N/A*	*N/A*	0.983	A
Gusset Plates UC	1/2" Plate	*N/A*	*N/A*	*N/A*	*N/A*	0.983	A
Truss Bearings	Rockers & Bolsters	*N/A*	*N/A*	*N/A*	*N/A*	0.911	A
Truss Bracing	**Controlling PR:**	**0.000**	**0.000**	**0.000**	**0.000**	**0.549**	**A**
Upper Lateral	2L6"x4"x3/8"	*N/A*	*N/A*	*N/A*	*N/A*	0.231	A
Top Struts	2x2L5"x3 1/2"x5/16"	*N/A*	*N/A*	*N/A*	*N/A*	0.369	A
Lower Lateral L0-L2	2L4"x3"x1/2"	*N/A*	*N/A*	*N/A*	*N/A*	0.549	A
Lower Lateral L2-L5	2L4"x3"x1/2"	*N/A*	*N/A*	*N/A*	*N/A*	0.477	A

GARVER	Project	US-70 Roosevelt Bridge	ORIGINATED BY:	JWM	DATE:	3/5/2021
	Job No.	20T03060	REVISED BY:	_	DATE:	_
	Subject	Approach Spans Superstructure Performance Ratio Summary				
	Path	L:\2020\20T03060 - ODOT CI-2262 US-70 Roosevelt Bridge\Design\Bridge\Phase I\Alt 1\[Approach Span Superstructure Performance Ratio Summary.xlsm]Model 1 - PR				

Model 1 - Existing Condition (No Reduction) Performance Ratio Summary

PR Color Key
Black: PR < 1.00
Purple: 1.00 < PR < 1.10
Orange: 1.10 < PR < 1.50
Red: PR > 1.50

Controlling Capacity Key
M+: Positive Moment
M-: Negative Moment
R: Rivets
V: Shear
A: Axial

Primary Girder Key
G-60: 60'-1" Spans
G-34: 34'-0" Spans Without Utility Towers
G-34T1: 34'-0" Spans With Utility Tower (Girder 1)
G-34T2: 34'-0" Spans With Utility Tower (Girder 2)

Superstructure Element	Member Shape	Flexural Capacity		Rivet Capacity	Shear Capacity	Axial Capacity	Controlling Capacity
		Positive Moment	Negative Moment				
Concrete Deck	**Controlling PR:**	***3.532***	***4.113***	**0.000**	**0.000**	**0.000**	**M-**
60'-1" Span Max	8.375" Slab	***2.954***	***3.138***	*N/A*	*N/A*	*N/A*	M-
60'-1" Span Min	7.375" Slab	***3.532***	***4.113***	*N/A*	*N/A*	*N/A*	M-
34'-0" Span Max	8.375" Slab	***2.950***	***3.100***	*N/A*	*N/A*	*N/A*	M-
34'-0" Span Min	7.375" Slab	***3.527***	***4.063***	*N/A*	*N/A*	*N/A*	M-
Bearings	**Controlling PR:**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**M+**
Floor Beams	**Controlling PR:**	***1.730***	***1.459***	***1.666***	***1.180***	***1.612***	**M+**
Beam	W16x45	***1.730***	***1.459***	*N/A*	***1.180***	*N/A*	M+
Stiffeners	L 3"x3"x5/16"	*N/A*	*N/A*	***1.666***	*N/A*	***1.612***	R
Utility Tower Frame	**Controlling PR:**	***1.017***	***1.057***	***1.071***	**0.450**	**0.861**	**R**
Top Channel	C15x40	***1.017***	***1.057***	0.429	0.450	*N/A*	M-
Bottom Channel	C9x15	0.451	*N/A*	0.200	0.016	*N/A*	M+
Top Channel Brace	C12x25	*N/A*	*N/A*	0.256	*N/A*	0.022	R
2 Diagonals	2-L 3.5"x3.5"x5/16"	*N/A*	*N/A*	0.397	*N/A*	0.223	R
1 Diagonal	2-L 5.0"x3.5"x5/16"	*N/A*	*N/A*	0.397	*N/A*	0.843	A
Stiffeners	2-L 3.5"x3.5"x5/16"	*N/A*	*N/A*	***1.071***	*N/A*	0.861	R
Wind Bracing	**Controlling PR:**	**0.000**	**0.000**	**0.141**	**0.000**	**0.096**	**R**
Lateral Bracing	L 5" x 3 1/2" x 5/16"	*N/A*	*N/A*	*N/A*	*N/A*	0.052	A
Struts	2-L 5" x 3 1/2" x 5/16"	*N/A*	*N/A*	*N/A*	*N/A*	0.096	A
Cross Frame Diagonals	L 4" x 4" x 5/16"	*N/A*	*N/A*	*N/A*	*N/A*	0.064	A
Cross Frame Bottom	L 5" x 3 1/2" x 5/16"	*N/A*	*N/A*	*N/A*	*N/A*	0.011	A
Rivets	3/4" Dia	*N/A*	*N/A*	0.141	*N/A*	*N/A*	R

GARVER	Project	US-70 Roosevelt Bridge	ORIGINATED BY:	JWM	DATE:	3/5/2021
	Job No.	20T03060	REVISED BY:	_	DATE:	_
	Subject	Approach Spans Superstructure Performance Ratio Summary				
	Path	L:\2020\20T03060 - ODOT CI-2262 US-70 Roosevelt Bridge\Design\Bridge\Phase I\Alt 1\[Approach Span Superstructure Performance Ratio Summary.xlsm]Model 1 - PR				

Model 1 - Existing Condition (No Reduction) Performance Ratio Summary

PR Color Key
Black: PR < 1.00
Purple: 1.00 < PR < 1.10
Orange: 1.10 < PR < 1.50
Red: PR > 1.50

Controlling Capacity Key
M+: Positive Moment
M-: Negative Moment
R: Rivets
V: Shear
A: Axial

Primary Girder Key
G-60: 60'-1" Spans
G-34: 34'-0" Spans Without Utility Towers
G-34T1: 34'-0" Spans With Utility Tower (Girder 1)
G-34T2: 34'-0" Spans With Utility Tower (Girder 2)

Superstructure Element	Member Shape	Flexural Capacity		Rivet Capacity	Shear Capacity	Axial Capacity	Controlling Capacity
		Positive Moment	Negative Moment				
Primary Girders (G-60)	**Controlling PR:**	***1.064***	**0.000**	**0.872**	**0.997**	***1.283***	**A**
Top Flange	2-L6"x4"x3/4" & PLs	***1.064***	*N/A*	0.805	*N/A*	*N/A*	M+
Bottom Flange	2-L6"x4"x3/4" & PLs	***1.064***	*N/A*	0.805	*N/A*	***1.052***	M+
Web	54"x3/8"	*N/A*	*N/A*	*N/A*	0.997	*N/A*	V
Bearing Stiffeners	L 5"x3 1/2"x5/8"	*N/A*	*N/A*	0.872	*N/A*	***1.283***	A
Primary Girders (G-34)	**Controlling PR:**	***1.143***	**0.000**	**0.786**	***1.028***	***1.231***	**A**
Top Flange	2-L6"x4"x1/2"	***1.143***	*N/A*	0.583	*N/A*	***1.231***	A
Bottom Flange	2-L6"x4"x1/2"	***1.143***	*N/A*	0.583	*N/A*	***1.141***	M+
Web	54"x5/16"	*N/A*	*N/A*	*N/A*	***1.028***	*N/A*	V
Bearing Stiffeners	L 5"x3 1/2"x1/2"	*N/A*	*N/A*	0.786	*N/A*	***1.137***	A
Primary Girders (G-34T1)	**Controlling PR:**	***1.098***	**0.000**	**0.777**	**0.949**	***1.190***	**A**
Top Flange	2-L6"x4"x1/2"	***1.098***	*N/A*	0.523	*N/A*	***1.190***	A
Bottom Flange	2-L6"x4"x1/2"	***1.098***	*N/A*	0.523	*N/A*	***1.107***	A
Web	54"x5/16"	*N/A*	*N/A*	*N/A*	0.949	*N/A*	V
Bearing Stiffeners	L 5"x3 1/2"x1/2"	*N/A*	*N/A*	0.777	*N/A*	***1.124***	A
Primary Girders (G-34T2)	**Controlling PR:**	***1.036***	**0.000**	**0.817**	***1.024***	***1.183***	**A**
Top Flange	2-L6"x4"x5/8"	***1.036***	*N/A*	0.592	*N/A*	***1.126***	A
Bottom Flange	2-L6"x4"x5/8"	***1.036***	*N/A*	0.592	*N/A*	***1.047***	A
Web	54"x5/16"	*N/A*	*N/A*	*N/A*	***1.024***	*N/A*	V
Bearing Stiffeners	L 5"x3 1/2"x1/2"	*N/A*	*N/A*	0.817	*N/A*	***1.183***	A

GARVER	Project	US-70 Roosevelt Bridge	ORIGINATED BY:	JWM	DATE:	3/5/2021
	Job No.	20T03060	REVISED BY:		DATE:	
	Subject	Approach Spans Superstructure Performance Ratio Summary (Model 2)				
	Path	L:\2020\20T03060 - ODOT CI-2262 US-70 Roosevelt Bridge\Design\Bridge\Phase I\Alt 1\[Approach Span Superstructure Performance Ratio Summary.xlsm]Model 2 - PR				

Model 2 - Existing Condition (With Reductions) Performance Ratio Summary

PR Color Key
Black: PR < 1.00
Purple: 1.00 < PR < 1.10
Orange: 1.10 < PR < 1.50
Red: PR > 1.50

Controlling Capacity Key
M+: Positive Moment
M-: Negative Moment
R: Rivets
V: Shear
A: Axial

Primary Girder Key
G-60: 60'-1" Spans
G-34: 34'-0" Spans Without Utility Towers
G-34T1: 34'-0" Spans With Utility Tower (Girder 1)
G-34T2: 34'-0" Spans With Utility Tower (Girder 2)

Superstructure Element	Member Shape	Flexural Capacity		Rivet Capacity	Shear Capacity	Axial Capacity	Controlling Capacity
		Positive Moment	Negative Moment				
Concrete Deck	**Controlling PR:**	***3.532***	***4.113***	**0.000**	**0.000**	**0.000**	**M-**
60'-1" Span Max	8.375" Slab	***2.954***	***3.138***	*N/A*	*N/A*	*N/A*	M-
60'-1" Span Min	7.375" Slab	***3.532***	***4.113***	*N/A*	*N/A*	*N/A*	M-
34'-0" Span Max	8.375" Slab	***2.950***	***3.100***	*N/A*	*N/A*	*N/A*	M-
34'-0" Span Min	7.375" Slab	***3.527***	***4.063***	*N/A*	*N/A*	*N/A*	M-
Bearings	**Controlling PR:**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**M+**
Floor Beams	**Controlling PR:**	***2.140***	***1.629***	***1.666***	***1.325***	***1.612***	**M+**
Beam	W16x45	***2.140***	***1.629***	*N/A*	***1.325***	*N/A*	M+
Stiffeners	L 3"x3"x5/16"	*N/A*	*N/A*	***1.666***	*N/A*	***1.612***	R
Utility Tower Frame	**Controlling PR:**	***1.017***	***1.057***	***1.071***	**0.450**	**0.861**	**R**
Top Channel	C15x40	***1.017***	***1.057***	0.429	0.450	*N/A*	M-
Bottom Channel	C9x15	0.451	*N/A*	0.200	0.016	*N/A*	M+
Top Channel Brace	C12x25	*N/A*	*N/A*	0.256	*N/A*	0.022	R
2 Diagonals	2-L 3.5"x3.5"x5/16"	*N/A*	*N/A*	0.397	*N/A*	0.223	R
1 Diagonal	2-L 5.0"x3.5"x5/16"	*N/A*	*N/A*	0.397	*N/A*	0.843	A
Stiffeners	2-L 3.5"x3.5"x5/16"	*N/A*	*N/A*	***1.071***	*N/A*	0.861	R
Wind Bracing	**Controlling PR:**	**0.000**	**0.000**	**0.141**	**0.000**	**0.096**	**R**
Lateral Bracing	L 5" x 3 1/2" x 5/16"	*N/A*	*N/A*	*N/A*	*N/A*	0.052	A
Struts	2-L 5" x 3 1/2" x 5/16"	*N/A*	*N/A*	*N/A*	*N/A*	0.096	A
Cross Frame Diagonals	L 4" x 4" x 5/16"	*N/A*	*N/A*	*N/A*	*N/A*	0.064	A
Cross Frame Bottom	L 5" x 3 1/2" x 5/16"	*N/A*	*N/A*	*N/A*	*N/A*	0.011	A
Rivets	3/4" Dia	*N/A*	*N/A*	0.141	*N/A*	*N/A*	R

GARVER	Project	US-70 Roosevelt Bridge	ORIGINATED BY:	JWM	DATE:	3/5/2021
	Job No.	20T03060	REVISED BY:	_	DATE:	_
	Subject	Approach Spans Superstructure Performance Ratio Summary (Model 2)				
	Path	L:\2020\20T03060 - ODOT CI-2262 US-70 Roosevelt Bridge\Design\Bridge\Phase I\Alt 1\[Approach Span Superstructure Performance Ratio Summary.xlsm]Model 2 - PR				

Model 2 - Existing Condition (With Reductions) Performance Ratio Summary

PR Color Key
Black: PR < 1.00
Purple: 1.00 < PR < 1.10
Orange: 1.10 < PR < 1.50
Red: PR > 1.50

Controlling Capacity Key
M+: Positive Moment
M-: Negative Moment
R: Rivets
V: Shear
A: Axial

Primary Girder Key
G-60: 60'-1" Spans
G-34: 34'-0" Spans Without Utility Towers
G-34T1: 34'-0" Spans With Utility Tower (Girder 1)
G-34T2: 34'-0" Spans With Utility Tower (Girder 2)

Superstructure Element	Member Shape	Flexural Capacity		Rivet Capacity	Shear Capacity	Axial Capacity	Controlling Capacity
		Positive Moment	Negative Moment				
Primary Girders (G-60)	**Controlling PR:**	***1.064***	**0.000**	**0.872**	**0.997**	***1.283***	**A**
Top Flange	2-L6"x4"x3/4" & PLs	***1.064***	*N/A*	0.805	*N/A*	*N/A*	M+
Bottom Flange	2-L6"x4"x3/4" & PLs	***1.064***	*N/A*	0.805	*N/A*	***1.052***	M+
Web	54"x3/8"	*N/A*	*N/A*	*N/A*	0.997	*N/A*	V
Bearing Stiffeners	L 5"x3 1/2"x5/8"	*N/A*	*N/A*	0.872	*N/A*	***1.283***	A
Primary Girders (G-34)	**Controlling PR:**	***1.143***	**0.000**	**0.786**	***1.028***	***1.231***	**A**
Top Flange	2-L6"x4"x1/2"	***1.143***	*N/A*	0.583	*N/A*	***1.231***	A
Bottom Flange	2-L6"x4"x1/2"	***1.143***	*N/A*	0.583	*N/A*	***1.141***	M+
Web	54"x5/16"	*N/A*	*N/A*	*N/A*	***1.028***	*N/A*	V
Bearing Stiffeners	L 5"x3 1/2"x1/2"	*N/A*	*N/A*	0.786	*N/A*	***1.137***	A
Primary Girders (G-34T1)	**Controlling PR:**	***1.098***	**0.000**	**0.777**	**0.949**	***1.190***	**A**
Top Flange	2-L6"x4"x1/2"	***1.098***	*N/A*	0.523	*N/A*	***1.190***	A
Bottom Flange	2-L6"x4"x1/2"	***1.098***	*N/A*	0.523	*N/A*	***1.107***	A
Web	54"x5/16"	*N/A*	*N/A*	*N/A*	0.949	*N/A*	V
Bearing Stiffeners	L 5"x3 1/2"x1/2"	*N/A*	*N/A*	0.777	*N/A*	***1.124***	A
Primary Girders (G-34T2)	**Controlling PR:**	***1.036***	**0.000**	**0.817**	***1.024***	***1.183***	**A**
Top Flange	2-L6"x4"x5/8"	***1.036***	*N/A*	0.592	*N/A*	***1.126***	A
Bottom Flange	2-L6"x4"x5/8"	***1.036***	*N/A*	0.592	*N/A*	***1.047***	A
Web	54"x5/16"	*N/A*	*N/A*	*N/A*	***1.024***	*N/A*	V
Bearing Stiffeners	L 5"x3 1/2"x1/2"	*N/A*	*N/A*	0.817	*N/A*	***1.183***	A

GARVER	Project	US-70 Roosevelt Bridge	ORIGINATED BY:	JWM	DATE:	3/5/2021
	Job No.	20T03060	REVISED BY:	_	DATE:	_
	Subject	Approach Spans Superstructure Performance Ratio Summary (Model 3 - Retrofit)				
	Path	L:\2020\20T03060 - ODOT CI-2262 US-70 Roosevelt Bridge\Design\Bridge\Phase I\Alt 1\[Approach Span Superstructure Performance Ratio Summary.xlsm]Model 3 - PR (Retrofit)				

Model 3 - Retrofit Performance Ratio Summary

PR Color Key
Black: PR < 1.00
Purple: 1.00 < PR < 1.10
Orange: 1.10 < PR < 1.50
Red: PR > 1.50

Controlling Capacity Key
M+: Positive Moment
M-: Negative Moment
R: Rivets
V: Shear
A: Axial

Primary Girder Key
G-60: 60'-1" Spans
G-34: 34'-0" Spans Without Utility Towers
G-34T1: 34'-0" Spans With Utility Tower (Girder 1)
G-34T2: 34'-0" Spans With Utility Tower (Girder 2)

Superstructure Element	Member Shape	Flexural Capacity		Rivet Capacity	Shear Capacity	Axial Capacity	Controlling Capacity
		Positive Moment	Negative Moment				
Concrete Deck	**Controlling PR:**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**M+**
Bearings	**Controlling PR:**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**M+**
Floor Beams	**Controlling PR:**	**0.944**	**0.945**	**0.000**	**0.924**	**0.839**	**M-**
Beam	W16x45	0.944	0.945	*N/A*	0.924	*N/A*	M-
Stiffeners	L 3"x3"x5/16"	*N/A*	*N/A*	*N/A*	*N/A*	0.839	A
Utility Tower Frame	**Controlling PR:**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**M+**
Wind Bracing	**Controlling PR:**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**M+**

GARVER	Project	US-70 Roosevelt Bridge	ORIGINATED BY:	JWM	DATE:	3/5/2021
	Job No.	20T03060	REVISED BY:	_	DATE:	_
	Subject	Approach Spans Superstructure Performance Ratio Summary (Model 3 - Retrofit)				
	Path	L:\2020\20T03060 - ODOT CI-2262 US-70 Roosevelt Bridge\Design\Bridge\Phase I\Alt 1\[Approach Span Superstructure Performance Ratio Summary.xlsm]Model 3 - PR (Retrofit)				

Model 3 - Retrofit Performance Ratio Summary

PR Color Key
Black: PR < 1.00
Purple: 1.00 < PR < 1.10
Orange: 1.10 < PR < 1.50
Red: PR > 1.50

Controlling Capacity Key
M+: Positive Moment
M-: Negative Moment
R: Rivets
V: Shear
A: Axial

Primary Girder Key
G-60: 60'-1" Spans
G-34: 34'-0" Spans Without Utility Towers
G-34T1: 34'-0" Spans With Utility Tower (Girder 1)
G-34T2: 34'-0" Spans With Utility Tower (Girder 2)

