Final Bridge Selection Report

1st Avenue Bridge over the Rillito River

Tucson, Pima County, Arizona

City of Tucson Project No. 230193

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1 Introduction

This Bridge Selection Report is part of City of Tucson (COT) Department of Transportation and Mobility (DTM) Project No. 230193, entitled "1st Avenue: River Road to Grant Road Project," and is being conducted in partnership with Pima Association of Governments and the Regional Transportation Authority (PAG/RTA). The project is in the northwestern part of Tucson in Pima County, Arizona (Figures 1 and 2).

This project will construct a new bridge to replace the existing 1st Avenue Bridge over the Rillito River. Additionally, modernization and safety improvements will be made along the entire 1st Avenue corridor from Grant Road to River Road, based on guidance from the City of Tucson Street Design Guide 2021 (City of Tucson, 2021). Improvements will include pavement reconstruction, enhanced pedestrian and bicycle facilities, drainage infrastructure, landscaping, lighting, and upgraded traffic signals.

The 1st Avenue Project is primarily funded by the Regional Transportation Authority (RTA) through a 1/2-cent regional sales tax with contributions from COT development impact fees.

The existing 1st Avenue Bridge over the Rillito River has outlived its intended lifespan, has outdated pedestrian and bicycle facilities, and does not meet current hydraulic freeboard requirements. Replacing the bridge over the Rillito River is necessary to modernize the 1st Avenue corridor and improve the experience and safety of all its users.

The purpose of this Bridge Selection Report is to determine the preferred bridge alternative for the proposed replacement bridge over the Rillito River. Factors such as the preferred corridor geometry and abidance to the COT Street Design Guide determine travel lane widths, shoulder widths, and pedestrian/bicycle accommodations. Project specific drivers such as constructability, cost, bridge hydraulics, maintaining clearance for The Loop path beneath the bridge, and maintenance of traffic on 1st Avenue are used to determine the recommended bridge alternative.