Superstructure Element	Member Shape	Flexural Capacity		Rivet Capacity	Shear Capacity	Axial Capacity	Controlling Capacity
		Positive Moment	Negative Moment				
Primary Girders (G-60)	**Controlling PR:**	**0.984**	**0.000**	**0.000**	**0.999**	**0.962**	**V**
Top Flange	2-L6"x4"x3/4" & PLs	0.984	*N/A*	*N/A*	*N/A*	*N/A*	M+
Bottom Flange	2-L6"x4"x3/4" & PLs	0.984	*N/A*	*N/A*	*N/A*	*N/A*	M+
Web	54"x3/8"	*N/A*	*N/A*	*N/A*	0.999	*N/A*	V
Bearing Stiffeners	L 5"x3 1/2"x5/8"	*N/A*	*N/A*	*N/A*	*N/A*	0.962	A
Primary Girders (G-34)	**Controlling PR:**	**0.930**	**0.000**	**0.000**	**0.602**	**0.796**	**M+**
Top Flange	2-L6"x4"x1/2"	0.930	*N/A*	*N/A*	*N/A*	*N/A*	M+
Bottom Flange	2-L6"x4"x1/2"	0.930	*N/A*	*N/A*	*N/A*	*N/A*	M+
Web	54"x5/16"	*N/A*	*N/A*	*N/A*	0.602	*N/A*	V
Bearing Stiffeners	L 5"x3 1/2"x1/2"	*N/A*	*N/A*	*N/A*	*N/A*	0.796	A
Primary Girders (G-34T1)	**Controlling PR:**	**0.923**	**0.000**	**0.000**	**0.950**	**0.783**	**V**
Top Flange	2-L6"x4"x1/2"	0.923	*N/A*	*N/A*	*N/A*	*N/A*	M+
Bottom Flange	2-L6"x4"x1/2"	0.923	*N/A*	*N/A*	*N/A*	*N/A*	M+
Web	54"x5/16"	*N/A*	*N/A*	*N/A*	0.950	*N/A*	V
Bearing Stiffeners	L 5"x3 1/2"x1/2"	*N/A*	*N/A*	*N/A*	*N/A*	0.783	A
Primary Girders (G-34T2)	**Controlling PR:**	**0.870**	**0.000**	**0.000**	**0.613**	**0.840**	**M+**
Top Flange	2-L6"x4"x5/8"	0.870	*N/A*	*N/A*	*N/A*	*N/A*	M+
Bottom Flange	2-L6"x4"x5/8"	0.870	*N/A*	*N/A*	*N/A*	*N/A*	M+
Web	54"x5/16"	*N/A*	*N/A*	*N/A*	0.613	*N/A*	V
Bearing Stiffeners	L 5"x3 1/2"x1/2"	*N/A*	*N/A*	*N/A*	*N/A*	0.840	A

GARVER	Project	US-70 Roosevelt Bridge	ORIGINATED BY:	JWM	DATE:	3/5/2021
	Job No.	20T03060	REVISED BY:	_	DATE:	_
	Subject	Approach Spans Superstructure Performance Ratio Summary (Model 3 - Replace)				
	Path	L:\2020\20T03060 - ODOT CI-2262 US-70 Roosevelt Bridge\Design\Bridge\Phase I\Alt 1\[Approach Span Superstructure Performance Ratio Summary.xlsm]Model 3 - PR (Replace)				

Model 3 - Replace Performance Ratio Summary

PR Color Key
Black: PR < 1.00
Purple: 1.00 < PR < 1.10
Orange: 1.10 < PR < 1.50
Red: PR > 1.50

Controlling Capacity Key
M+: Positive Moment
M-: Negative Moment
R: Rivets
V: Shear
A: Axial

Primary Girder Key
G-60: 60'-1" Spans
G-34: 34'-0" Spans Without Utility Towers
G-34T1: 34'-0" Spans With Utility Tower (Girder 1)
G-34T2: 34'-0" Spans With Utility Tower (Girder 2)

Superstructure Element	Member Shape	Flexural Capacity		Rivet Capacity	Shear Capacity	Axial Capacity	Controlling Capacity
		Positive Moment	Negative Moment				
Concrete Deck	**Controlling PR:**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**M+**
Bearings	**Controlling PR:**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**M+**
Floor Beams	**Controlling PR:**	**0.929**	**0.984**	**0.000**	**0.615**	**0.610**	**M-**
Beam	W16x45	0.929	0.984	*N/A*	0.615	*N/A*	M-
Stiffeners	L 3"x3"x5/16"	*N/A*	*N/A*	*N/A*	*N/A*	0.610	A
Utility Tower Frame	**Controlling PR:**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**M+**
Wind Bracing	**Controlling PR:**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**M+**

GARVER	Project	US-70 Roosevelt Bridge	ORIGINATED BY:	JWM	DATE:	3/5/2021
	Job No.	20T03060	REVISED BY:	_	DATE:	_
	Subject	Approach Spans Superstructure Performance Ratio Summary (Model 3 - Replace)				
	Path	L:\2020\20T03060 - ODOT CI-2262 US-70 Roosevelt Bridge\Design\Bridge\Phase I\Alt 1\[Approach Span Superstructure Performance Ratio Summary.xlsm]Model 3 - PR (Replace)				

Model 3 - Replace Performance Ratio Summary

PR Color Key
Black: PR < 1.00
Purple: 1.00 < PR < 1.10
Orange: 1.10 < PR < 1.50
Red: PR > 1.50

Controlling Capacity Key
M+: Positive Moment
M-: Negative Moment
R: Rivets
V: Shear
A: Axial

Primary Girder Key
G-60: 60'-1" Spans
G-34: 34'-0" Spans Without Utility Towers
G-34T1: 34'-0" Spans With Utility Tower (Girder 1)
G-34T2: 34'-0" Spans With Utility Tower (Girder 2)

Superstructure Element	Member Shape	Flexural Capacity		Rivet Capacity	Shear Capacity	Axial Capacity	Controlling Capacity
		Positive Moment	Negative Moment				
Primary Girders (G-60)	Controlling PR:	0.000	0.000	0.000	0.000	0.000	M+
Primary Girders (G-34)	Controlling PR:	0.000	0.000	0.000	0.000	0.000	M+
Primary Girders (G-34T1)	Controlling PR:	0.000	0.000	0.000	0.000	0.000	M+
Primary Girders (G-34T2)	Controlling PR:	0.000	0.000	0.000	0.000	0.000	M+

OKLAHOMA DEPARTMENT OF TRANSPORTATION

FOR INFORMATION ONLY
3/3/2021

Attachment B

SHEET 1 | SHEET 2 | SHEET 3 | SHEET 4 | SHEET 5 | SHEET 6 | SHEET 7 | SHEET 8 | SHEET 9 | SHEET 10 | SHEET 11 | SHEET 12

KEYMAP

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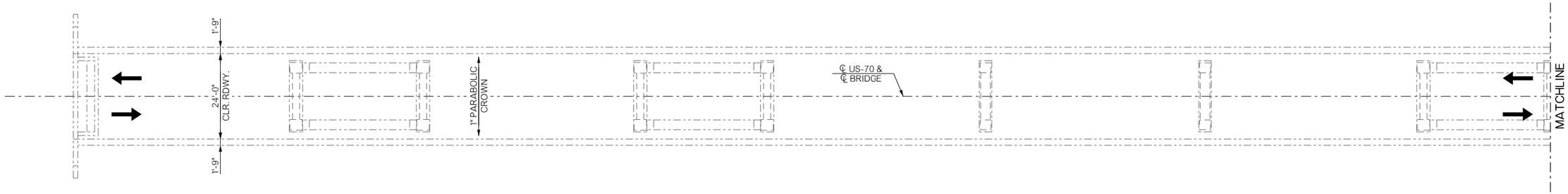
SCALE 1" = 15'



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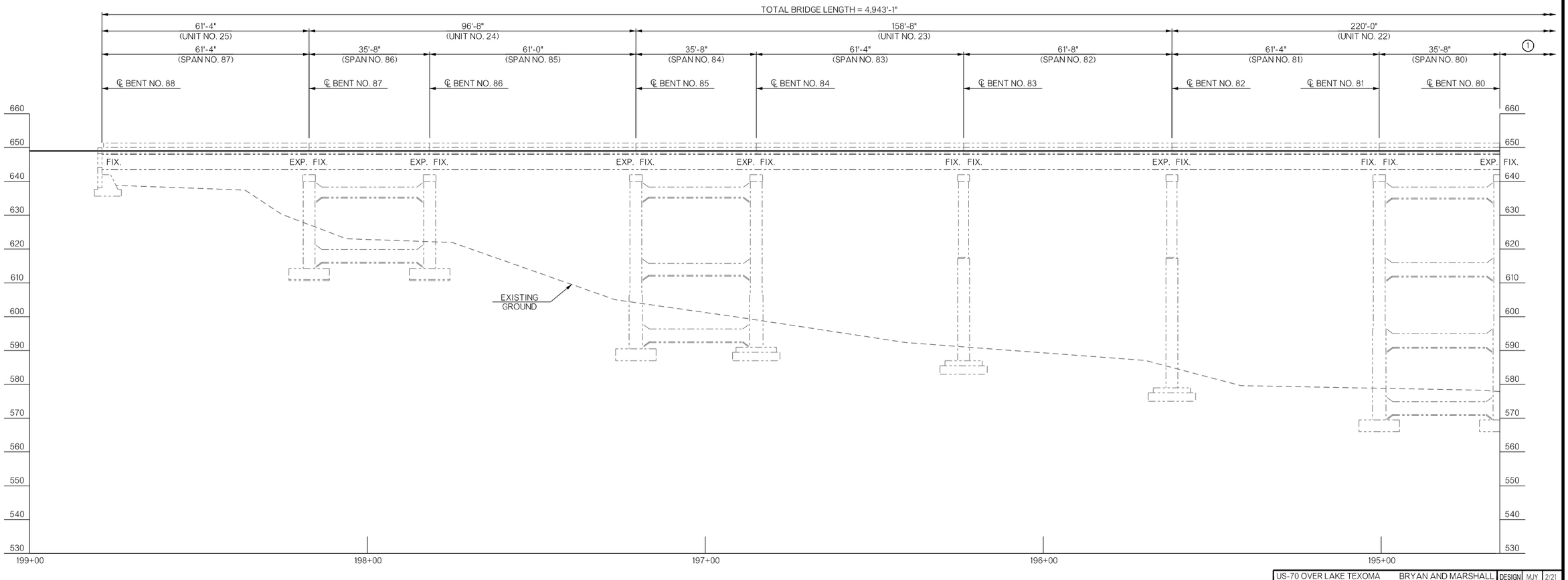

ELEVATION

NOTE:
STATIONS, UNIT, SPAN, TOWER, PIER AND BENT NUMBERS INCREASE EAST TO WEST.

US-70 OVER LAKE TEXOMA
BRIDGE "A"

BRYAN AND MARSHALL COUNTIES

GENERAL PLAN AND ELEVATION (SHEET 1 OF 12)

DESIGN	MJY	2/21
DETAIL	SJL	2/21
CHECK	XXX	XXX

GARVER

STATE OF OKLAHOMA

DEPARTMENT OF TRANSPORTATION

JOB PIECE NO. XXXXX(04)

SHEET NO. XX

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OKLAHOMA DEPARTMENT OF TRANSPORTATION

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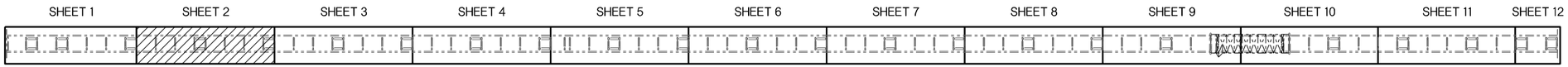
3/3/2021

Attachment B



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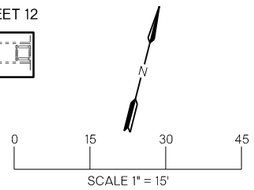

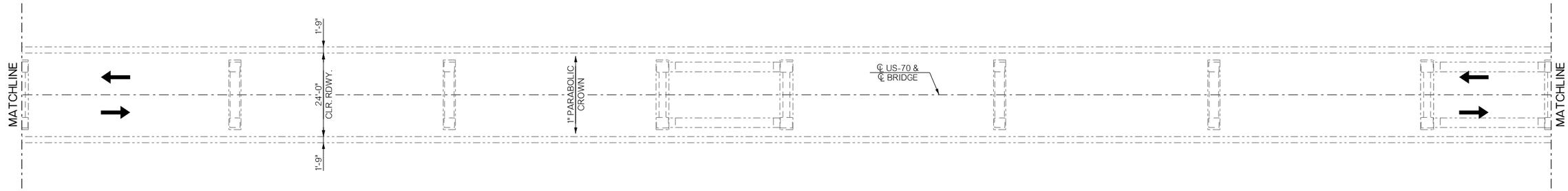

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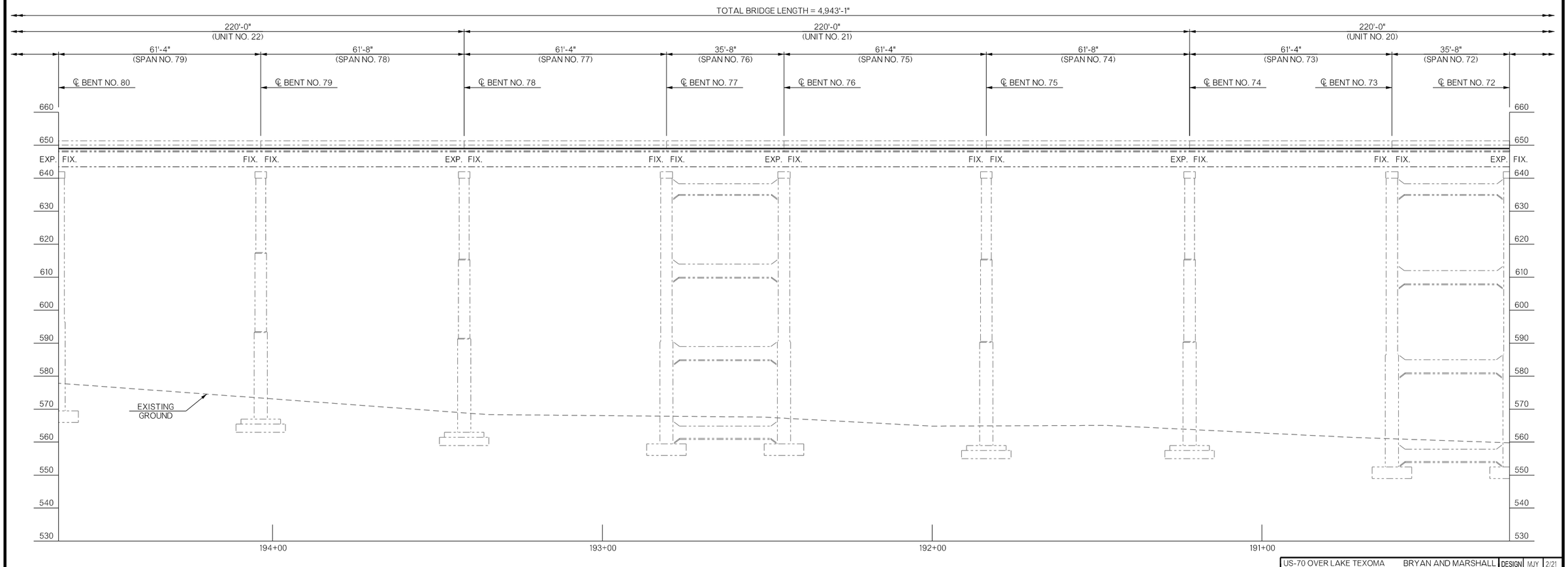

ELEVATION

① 35'-8" (SPAN NO. 81)
② 61'-4" (SPAN NO. 71)

NOTE:
STATIONS, UNIT, SPAN, TOWER, PIER AND BENT NUMBERS INCREASE EAST TO WEST.

US-70 OVER LAKE TEXOMA
BRIDGE "A"

BRYAN AND MARSHALL COUNTIES

GENERAL PLAN AND ELEVATION (SHEET 2 OF 12)

DESIGN	MJY	2/21
DETAIL	SJL	2/21
CHECK	XXX	XXX

GARVER

STATE OF OKLAHOMA

DEPARTMENT OF TRANSPORTATION

JOB PIECE NO. XXXXX(04)

SHEET NO. XX

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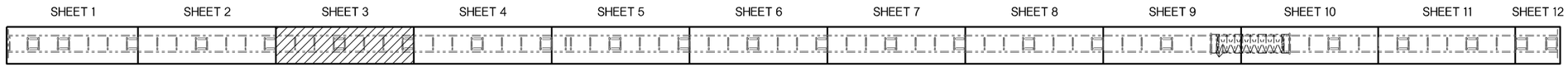

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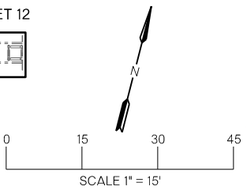

OKLAHOMA DEPARTMENT OF TRANSPORTATION

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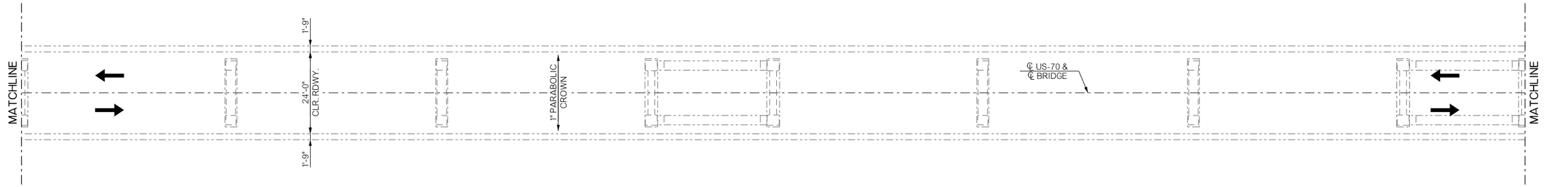
Attachment B



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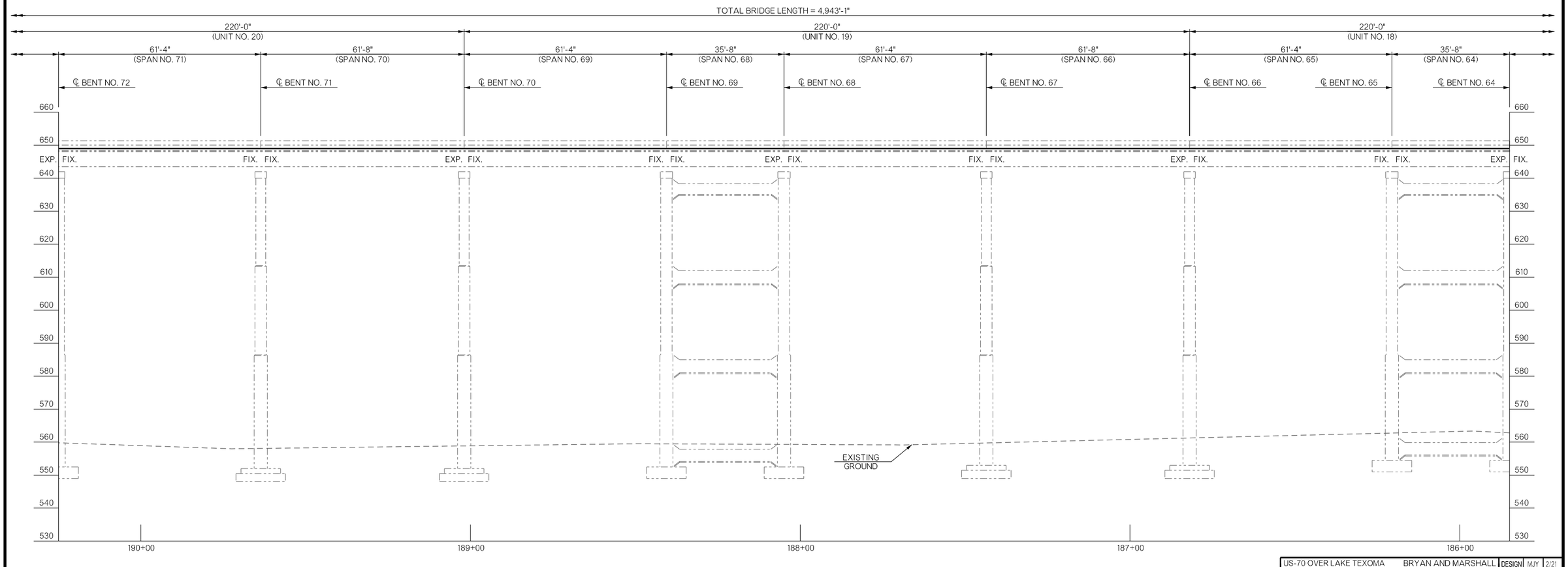

ELEVATION

① 35'-8" (SPAN NO. 72)
② 61'-4" (SPAN NO. 63)

NOTE:
STATIONS, UNIT, SPAN, TOWER, PIER AND BENT NUMBERS INCREASE EAST TO WEST.

US-70 OVER LAKE TEXOMA
BRIDGE "A"

BRYAN AND MARSHALL COUNTIES

DESIGN	MJY	2/21
DETAIL	SJL	2/21
CHECK	XXX	XXX

GENERAL PLAN AND ELEVATION (SHEET 3 OF 12)

GARVER

STATE OF OKLAHOMA

DEPARTMENT OF TRANSPORTATION

JOB PIECE NO. XXXXX(04)

SHEET NO. XX

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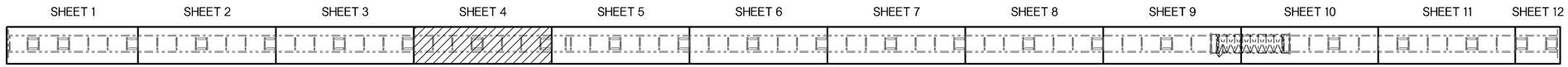

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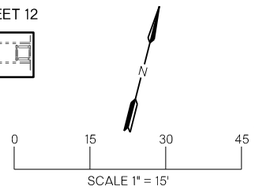

OKLAHOMA DEPARTMENT OF TRANSPORTATION

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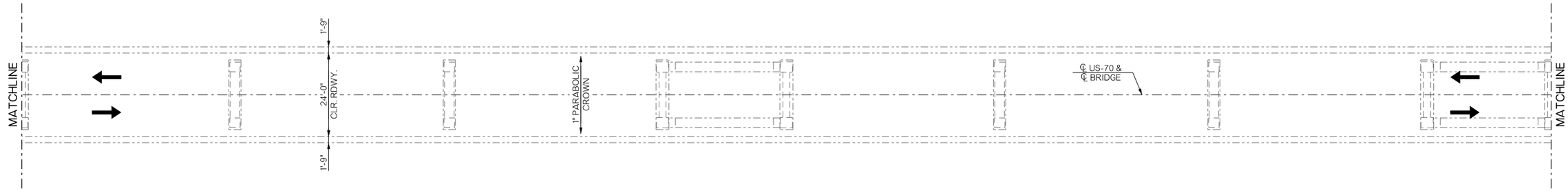
3/3/2021

Attachment B



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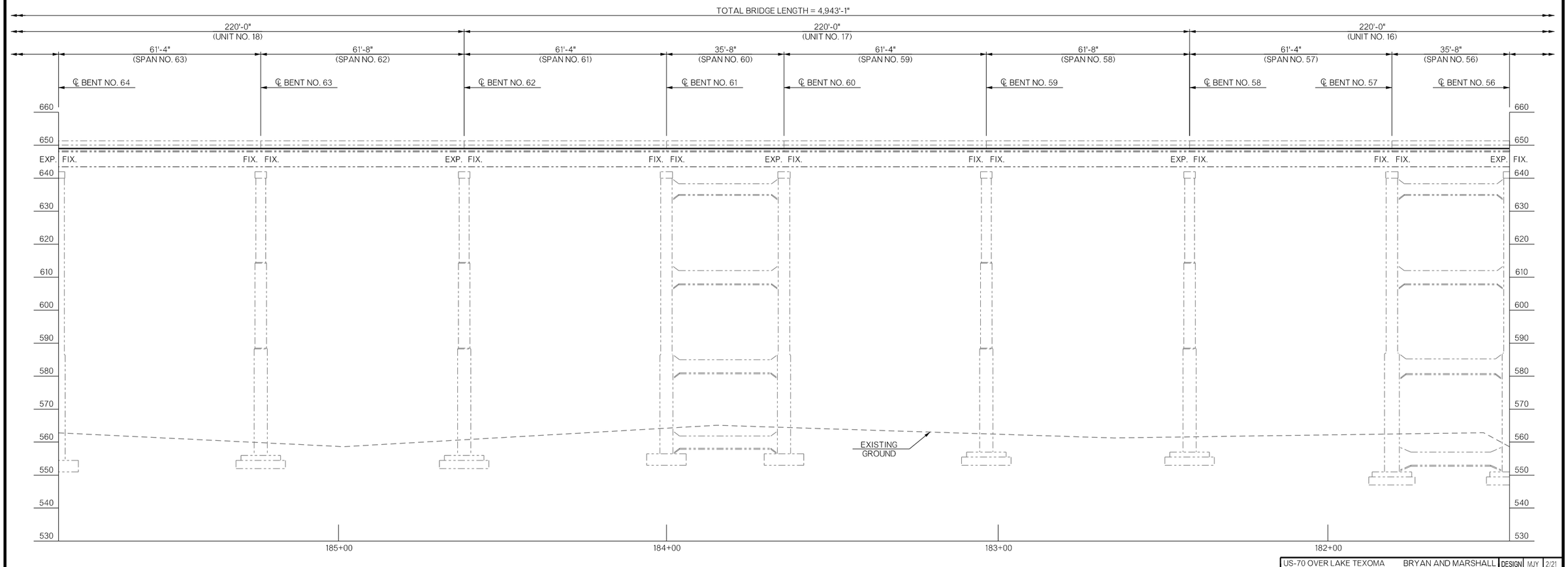

ELEVATION

① 35'-8" (SPAN NO. 64)
② 61'-4" (SPAN NO. 55)

NOTE:
STATIONS, UNIT, SPAN, TOWER, PIER AND BENT NUMBERS INCREASE EAST TO WEST.

US-70 OVER LAKE TEXOMA
BRIDGE "A"

BRYAN AND MARSHALL COUNTIES

DESIGN	MJY	2/21
DETAIL	SJL	2/21
CHECK	XXX	XXX

GENERAL PLAN AND ELEVATION (SHEET 4 OF 12)

GARVER

STATE OF OKLAHOMA

DEPARTMENT OF TRANSPORTATION

JOB PIECE NO. XXXXX(04)

SHEET NO. XX

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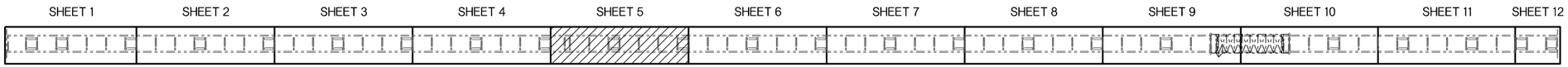
Attachment B



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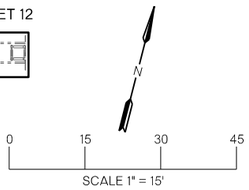

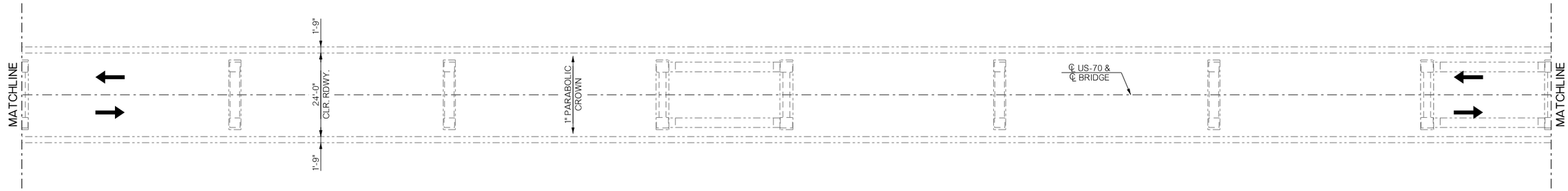

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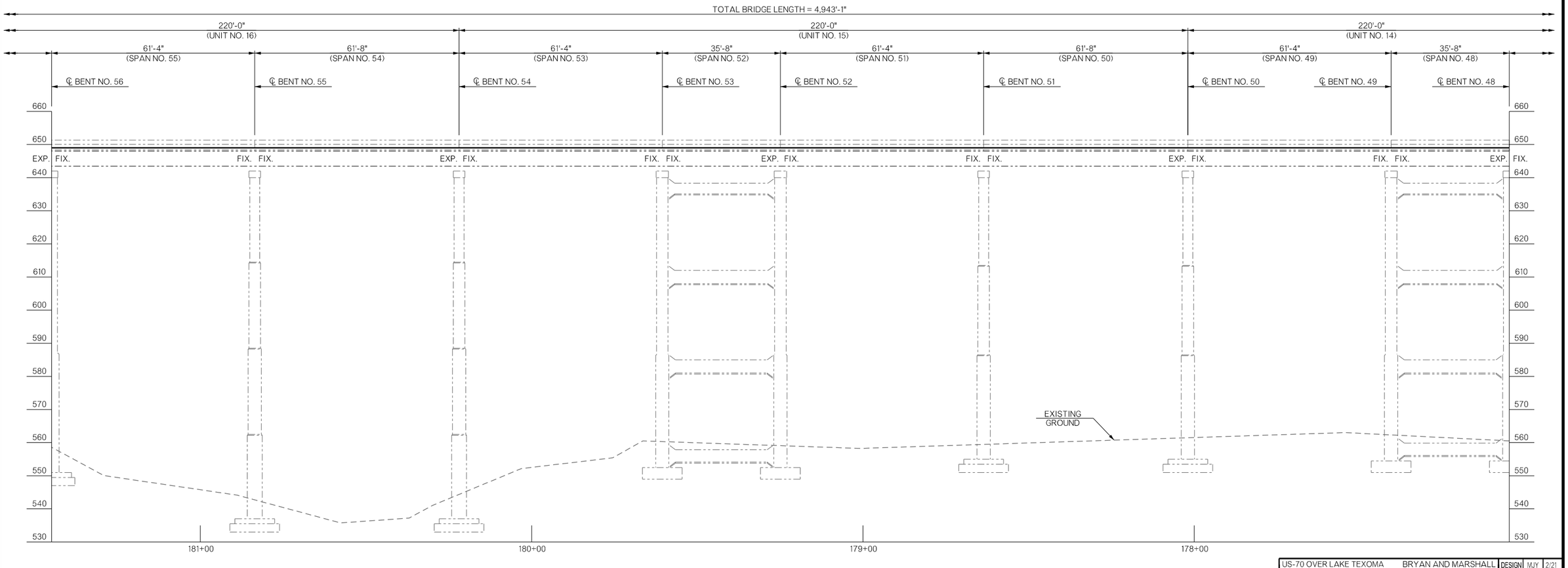

ELEVATION

① 35'-8" (SPAN NO. 56)
② 61'-4" (SPAN NO. 47)

NOTE:
STATIONS, UNIT, SPAN, TOWER, PIER AND BENT NUMBERS INCREASE EAST TO WEST.

US-70 OVER LAKE TEXOMA
BRIDGE "A"

BRYAN AND MARSHALL COUNTIES

GENERAL PLAN AND ELEVATION (SHEET 5 OF 12)

DESIGN	MJY	2/21
DETAIL	SJL	2/21
CHECK	XXX	XXX

GARVER

STATE OF OKLAHOMA

DEPARTMENT OF TRANSPORTATION

JOB PIECE NO. XXXXX(04)

SHEET NO. XX

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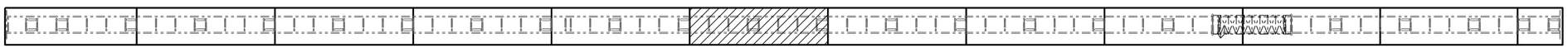
3/3/2021

Attachment B



KEYMAP

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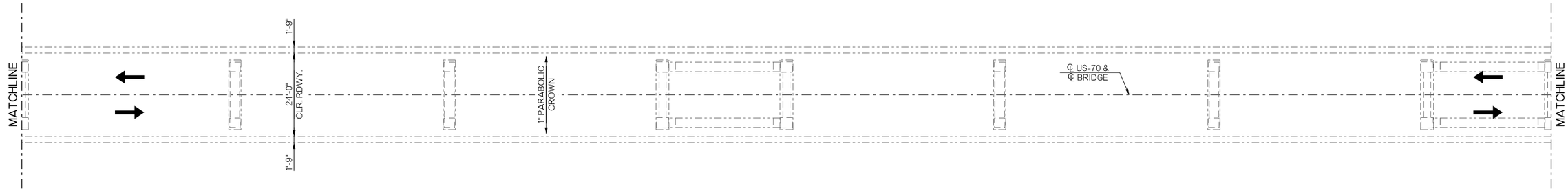
SCALE 1" = 15'



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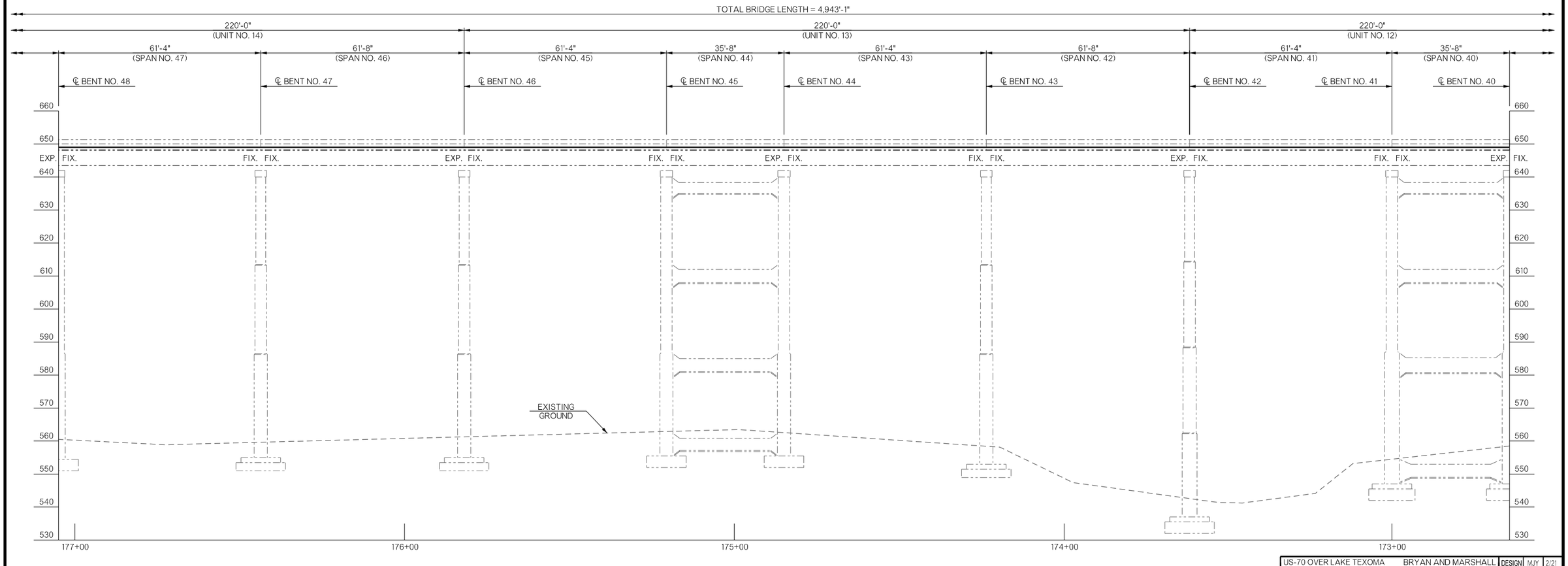

ELEVATION

① 35'-8" (SPAN NO. 48)
② 61'-4" (SPAN NO. 39)

NOTE:
STATIONS, UNIT, SPAN, TOWER, PIER AND BENT NUMBERS INCREASE EAST TO WEST.

US-70 OVER LAKE TEXOMA
BRIDGE "A"

BRYAN AND MARSHALL COUNTIES

DESIGN	MJY	2/21
DETAIL	SJL	2/21
CHECK	XXX	XXX

GENERAL PLAN AND ELEVATION (SHEET 6 OF 12)

GARVER

STATE OF OKLAHOMA

DEPARTMENT OF TRANSPORTATION

JOB PIECE NO. XXXXX(04)

SHEET NO. XX

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OKLAHOMA DEPARTMENT OF TRANSPORTATION

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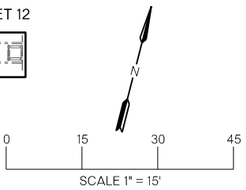
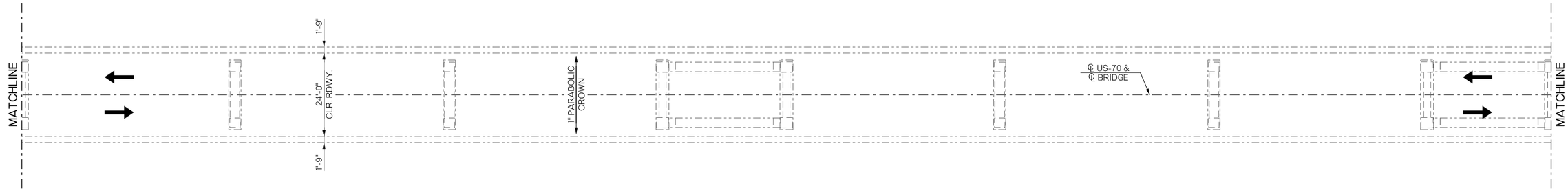
3/3/2021

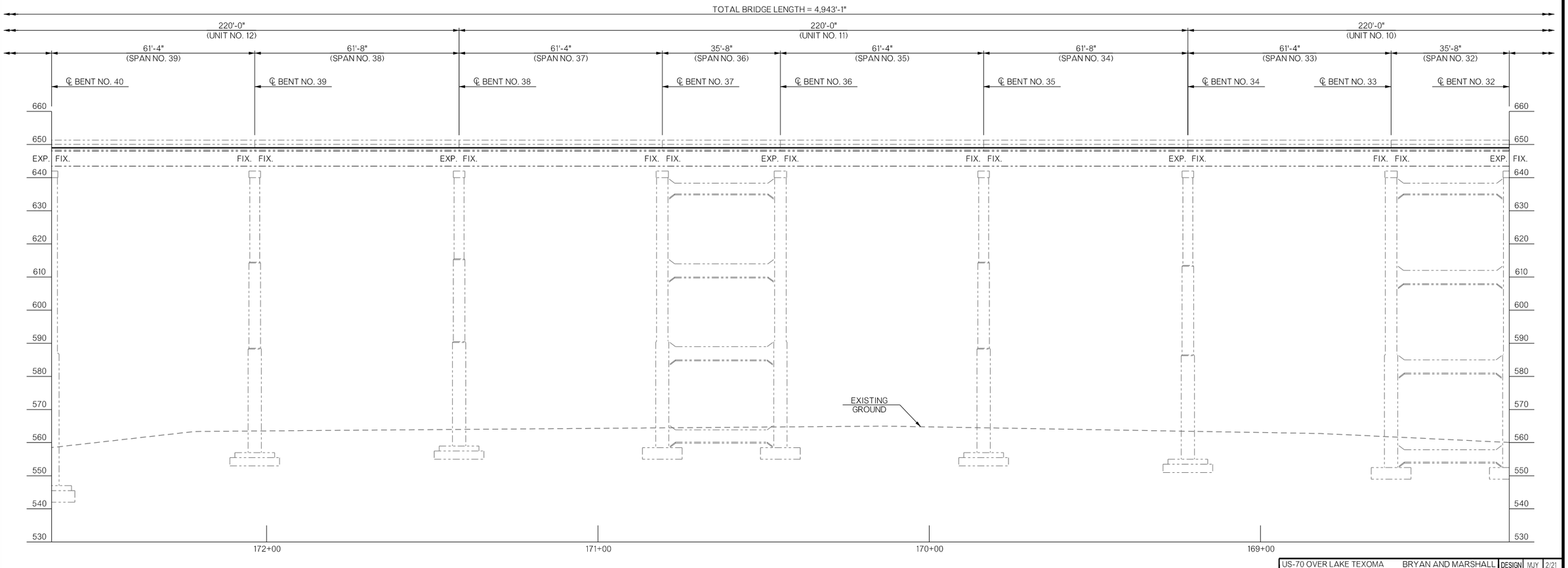
Attachment B

KEYMAP





PLAN



ELEVATION

① 35'-8" (SPAN NO. 40)
② 61'-4" (SPAN NO. 31)

NOTE:
STATIONS, UNIT, SPAN, TOWER, PIER AND BENT NUMBERS INCREASE EAST TO WEST.