Figure 1. Project Location Map

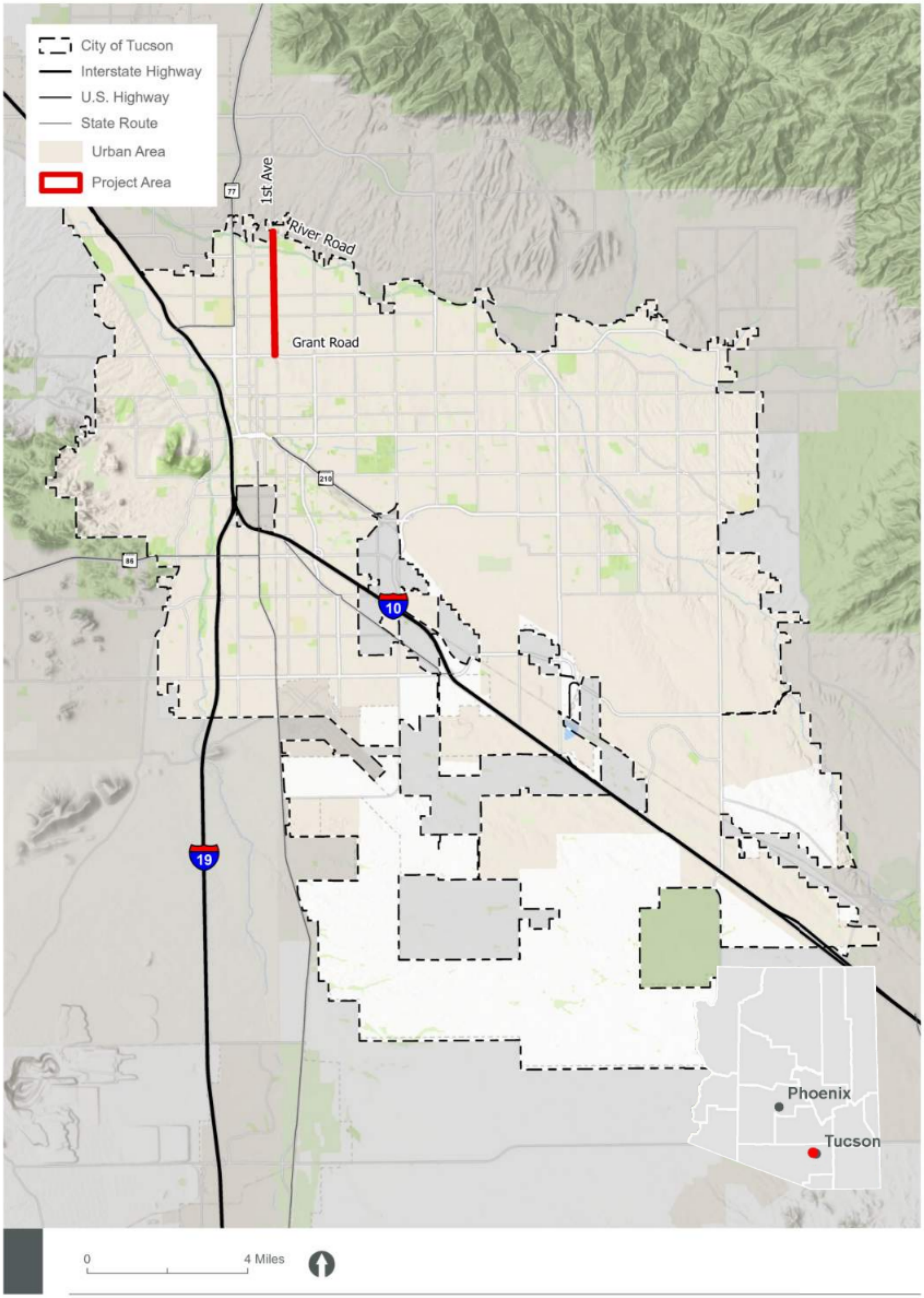
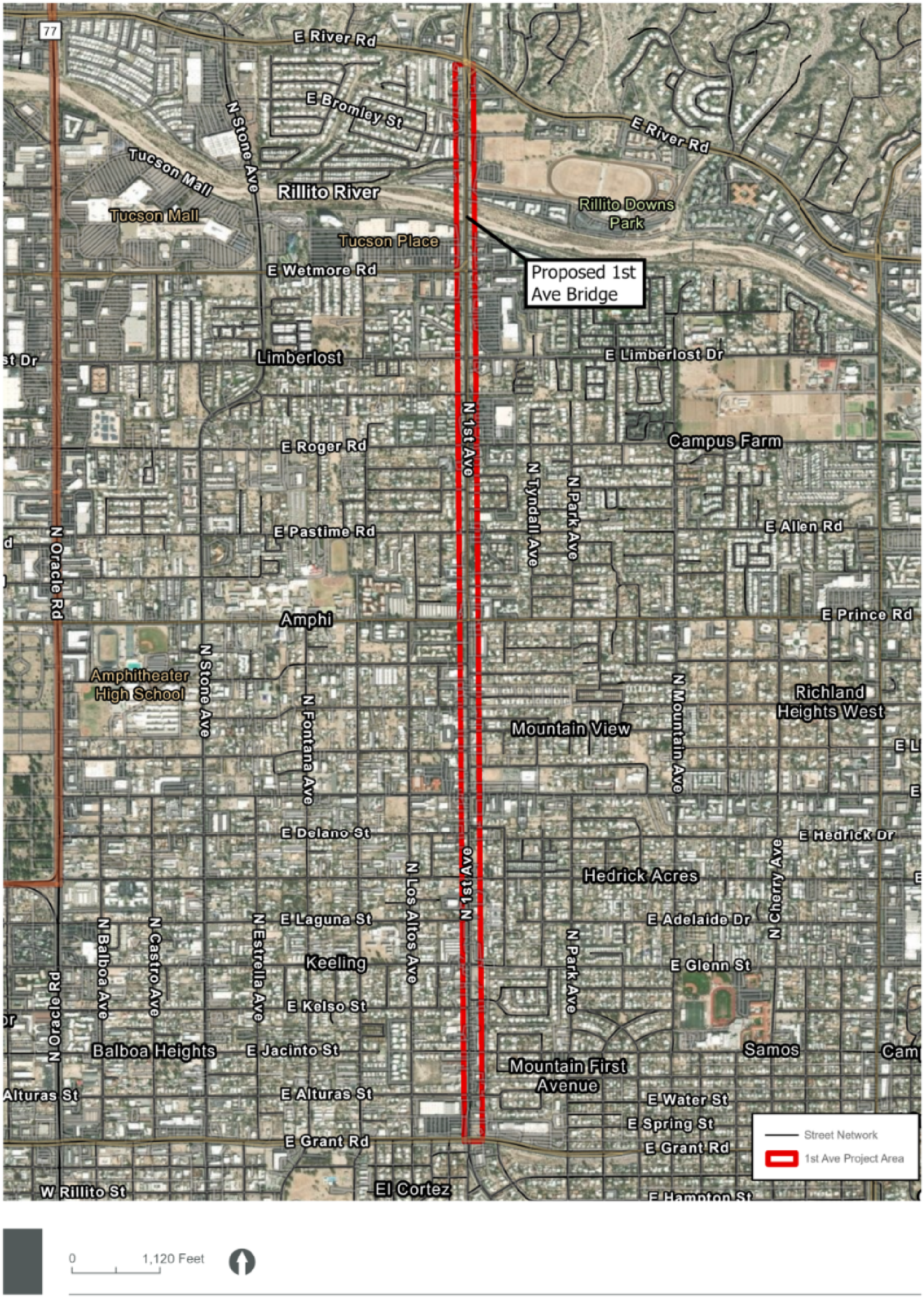


Figure 2. Project Vicinity Map



2 Background Data/Existing Conditions

2.1 Existing Roadway Geometry and Condition

The existing approach roadways to the bridge are approximately 68 feet wide, consisting of two 12-foot travel lanes in each direction, a 12-foot two-way left-turn lane/flush median in the center, and 4-foot shoulders on each side of the roadway. A 4-foot sidewalk is present on each side of the southern approach roadway and intermittently along the northern approach roadway. The roadway narrows to eliminate the 12-foot center median on the bridge, but the typical roadway travel lanes, shoulders, and sidewalks are maintained over the bridge.

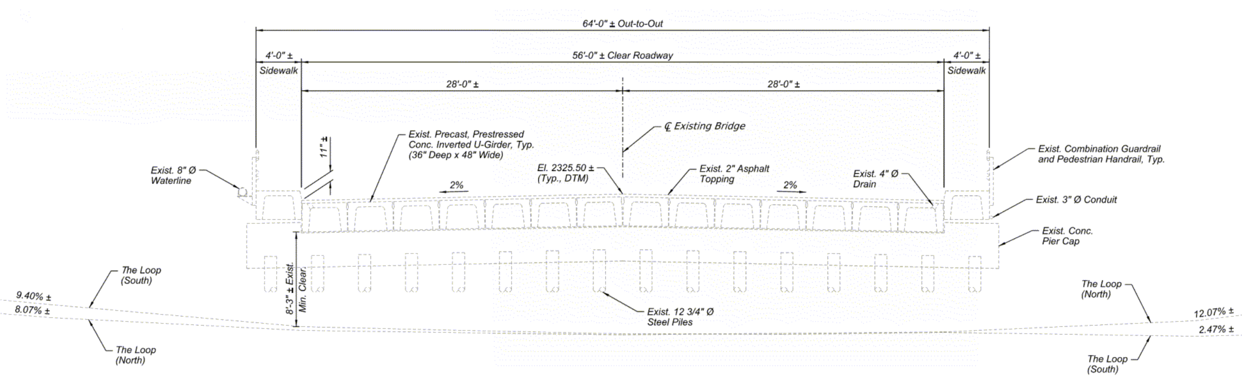
The bridge centerline follows a level vertical alignment, whereas the approach roadway centerlines have tangent vertical grades. There is a vertical grade break approximately 90 feet north of the end of the existing bridge. The bridge and approach roadways are on a horizontal tangent centered in the right-of-way.