US-70 OVER LAKE TEXOMA
BRIDGE "A"

BRYAN AND MARSHALL COUNTIES

DESIGN	MJY	2/21
DETAIL	SJL	2/21
CHECK	XXX	XXX

GENERAL PLAN AND ELEVATION (SHEET 7 OF 12)

GARVER

STATE OF OKLAHOMA

DEPARTMENT OF TRANSPORTATION

JOB PIECE NO. XXXXX(04)

SHEET NO. XX

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OKLAHOMA DEPARTMENT OF TRANSPORTATION

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3/3/2021

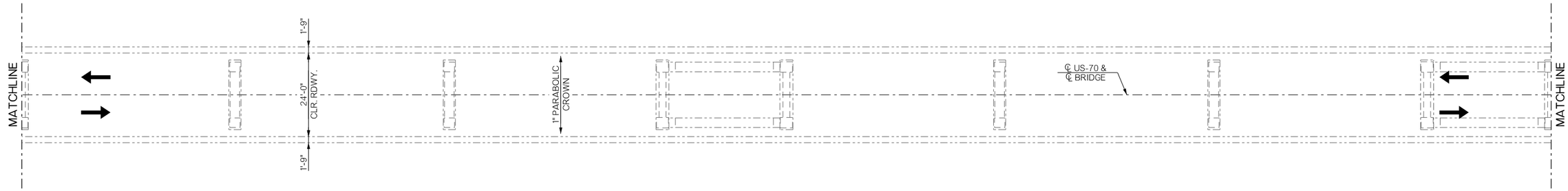
Attachment B

KEYMAP

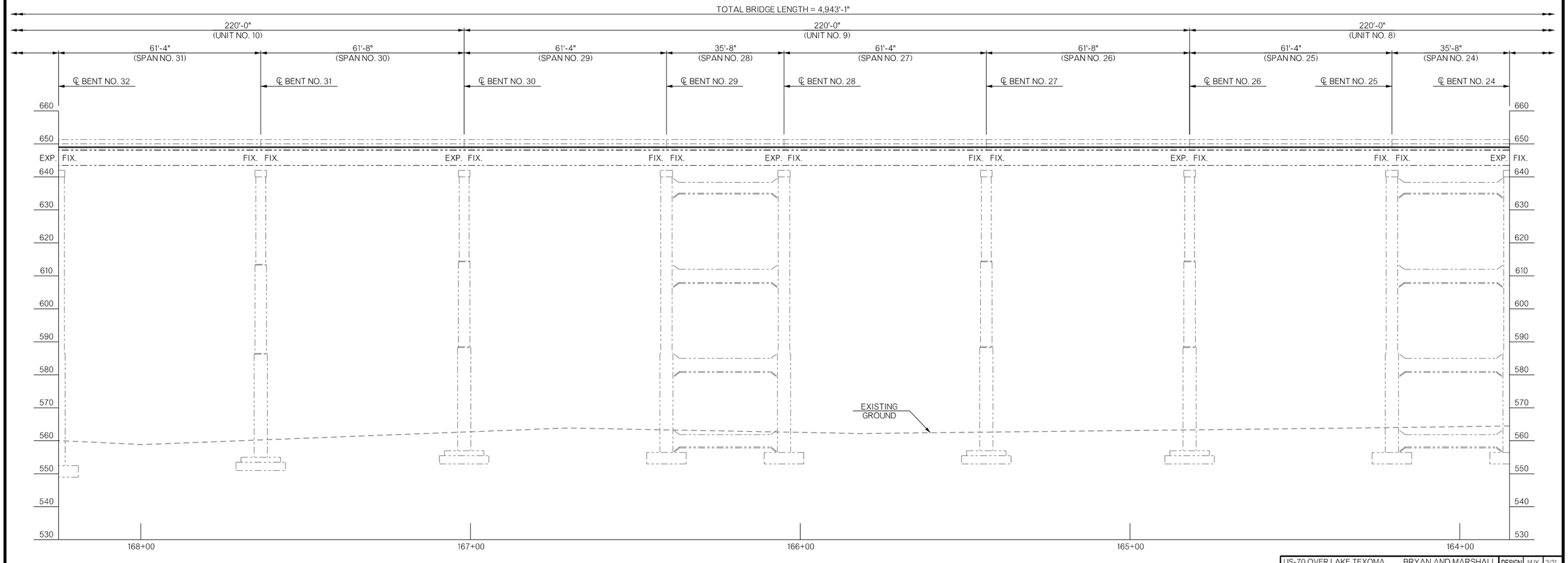
N

0 15 30 45

SCALE 1" = 15'



PLAN



ELEVATION

① 35'-8" (SPAN NO. 32)
② 61'-4" (SPAN NO. 23)

NOTE:
STATIONS, UNIT, SPAN, TOWER, PIER AND BENT NUMBERS INCREASE EAST TO WEST.

US-70 OVER LAKE TEXOMA
BRIDGE "A"

BRYAN AND MARSHALL COUNTIES

GENERAL PLAN AND ELEVATION (SHEET 8 OF 12)

DESIGN	MJY	2/21
DETAIL	SJL	2/21
CHECK	XXX	XXX

GARVER

STATE OF OKLAHOMA

DEPARTMENT OF TRANSPORTATION

JOB PIECE NO. XXXXX(04)

SHEET NO. XX

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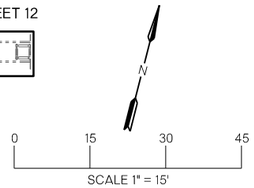
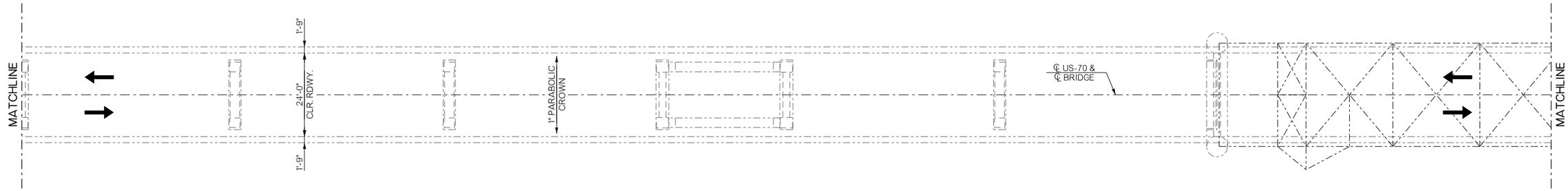
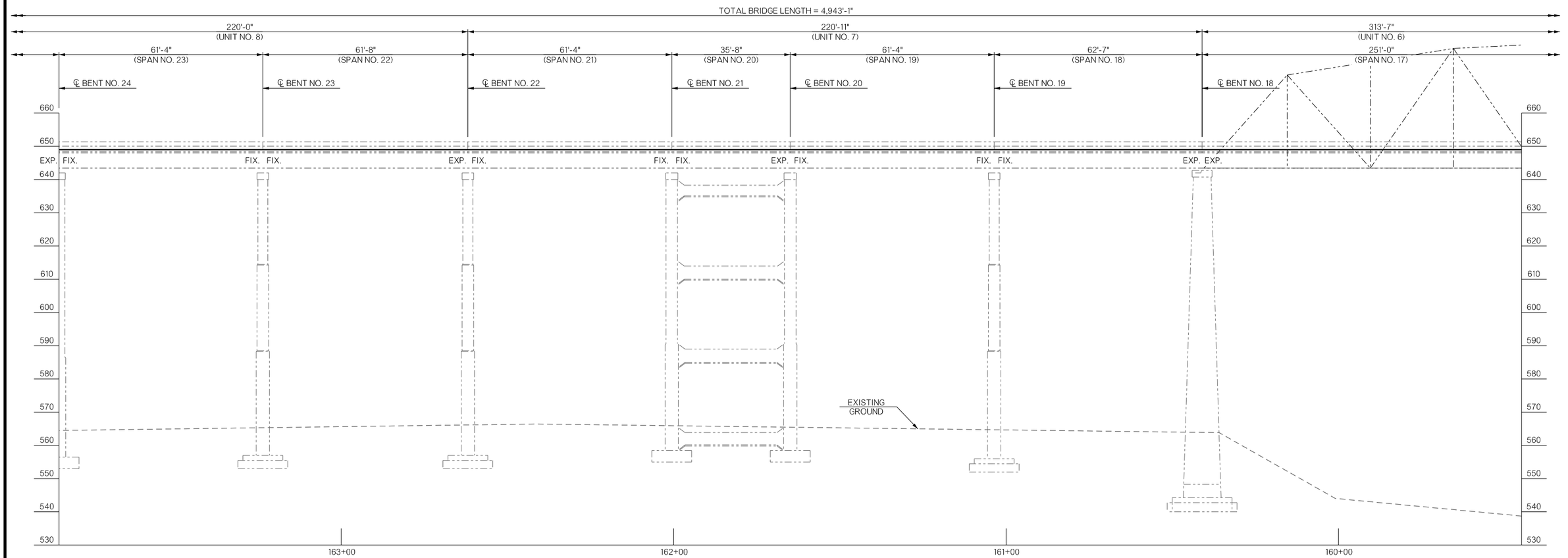
Attachment B

KEYMAP





PLAN



ELEVATION

① 35'-8" (SPAN NO. 24)

NOTE:
STATIONS, UNIT, SPAN, TOWER, PIER AND BENT NUMBERS INCREASE EAST TO WEST.

US-70 OVER LAKE TEXOMA BRIDGE "A"	BRYAN AND MARSHALL COUNTIES	
GENERAL PLAN AND ELEVATION (SHEET 9 OF 12)	DESIGN MJY 2/21	
	DETAIL SJL 2/21	
	CHECK XXX XXX	
GARVER		
STATE OF OKLAHOMA	DEPARTMENT OF TRANSPORTATION	
	JOB PIECE NO. XXXXX(04)	SHEET NO. XX

3/3/2021 2:55:07 PM L:\2020\20T03060 - ODOT CI-2262 US-70 Roosevelt Bridge\Drawings\BRIDGE\GENERAL PLAN AND ELEVATION 9.dgn

OKLAHOMA DEPARTMENT OF TRANSPORTATION

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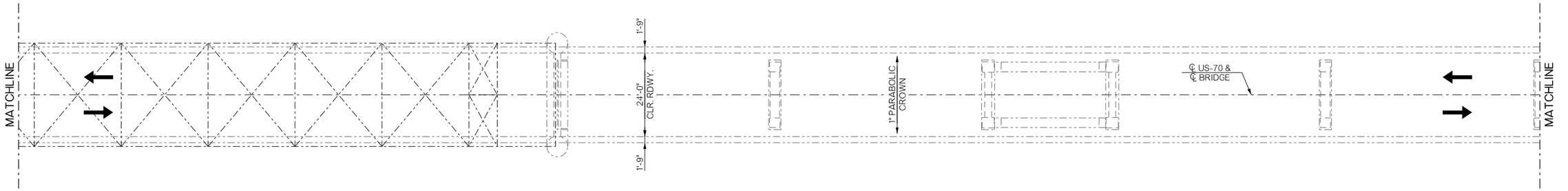
Attachment B

KEYMAP

N

0 15 30 45

SCALE 1" = 15'



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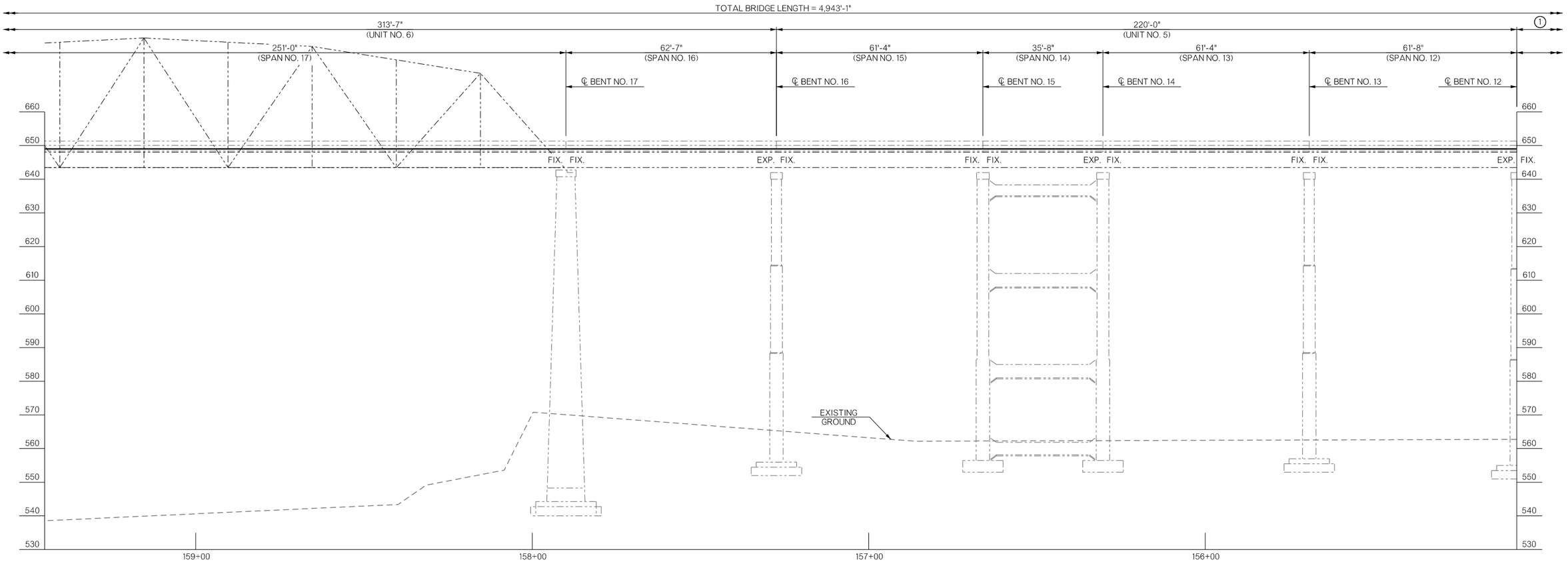

① 220'-0" (UNIT NO. 4)

② 61'-4" (SPAN NO. 11)

NOTE:
STATIONS, UNIT, SPAN, TOWER, PIER AND BENT NUMBERS INCREASE EAST TO WEST.

ELEVATION

US-70 OVER LAKE TEXOMA
BRIDGE "A"

BRYAN AND MARSHALL COUNTIES

DESIGN	MJY	2/21
DETAIL	SJL	2/21
CHECK	XXX	XXX

GENERAL PLAN AND ELEVATION (SHEET 10 OF 12)

GARVER

STATE OF OKLAHOMA

DEPARTMENT OF TRANSPORTATION

JOB PIECE NO. XXXXX(04)

SHEET NO. XX

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OKLAHOMA DEPARTMENT OF TRANSPORTATION

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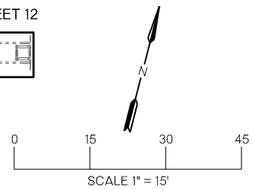
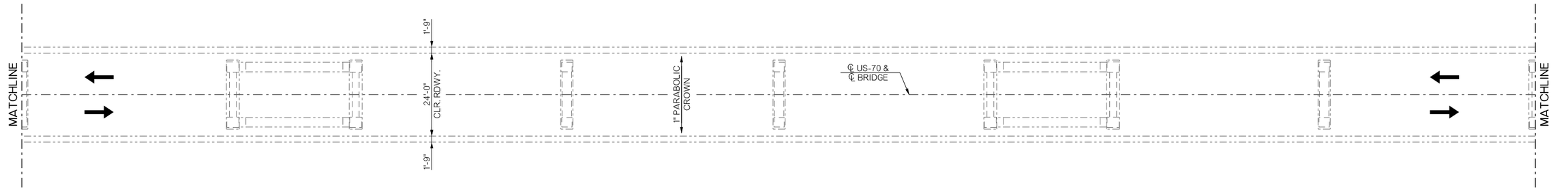
Attachment B

KEYMAP





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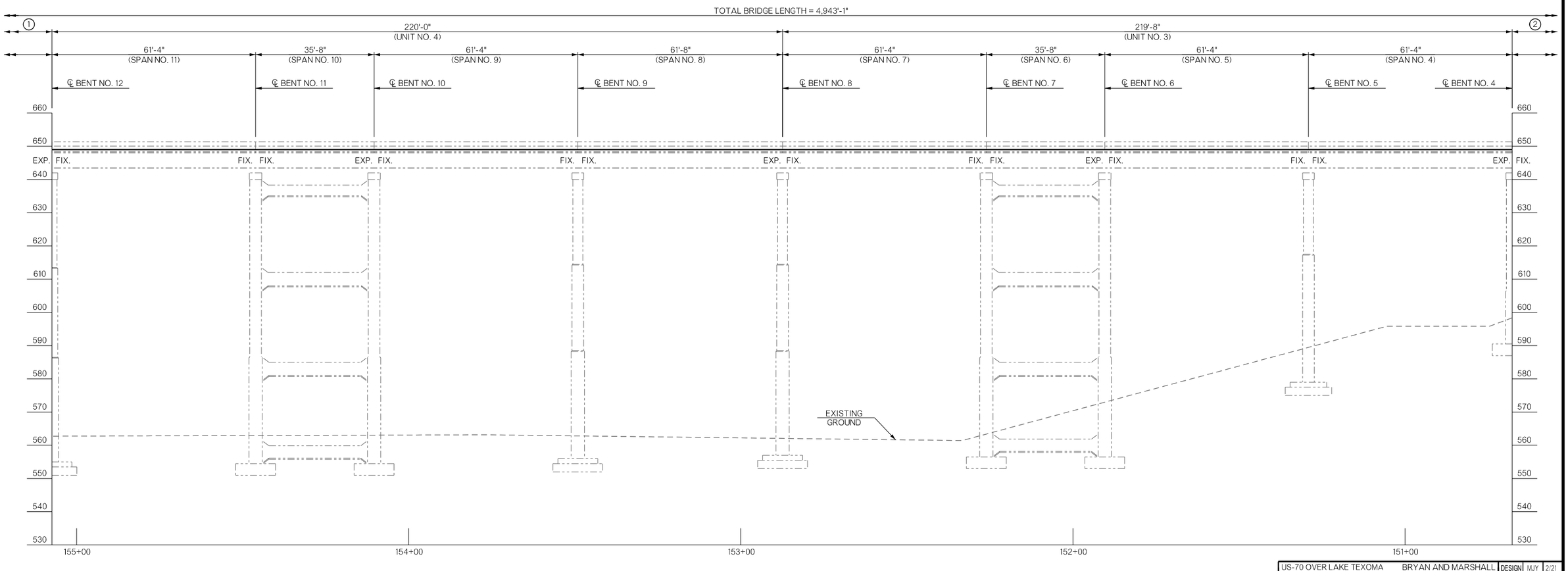

ELEVATION

① 220'-0" (UNIT NO. 5)
② 96'-8" (UNIT NO. 2)
③ 61'-8" (SPAN NO. 12)
④ 35'-8" (SPAN NO. 3)

NOTE:
STATIONS, UNIT, SPAN, TOWER, PIER AND BENT NUMBERS INCREASE EAST TO WEST.