2.2 Existing Bridge Geometry and Condition

The existing 1st Avenue Bridge over the Rillito River, Structure Number 9617, was built in 1961 and consists of six simple spans. The bridge has a total length of 362'-11 ½" back-to-back of abutments. The exterior spans measure 59'-6 ¼" while the interior spans measure 60'-1 ½". The bridge has an out-to-out width of 64'-0" with a clear roadway width of 56'-0", consisting of four 12'-0" lanes of undivided traffic, two 4'-0" shoulders, and two 4'-0" raised sidewalks. The deck crowns at the centerline and a 2% cross slope provides for deck runoff to 4" diameter drains located in the exterior roadway girders.

The bridge superstructure is comprised of sixteen adjacent precast prestressed inverted U-girders, with a 2" asphalt topping placed directly over the fourteen interior girders. The girders are nominally 48" wide by 30" deep and have diaphragms at the third points and ends of each span. The total superstructure depth is approximately 2'-8". The two exterior girders are raised approximately 11" above the adjacent interior girders to function as curbed pedestrian sidewalks. Galvanized guardrail posts bolted directly into the sidewalk girders support a combination guardrail and pedestrian handrail.

Figure 3. Existing Bridge Typical Section



The bridge piers and abutments have an 18° skew to align with the direction of flow in the Rillito River. The abutments and all five piers consist of cast-in-place (CIP) concrete caps founded on 12 3/4” outside diameter driven steel piles filled with concrete. According to the pile record in the As-Built drawings, each of the piles originally had a furnished length of 35-feet, with field cutoffs ranging from approximately 1 to 5 feet. Measurements of the above-ground piles heights indicate that the piles extend approximately 20 to 25 feet below existing grade.

Figure 4. View of Existing Bridge Pier, Piles, and Underside of Girders

Each of the five 2’-6” wide CIP pier caps are supported on 16 vertical piles. The 3’-0” wide CIP abutment caps are supported on thirteen piles each. Four of the piles at each abutment are battered at a 3:12 horizontal to vertical ratio, with the remaining nine piles driven vertically. Extending approximately 10 feet out from each end of the abutment caps are 1’-0” thick wingwalls.

The original bank protection for the existing bridge consisted of precast concrete slabs and railroad rails. Subsequent improvements to bank protection along the Rillito River resulted in the current soil cement bank protection system at the bridge abutments, which accommodates a 10-foot-wide multi-use path, “The Loop,” as it passes beneath the existing bridge along both banks. The Loop has minimum clearances for pedestrians and cyclists under the existing bridge of 8’-7” and 8’-3” at the north and south banks, respectively.

Figure 5. Partial Elevation View of Existing Bridge with The Loop Passing Beneath

According to ADOT's Structure Inventory and Appraisal (SI&A) form, the existing bridge (Structure Number 9617) was designed for the HS 20-44 vehicular live load, has an overall NBI Bridge Condition of Fair, and a Sufficiency Rating of 87.40. The July 27, 2023, ADOT Bridge Inspection Report reported the Condition and Appraisal Ratings shown in Table 1.

Table 1. Structure #9617 Condition and Appraisal Ratings (2023)

Rating Type	Code	Element	Rating	Description
NBI Condition Ratings	N58	Deck	7	Good
	N59	Superstructure	6	Satisfactory
	N60	Substructure	6	Satisfactory
	N61	Channel	7	Minor Damage
Appraisal Ratings	N67	Structural Evaluation	6	Equal Min. Criteria
	N68	Deck Geometry	5	Above Tolerable
	N69	Vert. & Horiz. Clearances	N	Not Applicable (NBI)
	N71	Waterway Adequacy	8	Equal Desirable
	N72	Approach Roadway Alignment	8	Equal Desirable
	N113	Scour Critical Rating	5	Stable w/in Footing

The SI&A form provides LFR Inventory and Operating Load Ratings of 27 and 76 tons, respectively, for the existing structure. The bridge is not load posted, because the Operating Rating Factor is greater than 1.0. The design life for bridges from this era was typically 50 years, so at nearly 64 years old, the bridge has outlived its intended lifespan.