US-70 OVER LAKE TEXOMA
BRIDGE "A"

BRYAN AND MARSHALL COUNTIES

DESIGN	MJY	2/21
DETAIL	SJL	2/21
CHECK	XXX	XXX

GENERAL PLAN AND ELEVATION (SHEET 11 OF 12)

GARVER

STATE OF OKLAHOMA

DEPARTMENT OF TRANSPORTATION

JOB PIECE NO. XXXXX(04)

SHEET NO. XX

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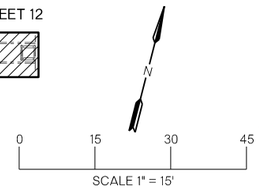
KEYMAP



OKLAHOMA DEPARTMENT OF TRANSPORTATION

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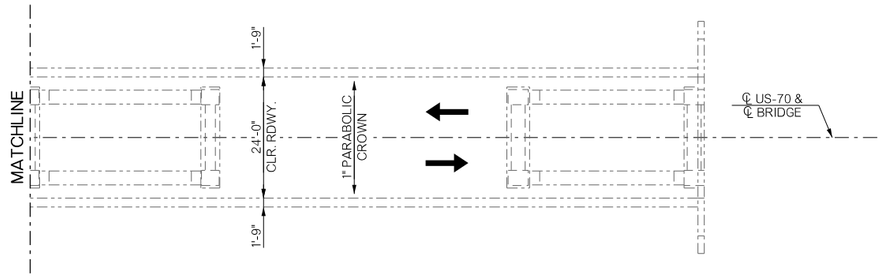
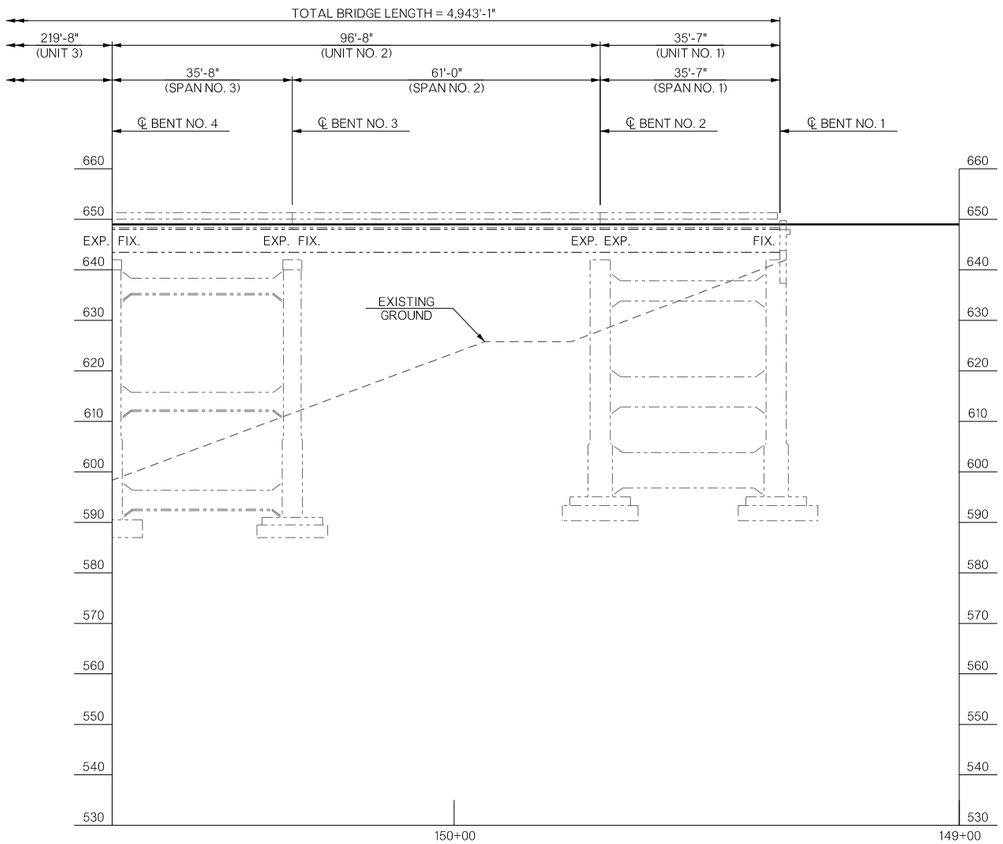
3/3/2021

Attachment B



PLAN



ELEVATION

INDEX OF SHEETS

SHEET NO.	TITLE
XXX	GENERAL PLAN AND ELEVATION
	ABUTMENT DETAILS
	BENT DETILS
	PIER DETAILS
	TOWER DETAILS
	TYPICAL SECTION

(1) 61'-4" (SPAN NO. 4)

NOTE:
STATIONS, UNIT, SPAN, TOWER, PIER AND BENT NUMBERS INCREASE EAST TO WEST.

US-70 OVER LAKE TEXOMA
BRIDGE "A"

BRYAN AND MARSHALL COUNTIES

GENERAL PLAN AND ELEVATION (SHEET 12 OF 12)

DESIGN	MJY	2/21
DETAIL	SJL	2/21
CHECK	XXX	XXX

GARVER

STATE OF OKLAHOMA

DEPARTMENT OF TRANSPORTATION

JOB PIECE NO. XXXXX(04)

SHEET NO. XX

3/3/2021 2:55:17 PM L:\2020\20T03060 - 000T CI-2262 US-70 Roosevelt Bridge\Drawings\BRIDGE\GENERAL PLAN AND ELEVATION 12.dgn

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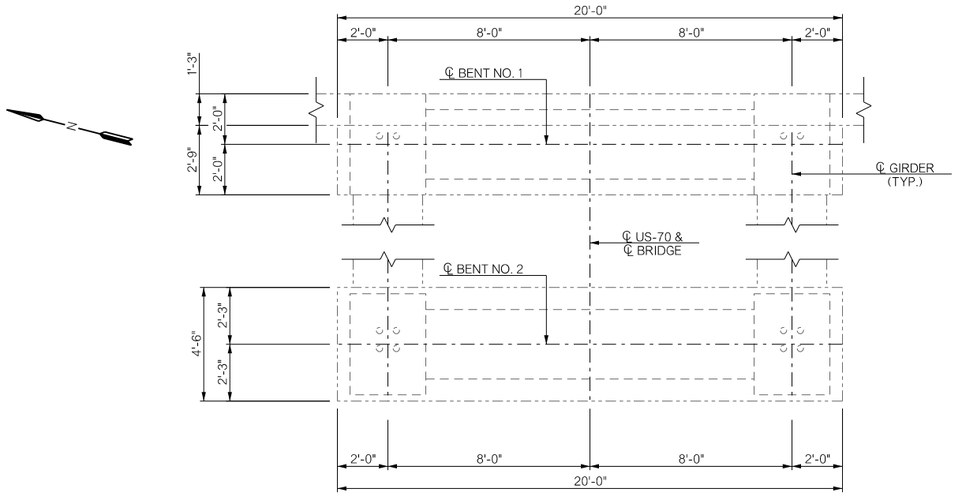
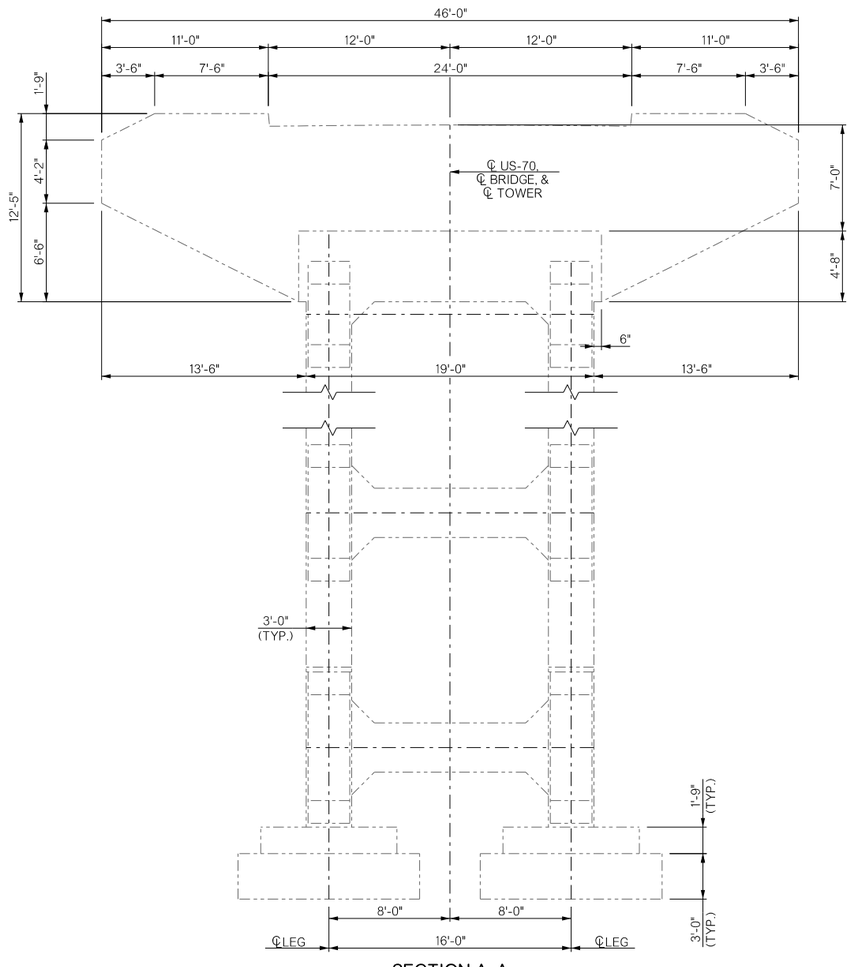
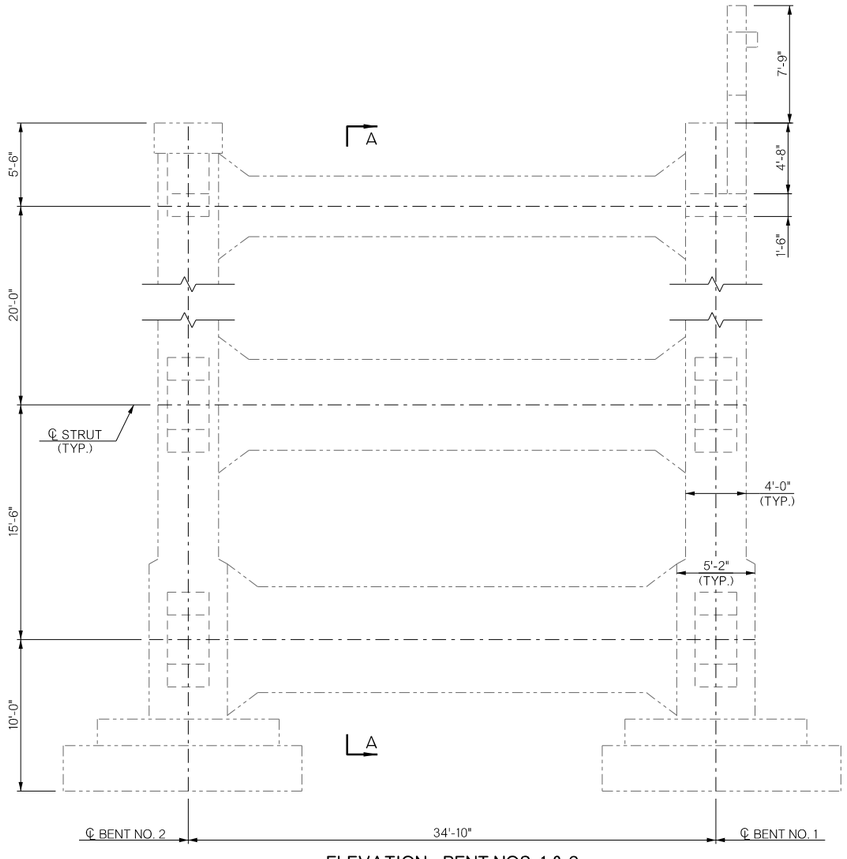
Attachment B



PLAN - BENT NOS. 1 & 2



SECTION A-A



ELEVATION - BENT NOS. 1 & 2

NOTE:
STATIONS, UNIT, SPAN, TOWER, PIER AND BENT NUMBERS INCREASE EAST TO WEST.

US-70 OVER LAKE TEXOMA BRIDGE "A" — BRYAN AND MARSHALL COUNTIES

DESIGN	MJY	2/21
DETAIL	SJL	2/21
CHECK	XXX	XXX

ABUTMENT DETAILS (SHEET 1 OF 2)

GARVER

STATE OF OKLAHOMA — DEPARTMENT OF TRANSPORTATION

JOB PIECE NO. XXXXX(04) — SHEET NO. XX

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OKLAHOMA DEPARTMENT OF TRANSPORTATION

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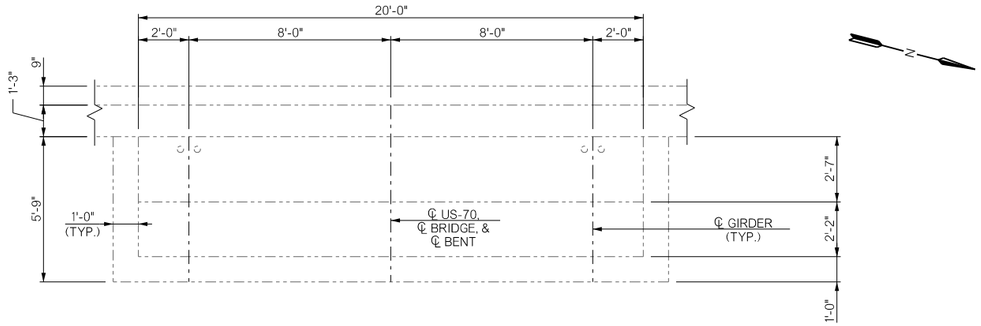
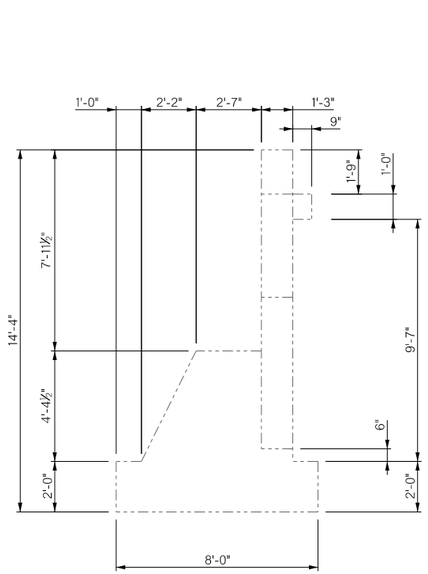
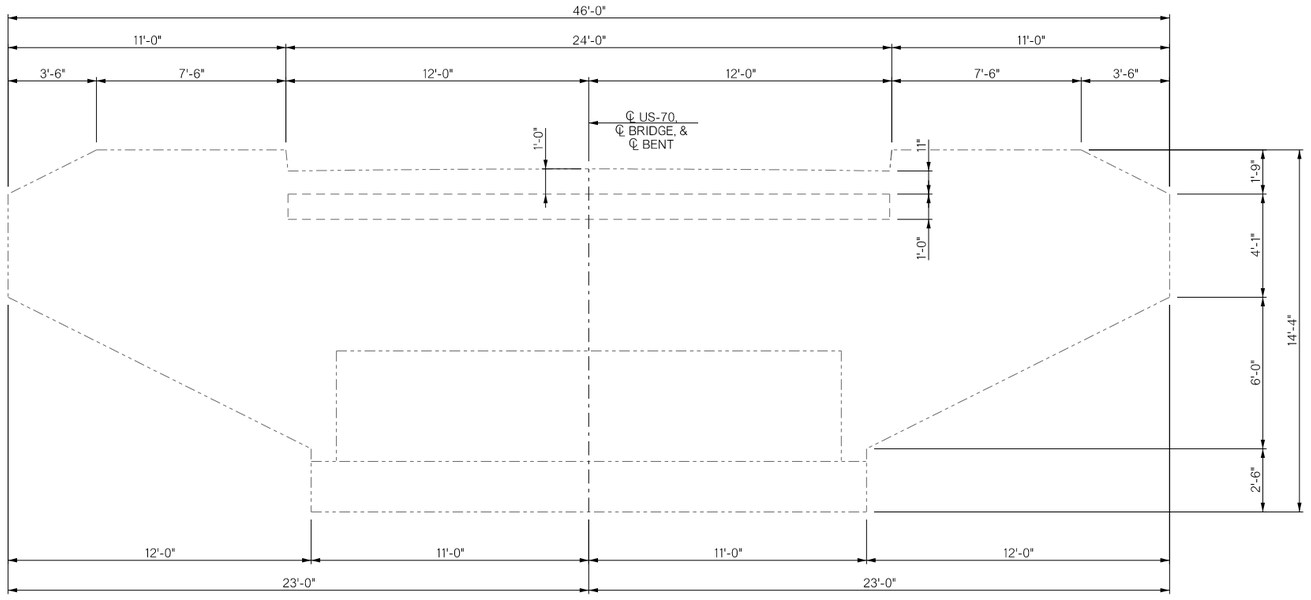
Attachment B



PLAN - BENT NO. 88



END ELEVATION - BENT NO. 88
(LOOKING FORWARD STATION)



FRONT ELEVATION - BENT NO. 88
(LOOKING FORWARD STATION)

NOTE:
STATIONS, UNIT, SPAN, TOWER, PIER AND BENT NUMBERS INCREASE EAST TO WEST.

US-70 OVER LAKE TEXOMA BRIDGE "A"
BRYAN AND MARSHALL COUNTIES

ABUTMENT DETAILS
(SHEET 2 OF 2)

DESIGN	MJY	2/21
DETAIL	SJL	2/21
CHECK	XXX	XXX

GARVER

STATE OF OKLAHOMA
DEPARTMENT OF TRANSPORTATION
JOB PIECE NO. XXXXX(04)
SHEET NO. XX

3/3/2021 2:55:36 PM L:\2020\20T03060 - ODOT CI-2262 US-70 Roosevelt Bridge\Drawings\BRIDGE\ABUTMENT DETAILS 2.dgn

OKLAHOMA DEPARTMENT OF TRANSPORTATION

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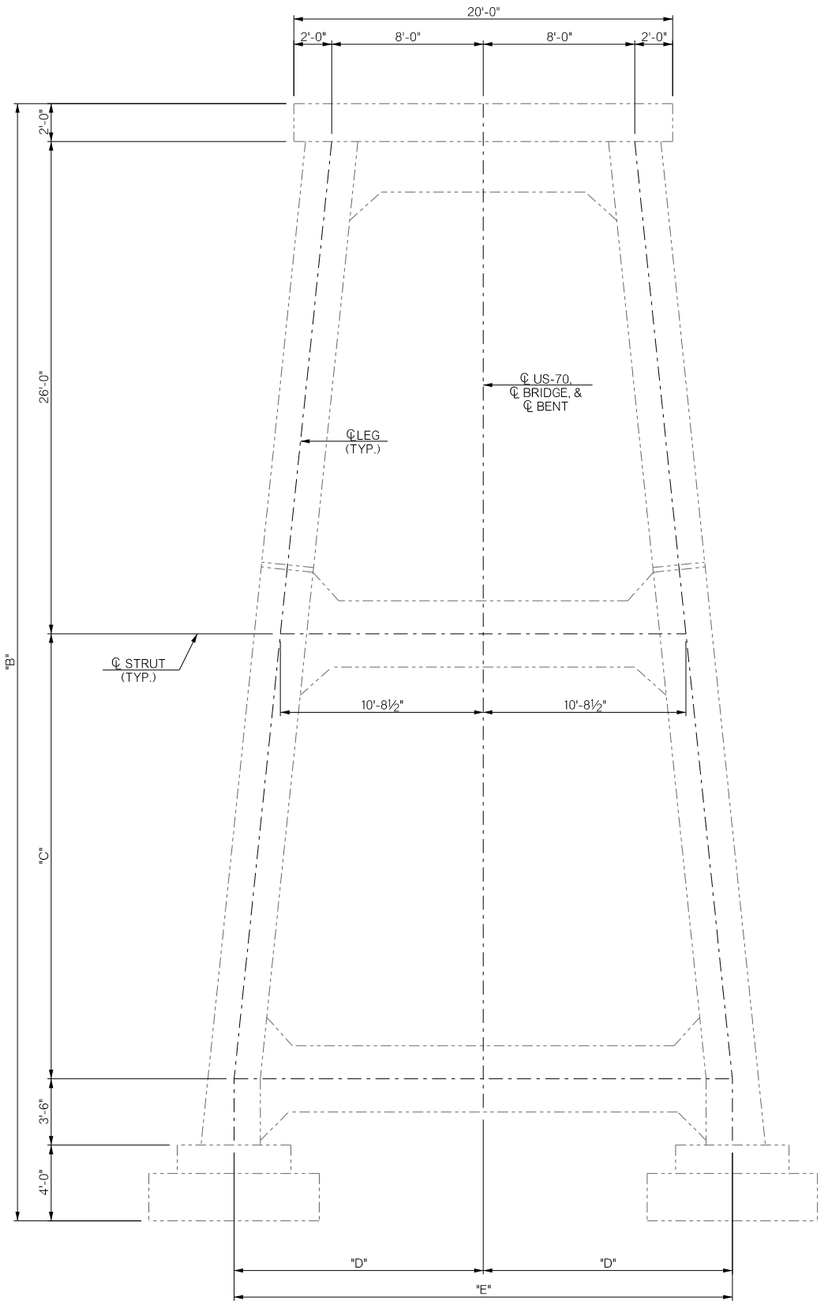
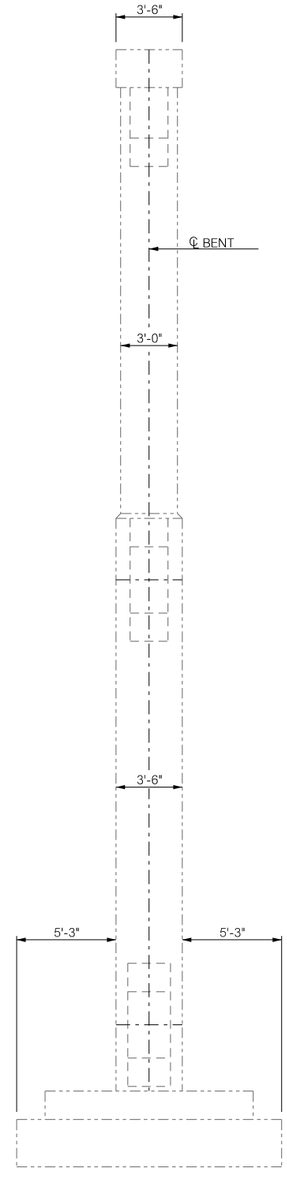
3/3/2021

Attachment B



TRANSVERSE ELEVATION



LONGITUDINAL ELEVATION

TABLE OF VARIABLES				
"A"	"B"	"C"	"D"	"E"
5	67'-0"	31'-6"	13'-11⅞"	27'-11¾"
82	67'-0"	31'-6"	13'-11⅞"	27'-11¾"
83	59'-0"	23'-6"	13'-1⅞"	26'-3¾"

DETAILS OF TWO STORY BENT ①

① BENT "A"

NOTE:
STATIONS, UNIT, SPAN, TOWER, PIER AND BENT NUMBERS INCREASE EAST TO WEST.

US-70 OVER LAKE TEXOMA BRIDGE "A"

BRYAN AND MARSHALL COUNTIES

BENT DETAILS (SHEET 1 OF 3)

DESIGN	MJY	2/21
DETAIL	SJL	2/21
CHECK	XXX	XXX

GARVER

STATE OF OKLAHOMA

DEPARTMENT OF TRANSPORTATION

JOB PIECE NO. XXXXX(04)

SHEET NO. XX

3/3/2021 2:55:45 PM L:\2020\20T03060 - ODOT CI-2262 US-70 Roosevelt Bridge\Drawings\BRIDGE\BENT DETAILS 1.dgn

OKLAHOMA DEPARTMENT OF TRANSPORTATION

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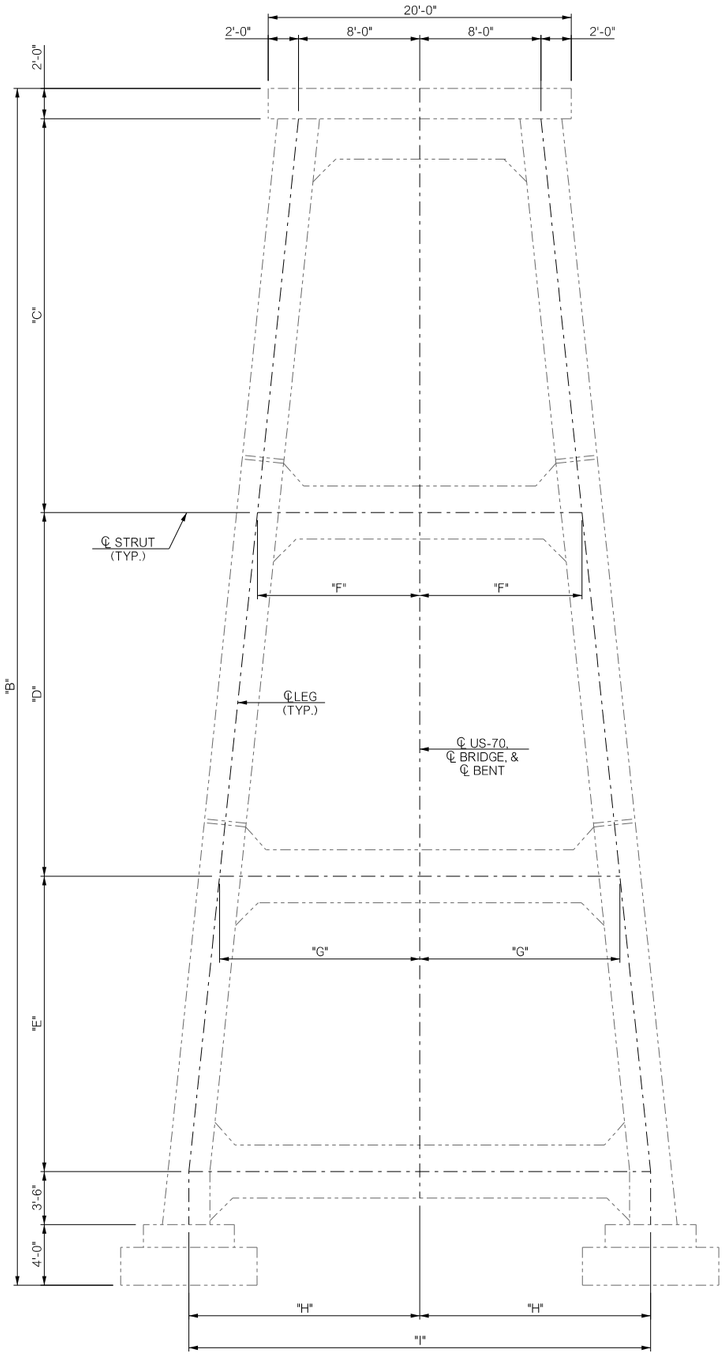
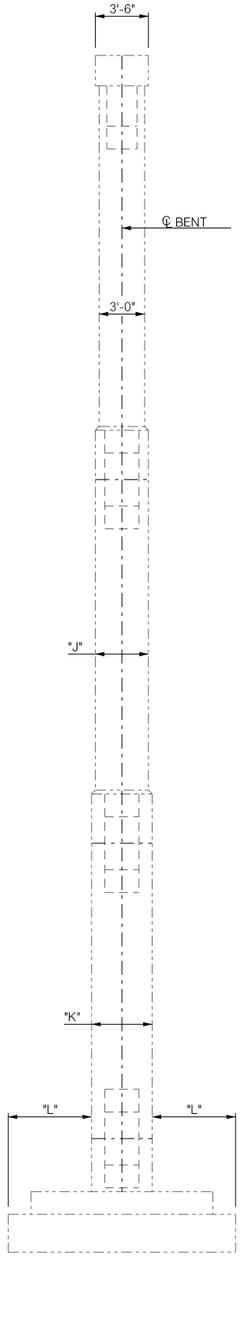


TRANSVERSE ELEVATION



LONGITUDINAL ELEVATION

DETAILS OF THREE STORY BENT ①

① BENT "A"

TABLE OF VARIABLES										
"A"	"B"	"C"	"D"	"E"	"F"	"G"	"H"	"I"	"J"	"K"	"L"
8	89'-0"	29'-0"	26'-0"	24'-6"	11'-0¼"	13'-8¾"	16'-3⅜"	32'-6¾"	3'-7½"	4'-3"	5'-4½"
9	90'-0"	29'-0"	26'-0"	25'-6"	11'-0¼"	13'-8¾"	16'-4⅝"	32'-9¼"	3'-7½"	4'-3"	5'-4½"
12	91'-0"	30'-0"	27'-0"	24'-6"	11'-1½"	13'-11¼"	16'-5⅞"	32'-11¾"	3'-9"	4'-6"	5'-3"
13	89'-0"	29'-0"	26'-0"	24'-6"	11'-0¼"	13'-8¾"	16'-3⅜"	32'-6¾"	3'-7½"	4'-3"	5'-4½"
16	90'-0"	29'-0"	26'-0"	25'-6"	11'-0¼"	13'-8¾"	16'-4⅝"	32'-9¼"	3'-7½"	4'-3"	5'-4½"
19	90'-0"	29'-0"	26'-0"	25'-6"	11'-0¼"	13'-8¾"	16'-4⅝"	32'-9¼"	3'-7½"	4'-3"	5'-4½"
22	89'-0"	29'-0"	26'-0"	24'-6"	11'-0¼"	13'-8¾"	16'-3⅜"	32'-6¾"	3'-7½"	4'-3"	5'-4½"
23	89'-0"	29'-0"	26'-0"	24'-6"	11'-0¼"	13'-8¾"	16'-3⅜"	32'-6¾"	3'-7½"	4'-3"	5'-4½"
26	89'-0"	29'-0"	26'-0"	24'-6"	11'-0¼"	13'-8¾"	16'-3⅜"	32'-6¾"	3'-7½"	4'-3"	5'-4½"
27	89'-0"	29'-0"	26'-0"	24'-6"	11'-0¼"	13'-8¾"	16'-3⅜"	32'-6¾"	3'-7½"	4'-3"	5'-4½"
30	89'-0"	29'-0"	26'-0"	24'-6"	11'-0¼"	13'-8¾"	16'-3⅜"	32'-6¾"	3'-7½"	4'-3"	5'-4½"
31	91'-0"	30'-0"	27'-0"	24'-6"	11'-1½"	13'-11¼"	16'-5⅞"	32'-11¾"	3'-9"	4'-6"	5'-3"
34	91'-0"	30'-0"	27'-0"	24'-6"	11'-1½"	13'-11¼"	16'-5⅞"	32'-11¾"	3'-9"	4'-6"	5'-3"
35	89'-0"	29'-0"	26'-0"	24'-6"	11'-0¼"	13'-8¾"	16'-3⅜"	32'-6¾"	3'-7½"	4'-3"	5'-4½"
38	87'-0"	28'-0"	25'-0"	24'-6"	10'-11"	13'-6¼"	16'-0⅞"	32'-1¾"	3'-6"	4'-0"	5'-6"
39	89'-0"	29'-0"	26'-0"	24'-6"	11'-0¼"	13'-8¾"	16'-3⅜"	32'-6¾"	3'-7½"	4'-3"	5'-4½"
43	93'-0"	30'-0"	27'-0"	26'-6"	11'-1½"	13'-11¼"	16'-8⅜"	33'-4¾"	3'-9"	4'-6"	5'-3"
46	91'-0"	30'-0"	27'-0"	24'-6"	11'-1½"	13'-11¼"	16'-5⅞"	32'-11¾"	3'-9"	4'-6"	5'-3"
47	91'-0"	30'-0"	27'-0"	24'-6"	11'-1½"	13'-11¼"	16'-5⅞"	32'-11¾"	3'-9"	4'-6"	5'-3"
50	91'-0"	30'-0"	27'-0"	24'-6"	11'-1½"	13'-11¼"	16'-5⅞"	32'-11¾"	3'-9"	4'-6"	5'-3"
51	91'-0"	30'-0"	27'-0"	24'-6"	11'-1½"	13'-11¼"	16'-5⅞"	32'-11¾"	3'-9"	4'-6"	5'-3"
58	89'-0"	29'-0"	26'-0"	24'-6"	11'-0¼"	13'-8¾"	16'-3⅜"	32'-6¾"	3'-7½"	4'-3"	5'-4½"
59	89'-0"	29'-0"	26'-0"	24'-6"	11'-0¼"	13'-8¾"	16'-3⅜"	32'-6¾"	3'-7½"	4'-3"	5'-4½"
62	90'-0"	29'-0"	26'-0"	25'-6"	11'-0¼"	13'-8¾"	16'-4⅝"	32'-9¼"	3'-7½"	4'-3"	5'-4½"
63	90'-0"	29'-0"	26'-0"	25'-6"	11'-0¼"	13'-8¾"	16'-4⅝"	32'-9¼"	3'-7½"	4'-3"	5'-4½"
66	93'-0"	30'-0"	27'-0"	26'-6"	11'-1½"	13'-11¼"	16'-8⅜"	33'-4¾"	3'-9"	4'-6"	5'-3"
67	93'-0"	30'-0"	27'-0"	26'-6"	11'-1½"	13'-11¼"	16'-8⅜"	33'-4¾"	3'-9"	4'-6"	5'-3"
70	94'-0"	30'-0"	27'-0"	27'-6"	11'-1½"	13'-11¼"	16'-9⅝"	33'-7¼"	3'-9"	4'-6"	5'-3"
71	94'-0"	30'-0"	27'-0"	27'-6"	11'-1½"	13'-11¼"	16'-9⅝"	33'-7¼"	3'-9"	4'-6"	5'-3"
74	87'-0"	28'-0"	25'-0"	24'-6"	10'-11"	13'-6¼"	16'-0⅞"	32'-1¾"	3'-6"	4'-0"	5'-6"
75	87'-0"	28'-0"	25'-0"	24'-6"	10'-11"	13'-6¼"	16'-0⅞"	32'-1¾"	3'-6"	4'-0"	5'-6"
78	83'-0"	28'-0"	24'-0"	21'-6"	10'-11"	13'-5"	15'-7⅞"	31'-3¾"	3'-6"	4'-0"	5'-6"
79	79'-0"	26'-0"	24'-0"	19'-6"	10'-8½"	13'-2½"	15'-2⅞"	30'-5¾"	3'-6"	4'-0"	5'-6"

NOTE:
STATIONS, UNIT, SPAN, TOWER, PIER AND BENT NUMBERS INCREASE EAST TO WEST.

US-70 OVER LAKE TEXOMA BRIDGE "A"
BRYAN AND MARSHALL COUNTIES

BENT DETAILS
(SHEET 2 OF 3)

DESIGN	MJY	2/21
DETAIL	SJL	2/21
CHECK	XXX	XXX

GARVER

STATE OF OKLAHOMA
DEPARTMENT OF TRANSPORTATION
JOB PIECE NO. XXXXX(04)
SHEET NO. XX

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OKLAHOMA DEPARTMENT OF TRANSPORTATION

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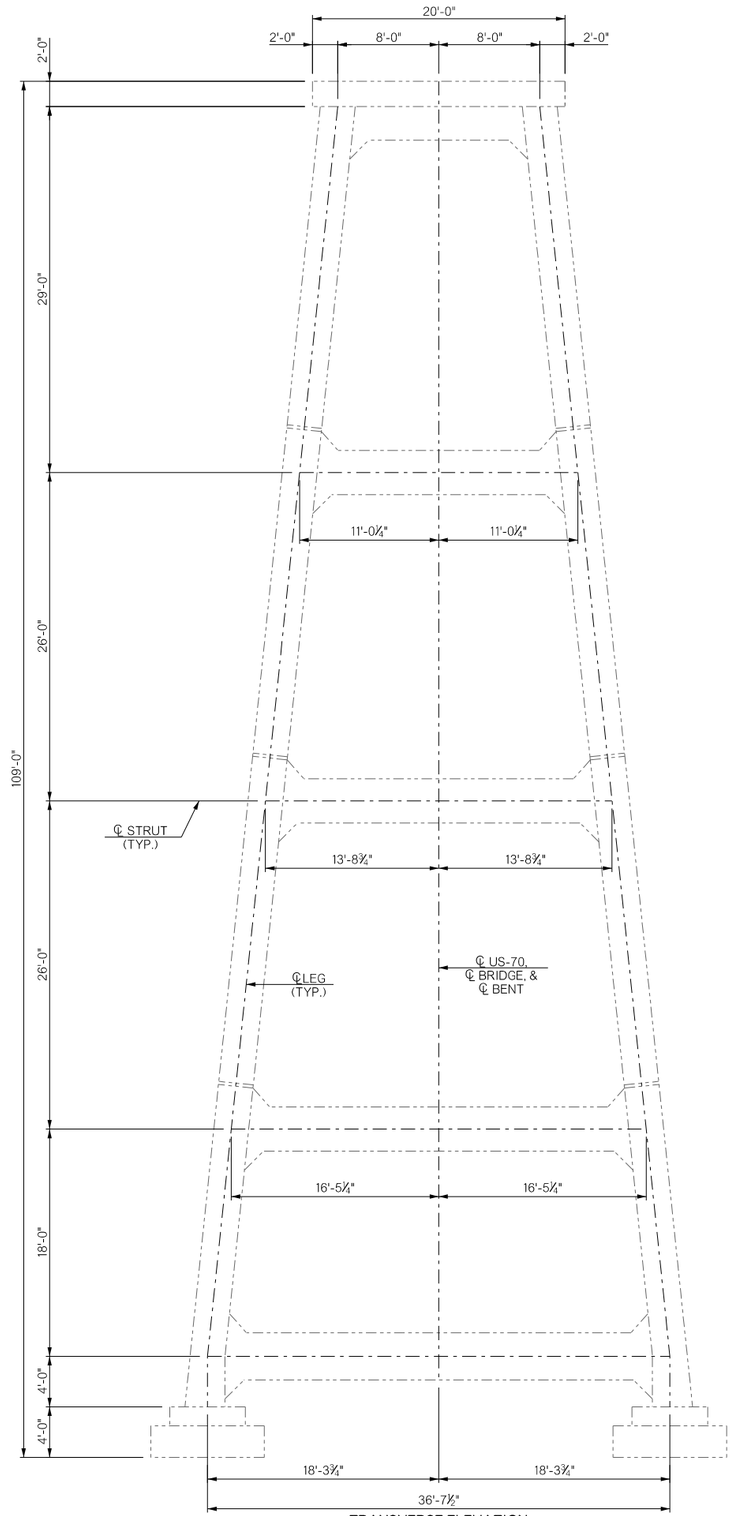
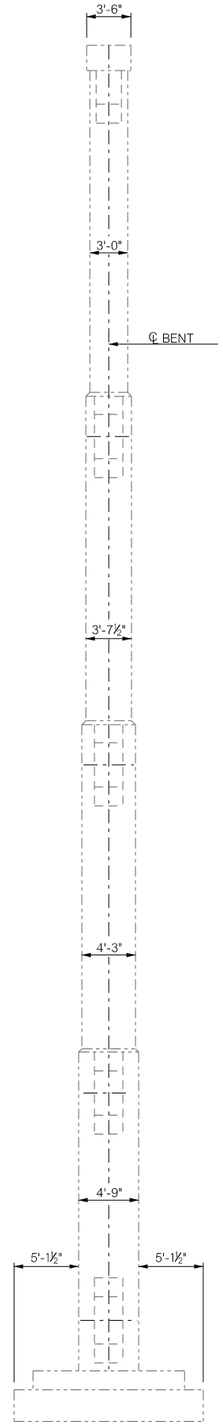
Attachment B



TRANSVERSE ELEVATION



LONGITUDINAL ELEVATION

NOTE:
STATIONS, UNIT, SPAN, TOWER, PIER AND BENT NUMBERS INCREASE EAST TO WEST.

DETAILS OF FOUR STORY BENT

US-70 OVER LAKE TEXOMA BRIDGE "A"
BRYAN AND MARSHALL COUNTIES

BENT DETAILS
(SHEET 3 OF 3)

DESIGN	MJY	2/21
DETAIL	SJL	2/21
CHECK	XXX	XXX

GARVER

STATE OF OKLAHOMA
DEPARTMENT OF TRANSPORTATION
JOB PIECE NO. XXXXX(04)
SHEET NO. XX

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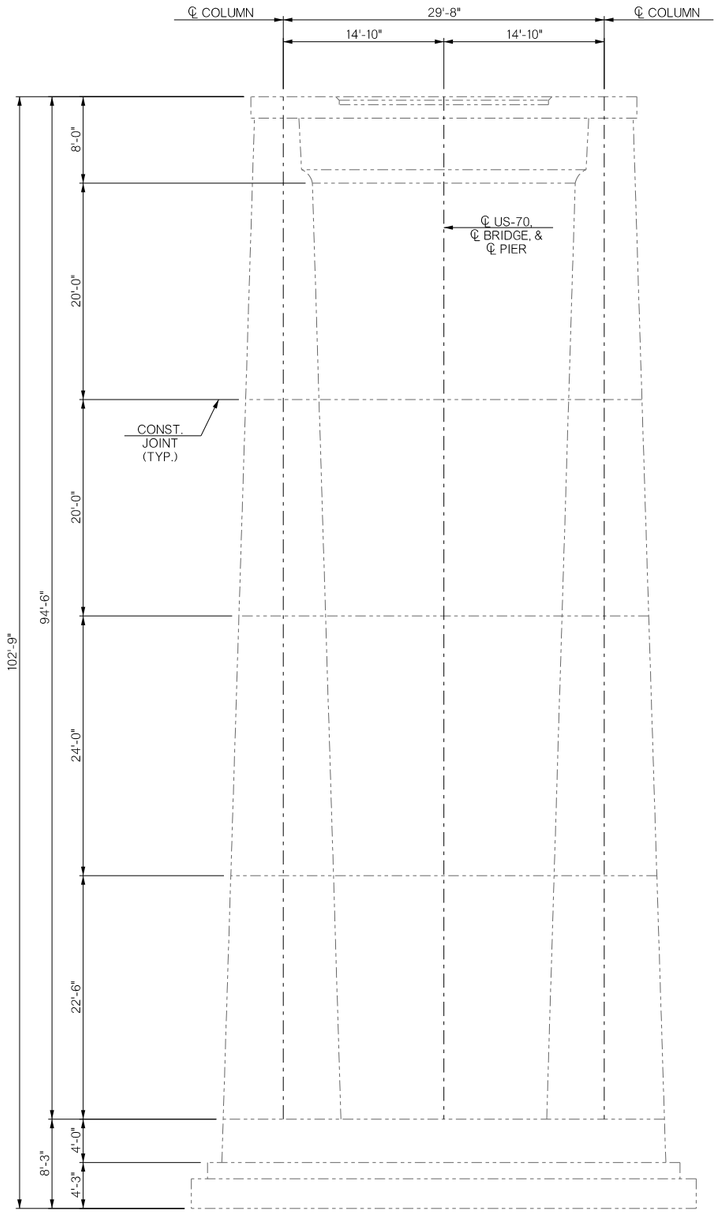

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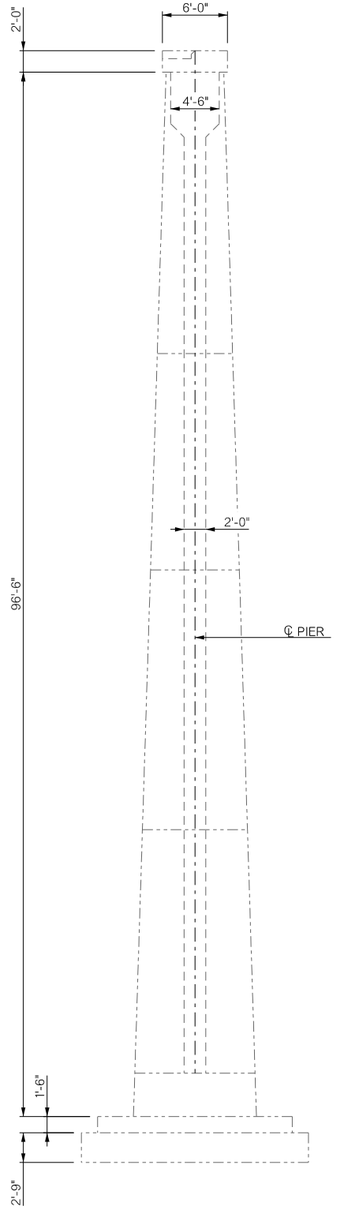

LONGITUDINAL ELEVATION

PIER DETAILS

NOTE:
STATIONS, UNIT, SPAN, TOWER, PIER AND BENT NUMBERS INCREASE EAST TO WEST.

US-70 OVER LAKE TEXOMA BRIDGE "A"	BRYAN AND MARSHALL COUNTIES	DESIGN	MJY 2/21
PIER DETAILS		DETAIL	SJL 2/21
		CHECK	XXX XXX
		GARVER	
STATE OF OKLAHOMA	DEPARTMENT OF TRANSPORTATION		
	JOB PIECE NO. XXXXX(04)	SHEET NO. XX	

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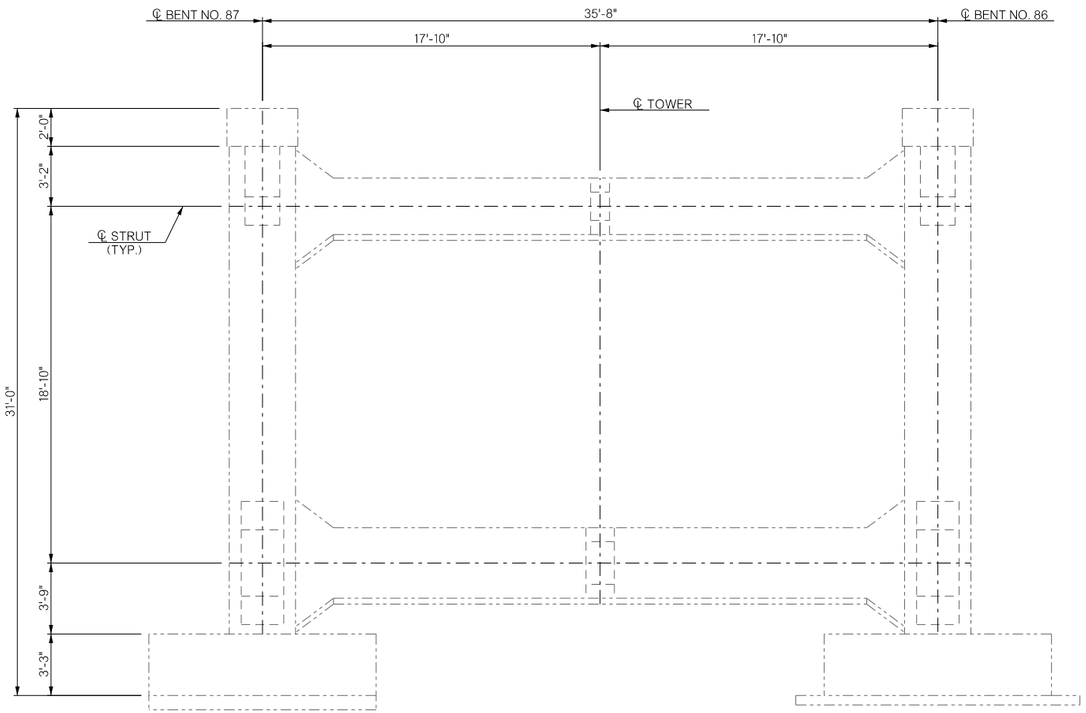

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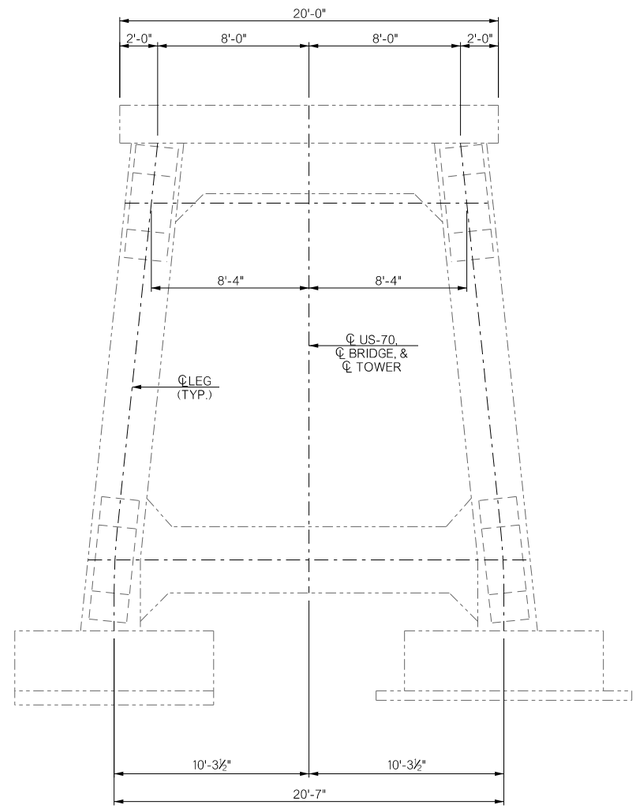

TRANSVERSE ELEVATION

DETAILS OF ONE STORY TOWER

NOTE:
STATIONS, UNIT, SPAN, TOWER, PIER AND BENT NUMBERS INCREASE EAST TO WEST.

US-70 OVER LAKE TEXOMA BRIDGE "A"	BRYAN AND MARSHALL COUNTIES	DESIGN	MJY	2/21
		DETAIL	SJL	2/21
TOWER DETAILS (SHEET 1 OF 3)		CHECK	XXX	XXX
		GARVER		
STATE OF OKLAHOMA	DEPARTMENT OF TRANSPORTATION			
	JOB PIECE NO. XXXXX(04)	SHEET NO. XX		

OKLAHOMA DEPARTMENT OF TRANSPORTATION

FOR INFORMATION ONLY
3/3/2021

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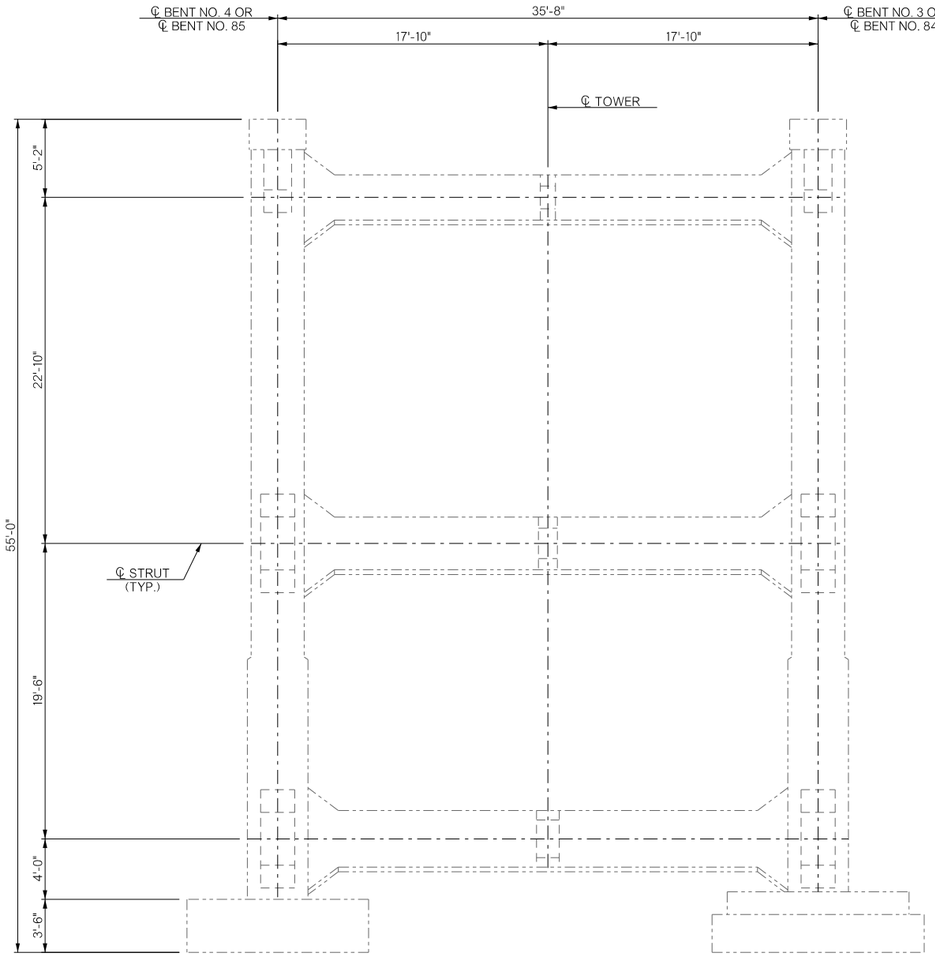

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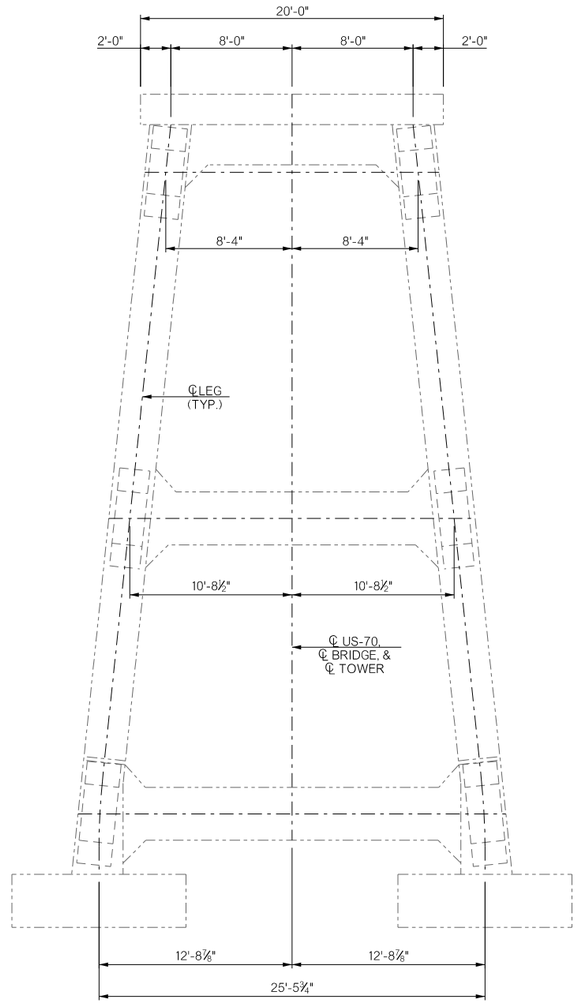

TRANSVERSE ELEVATION

DETAILS OF TWO STORY TOWER

NOTE:
STATIONS, UNIT, SPAN, TOWER, PIER AND BENT NUMBERS INCREASE EAST TO WEST.

US-70 OVER LAKE TEXOMA BRIDGE "A"	BRYAN AND MARSHALL COUNTIES	DESIGN	MJY 2/21
TOWER DETAILS (SHEET 2 OF 3)		DETAIL	SJL 2/21
		CHECK	XXX XXX
		GARVER	
STATE OF OKLAHOMA	DEPARTMENT OF TRANSPORTATION		
	JOB PIECE NO. XXXXX(04)	SHEET NO. XX	

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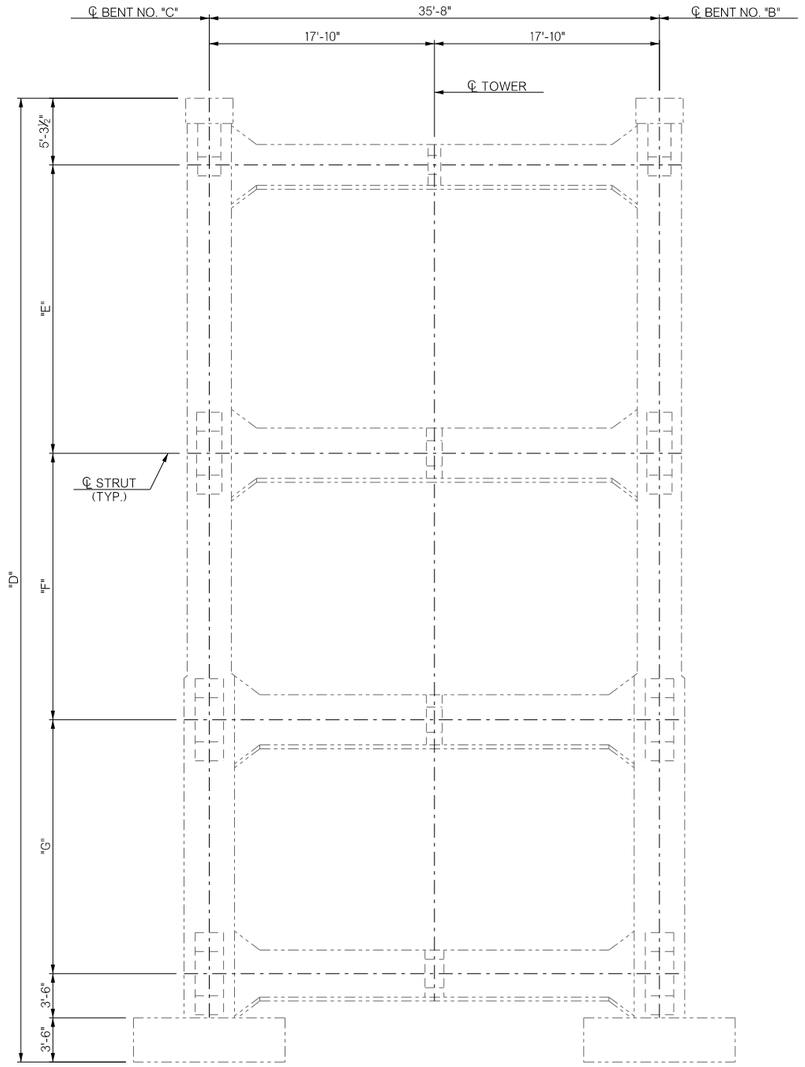
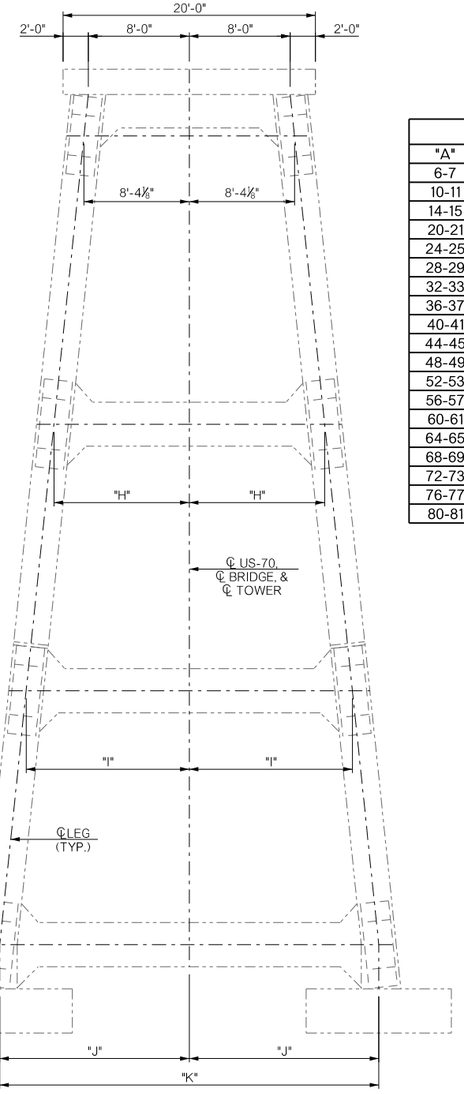
Attachment B



ALL LOCATIONS EXCEPT AS SHOWN BELOW



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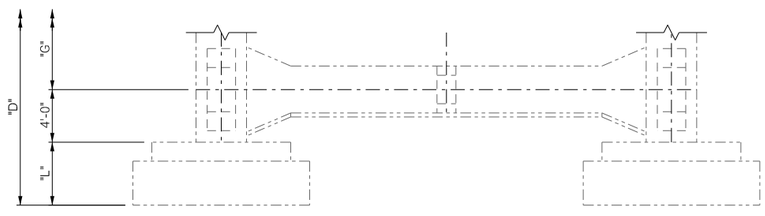
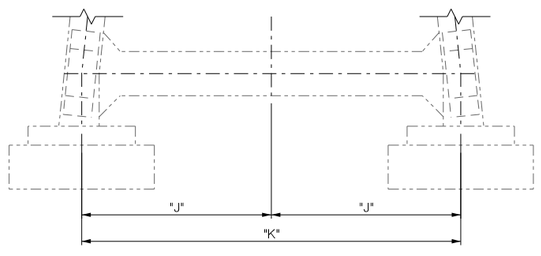


VAR. "L"	
TOWER	"L"
40-41	5'-0"
56-57	4'-0"

TOWERS 40-41 & 56-57 ONLY

LONGITUDINAL ELEVATION



TOWERS 40-41 & 56-57 ONLY

TRANSVERSE ELEVATION

TABLE OF VARIABLES										
"A"	"B"	"C"	"D"	"E"	"F"	"G"	"H"	"I"	"J"	"K"
6-7	6	7	89'-0"	26'-8½"	27'-0"	23'-0"	11'-1½"	13'-11¼"	16'-4"	32'-8"
10-11	10	11	91'-0"	26'-8½"	27'-0"	25'-0"	11'-1½"	13'-11¼"	16'-6½"	33'-1"
14-15	14	15	89'-0"	26'-8½"	27'-0"	23'-0"	11'-1½"	13'-11¼"	16'-4"	32'-8"
20-21	20	21	87'-0"	24'-8½"	25'-0"	25'-0"	10'-11"	13'-6¼"	16'-1½"	32'-3"
24-25	24	25	89'-0"	26'-8½"	27'-0"	23'-0"	11'-1½"	13'-11¼"	16'-4"	32'-8"
28-29	28	29	89'-0"	26'-8½"	27'-0"	23'-0"	11'-1½"	13'-11¼"	16'-4"	32'-8"
32-33	32	33	93'-0"	26'-8½"	27'-0"	27'-0"	11'-1½"	13'-11¼"	16'-9"	33'-6"
36-37	36	37	87'-0"	24'-8½"	25'-0"	25'-0"	10'-11"	13'-6¼"	16'-1½"	32'-3"
40-41	40	41	100'-0"	26'-8½"	27'-0"	32'-0"	11'-1½"	13'-11¼"	17'-3¼"	34'-6½"
44-45	44	45	90'-0"	26'-8½"	27'-0"	24'-0"	11'-1½"	13'-11¼"	16'-5¼"	32'-10½"
48-49	48	49	91'-0"	26'-8½"	27'-0"	25'-0"	11'-1½"	13'-11¼"	16'-6½"	33'-1"
52-53	52	53	93'-0"	26'-8½"	27'-0"	27'-0"	11'-1½"	13'-11¼"	16'-9"	33'-6"
56-57	56	57	95'-0"	26'-8½"	27'-0"	28'-0"	11'-1½"	13'-11¼"	16'-10¼"	33'-8½"
60-61	60	61	89'-0"	26'-8½"	27'-0"	23'-0"	11'-1½"	13'-11¼"	16'-4"	32'-8"
64-65	64	65	91'-0"	26'-8½"	27'-0"	25'-0"	11'-1½"	13'-11¼"	16'-6½"	33'-1"
68-69	68	69	93'-0"	26'-8½"	27'-0"	27'-0"	11'-1½"	13'-11¼"	16'-9"	33'-6"
72-73	72	73	93'-0"	26'-8½"	27'-0"	27'-0"	11'-1½"	13'-11¼"	16'-9"	33'-6"
76-77	76	77	86'-0"	24'-8½"	25'-0"	24'-0"	10'-11"	13'-6¼"	16'-0¼"	32'-0½"
80-81	80	81	76'-0"	22'-8½"	21'-0"	20'-0"	10'-8½"	12'-10¾"	14'-11¾"	29'-11½"

NOTE:
STATIONS, UNIT, SPAN, TOWER, PIER AND BENT NUMBERS INCREASE EAST TO WEST.

DETAILS OF THREE STORY TOWER ①

① TOWER "A"

US-70 OVER LAKE TEXOMA
BRIDGE "A"

BRYAN AND MARSHALL COUNTIES

TOWER DETAILS
(SHEET 3 OF 3)

DESIGN	MJY	2/21
DETAIL	SJL	2/21
CHECK	XXX	XXX

GARVER

STATE OF OKLAHOMA

DEPARTMENT OF TRANSPORTATION

JOB PIECE NO. XXXXX(04)

SHEET NO. XX

OKLAHOMA DEPARTMENT OF TRANSPORTATION

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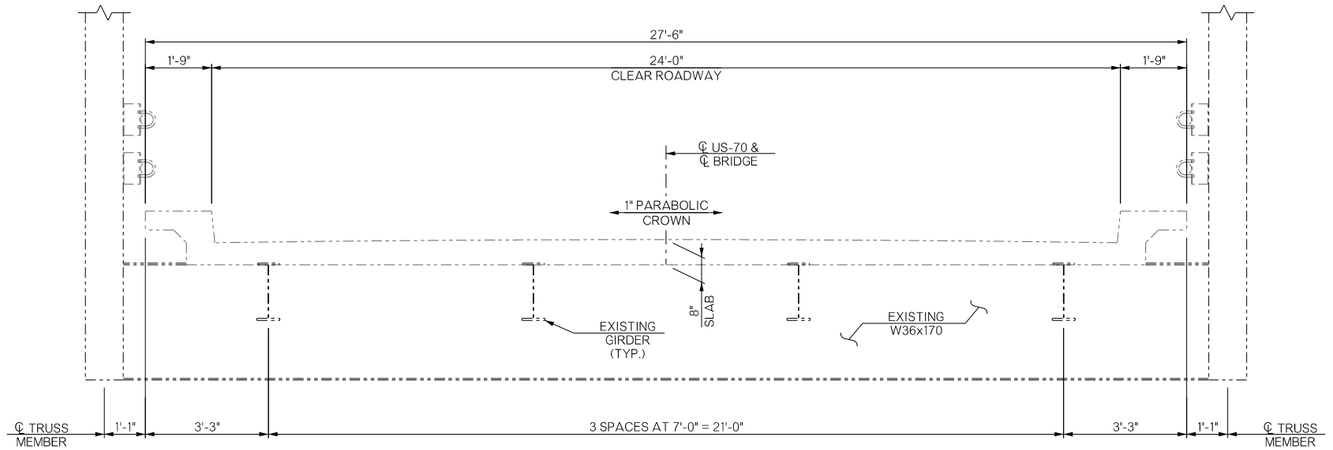
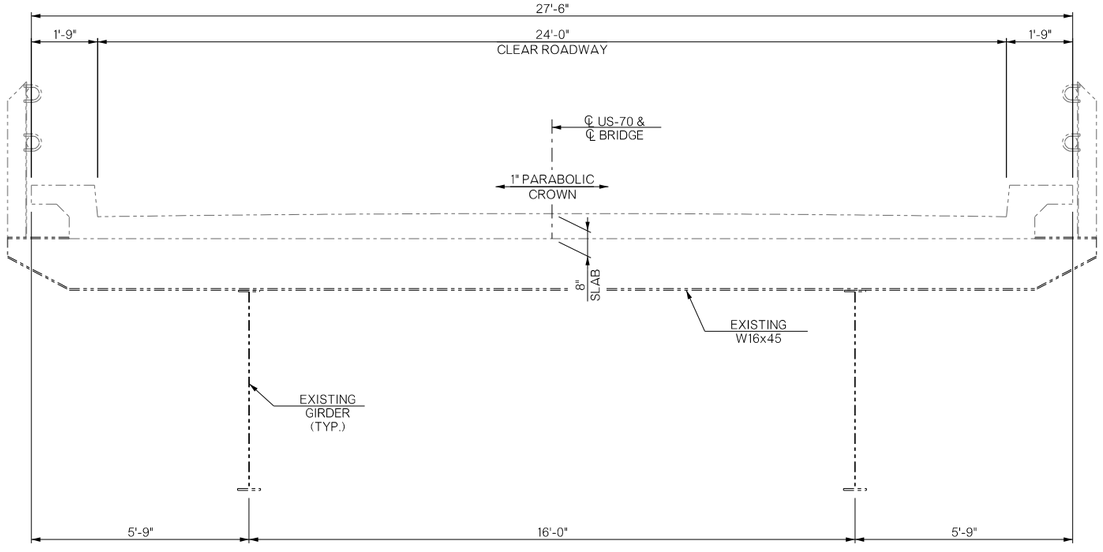
Attachment B



TYPICAL SECTION - SPAN NO. 18 (TRUSS SPAN)
(LOOKING FORWARD STATION)



TYPICAL SECTION - SPAN NOS. 1 - 17 & 19 - 89
(LOOKING FORWARD STATION)

NOTE:
STATIONS, UNIT, SPAN, TOWER, PIER AND BENT NUMBERS INCREASE EAST TO WEST.

US-70 OVER LAKE TEXOMA
BRIDGE "A"

BRYAN AND MARSHALL COUNTIES

TYPICAL SECTIONS

DESIGN	MJY	2/21
DETAIL	SJL	2/21
CHECK	XXX	XXX

GARVER

STATE OF OKLAHOMA

DEPARTMENT OF TRANSPORTATION

JOB PIECE NO. XXXXX(04)

SHEET NO. XX

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COX | McLAIN
Environmental Consulting

MEMORANDUM

TO: Kirsten McCullough, Garver

FROM: Kory Van Hemert and Emily Reed, Cox McLain Environmental Consulting, Inc.

DATE: 02/26/21

RE: Supplemental Research and Documentation for the Roosevelt Memorial Bridge over Lake Texoma

---

Project Understanding

The Oklahoma Department of Transportation (ODOT), in cooperation with the Federal Highway Administration (FHWA), is proposing to improve the bridge crossing over Lake Texoma (Washita River) on U.S. Highway 70 in Bryan and Marshall Counties, Oklahoma. The existing bridge is functionally obsolete and at risk of becoming structurally deficient. The Franklin D. Roosevelt Memorial Bridge (Roosevelt Bridge) over Lake Texoma (Structure #0706 0000X / NBI #10965) is an 87-span bridge with a Warren with polygonal top chord through-truss central span, constructed in 1942. It was assessed as being eligible for the National Register of Historic Places (NRHP) as part of the 2007 update of the "Spans of Time" Oklahoma Historic Bridges study.

ODOT may require the completion of a Programmatic Section 4(f) Evaluation and Approval for FHWA Projects that Necessitate the Use of Historic Bridges. Cox McLain Environmental Consulting, Inc., has conducted research to establish a thorough understanding of the NRHP eligibility of the bridge, including character-defining features. This memorandum addresses the data gaps in the existing evaluation records for the bridge.

Research Questions and Answers

1. Is the only reason the bridge is eligible under Criterion C because it is a rare example of its type?
    - According to Parsons Brinckerhoff's *Context for Common Bridge Types*, the significance of the Warren truss type diminishes past the first two decades of the 1900s. Even in the case of a bridge retaining all of its character-defining features, a Warren truss type built after 1920 would possess low to moderate significance. The 2007 Re-Evaluation of "Spans of Time" indicates that the Roosevelt Bridge is the only vehicular Warren through-truss with a polygonal top chord in Oklahoma. The rarity of the bridge's subtype on the Oklahoma highway system increases its significance under Criterion C, despite its later construction date. Bridges of the same subtype exist on railways in Oklahoma, including one for the BNSF Railway across Lake Texoma. The bridge's rarity as the only vehicular Warren through-truss with a polygonal top chord on the Oklahoma highway system, despite the subtype's use for railway crossings, is the primary reason for its eligibility under Criterion C.

2. What alterations to the bridge system, if any, have occurred?
    - According to ODOT's most recent bridge form for the Roosevelt Bridge, there are no known alterations to the character-defining features of either the main truss span or the 86 approach spans. One segment of the original pipe railing on the east approach has been replaced with guard railing. One segment of pipe railing on the west approach is visibly oxidized, indicating complete paint failure or potential replacement.

3. What is the NRHP boundary of the bridge property? Does it include the earthen embankment east of bridge?
    - The recommended NRHP boundary of the bridge includes the main Warren polygonal through-truss span, the 86 approach spans, all connected cantilevered power lines, and the steel pipe railing to its greatest extent (see **Figure 1**). The earthen embankment east of the bridge was constructed before the bridge and is a distinct and separate structure and not recommended for inclusion in the NRHP boundary.

Image 1. Construction of the Roosevelt Bridge substructure on dry ground before the filling of the reservoir. The eastern embankment can be seen at far right; view facing northeast. Image provided by Garver.

4. The bridge is eligible under Criterion A for its association with a major U.S. Army Corps of Engineers dam project. What are the character-defining features of the bridge that pertain to eligibility under Criterion A?
    - The bridge has associative significance with the important trend of water impoundment and the creation of dams and lakes across Oklahoma. While federal assistance for water projects in Oklahoma began at the turn of the century, water related public works projects found purchase in the state after the severe droughts of the 1930s. Depression-era funds to address water and soil conservation led to the creation of large-scale dams and associated culverts and bridges, with hydroelectric impoundments like the Neosho and Pensacola dams, in the late 1930s and early 1940s. The U.S. Army Corps of Engineers became engaged in these types of projects and eventually constructed the 1944 hydroelectric dam over the Red River, backing up the Washita River, a tributary,

and creating Lake Texoma. As a result, the Roosevelt Bridge was necessitated as a vehicular structure providing primary public access in the region and between the east and west sides of Lake Texoma, carrying the major thoroughfare of U.S. Highway 70. The Roosevelt Bridge began construction on dry land before the reservoir filling began in 1944. The bridge opened for traffic on June 21, 1945 (Image 2). It is significant as an example of a vehicular bridge created in direct response to the completion of a major water impoundment project, the Denison Dam. The main character-defining feature under Criterion A is the bridge's use as a vehicular crossing over a waterway. To retain

Image 2. A c. 1950 postcard of the Roosevelt Bridge. The Warren through-truss with a polygonal top chord can be seen at far right; view facing northeast.

Criterion A significance, the bridge must continue to provide a vehicular crossing as a major thoroughfare. The loss of material integrity would not automatically destroy the bridge's Criterion A significance if it continues to serve its historical function.

5. The bridge is eligible under Criterion C as a rare example of its type. What are the character-defining features of the bridge that pertain to eligibility under Criterion C?
    - The character-defining features for this bridge type, a Warren through-truss with a polygonal top chord, are the diagonal members forming a "W" with triangles, the vertical members, the inclined end posts, and the curved top chord, as well as the struts and bracing of the portal features of the through-truss. The loss of these character-defining features would impair the bridge's ability to convey its significance under Criterion C. Character-defining features unique to this bridge, unrelated to the bridge's subtype, are the concrete piers and bents comprising the substructure of the single main span and 86 approach spans, steel pipe railings, as well as the cantilevered powerlines on the truss and the 10 cantilevered electrical poles attached to the

approach spans (2 east of the main span, 8 to its west). The bridge functioning as a truss is also character-defining. The loss of these character-defining features unrelated to the bridge's subtype would not inhibit the conveyance of significance under Criterion C.

Attachment C

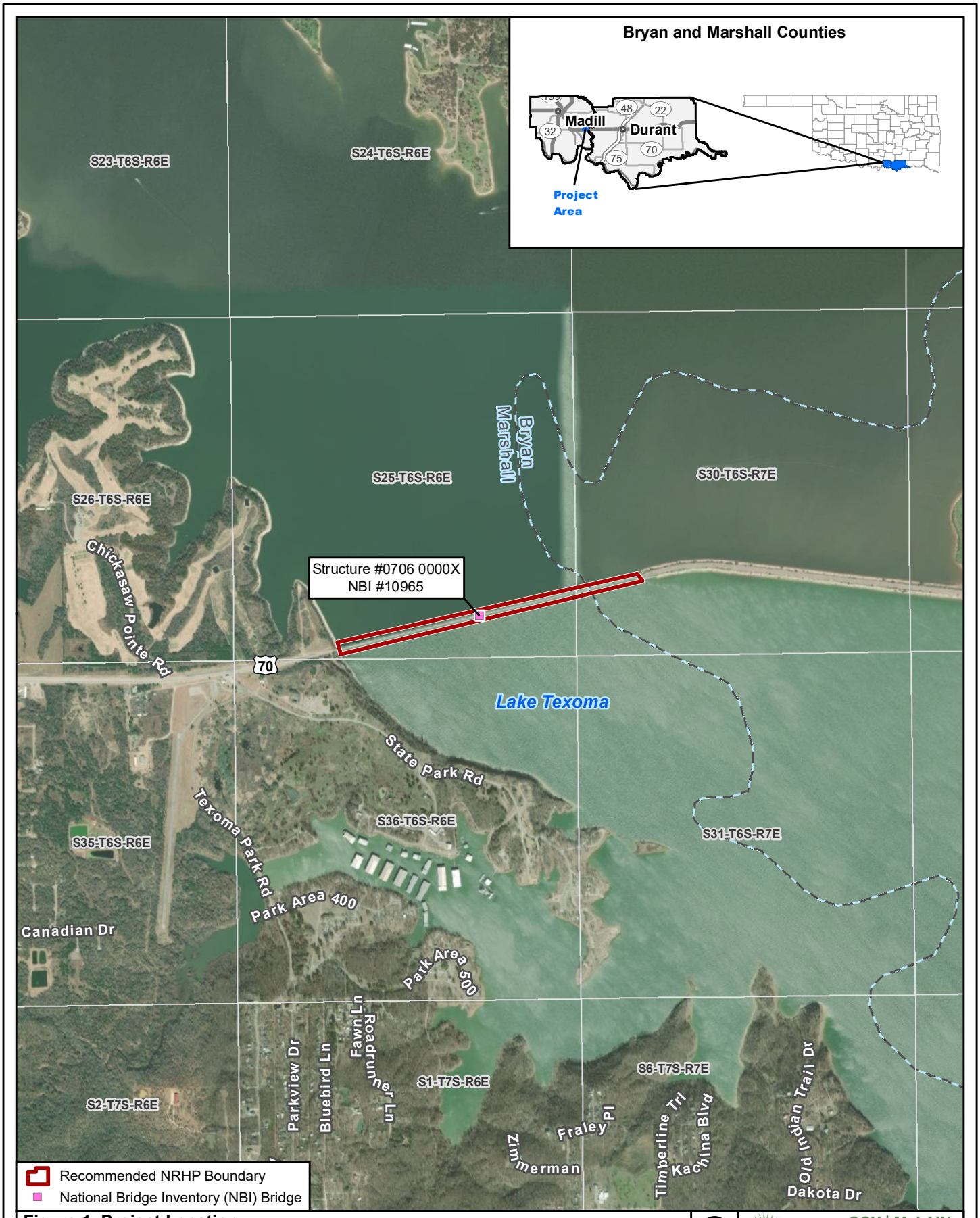

Figure 1. Project Location

US 70 over Lake Texoma
Bryan County, Oklahoma

Data Sources: BLM (2020), ODOT (2020)
Aerial Source: Maxar (2019)

COX | McLAIN Environmental Consulting

0 2,000 Feet
0 600 Meters

1 inch = 2,000 feet
Scale: 1:24,000
Date: 2/26/2021

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