2.3 Existing Hydraulics

The FEMA Flood Insurance Study (FIS) for Pima County and Incorporated Areas has a list of published peak discharges for various watercourses and the Rillito River is one of them. The Rillito River has a watershed area of 892 square miles at 1st Avenue. The FIS 10-yr, 50-yr, 100-yr, and 500-yr peak discharge values for the Rillito River at 1st Avenue are shown in the table below and were used for the hydraulic analysis at the bridge.

Table 2. Rillito River Peak Discharges by Recurrence Interval

Location	10-yr (cfs)	50-yr (cfs)	100-yr (cfs)	500-yr (cfs)
@ 1st Avenue	12,500	24,000	32,000	64,000

The Rillito River at 1st Avenue is mapped by FEMA and published on the Digital Flood Insurance Rate Map (DFIRM) number 04019C1687L, Effective June 16, 2011. Near the bridge, the Rillito River is mapped as a Zone AE with Floodway. The Floodway is the most restrictive part of the floodplain and is reserved for passage of the 100-year event. In the bridge vicinity, the Floodway and Zone AE Floodplain limits are equivalent, which means that no encroachment is allowed into the Floodway unless it can be demonstrated that a no-rise condition can be achieved. Increases to water surface elevations (WSELs) from the proposed bridge will trigger the Letter of Map Revision (LOMR) process, which starts with a Conditional LOMR (CLOMR) application. A major project goal is to avoid an increase in WSELs and a need for a CLOMR application by minimizing impacts within the floodplain and using refined hydraulic modeling techniques.

The banks of the Rillito River are channelized with cement soil alluvium (CSA) material, which carries The Loop path. The river improvements were part of several projects conducted by the Army Corps of Engineers (USACE) in the mid-1990's. Upon the completion of channel bank improvements, a Local Cooperation Agreement (LCA) was developed between the USACE and Pima County Regional Flood Control District (PCRFCD). The agreement, completed June of 1994, hands over the operation and maintenance of the river levees to PCRFCD. However, the structures are still considered to be under USACE review and authority, therefore requiring a Section 408 permit process, submitted on behalf of the PCRFCD who acts as the sponsor for the structures. PCRFCD will be submitting an inquiry to USACE on behalf of the project. USACE will review the application and determine if a Section 408 permit is required.

2.4 Existing Utilities

Descriptions of existing utility facilities within the bridge limits or with potential impacts to the bridge are provided below. As depicted in the Bridge Plans in Appendix B, the proposed bridge can accommodate relocated waterlines and other utilities as necessary.

Telecommunication Facilities

Lumen (formerly known as CenturyLink) and Cox Communications have aerial facilities, supported on TEP poles, crossing north-to-south over the Rillito River along the eastern side of the existing 1st Avenue bridge. Comcast, First Digital, and Zayo Group are also anticipated to potentially have aerial facilities supported on the same TEP poles.

A 3-inch diameter metal conduit is attached to the east face of the existing bridge, but it has not yet been determined whether it is actively used by any utility facilities or is abandoned.

Tucson Electric Power

TEP has overhead electric facilities within the bridge limits. TEP operates an electric transmission line, which runs east-to-west along the north bank of the Rillito River. These lines require a minimum vertical separation of 25 feet, 6 inches from the top of the proposed bridge deck and a minimum approach distance of 15 feet for construction equipment and 25 feet for cranes.

TEP also has overhead electric distribution lines running north-to-south over the Rillito River along the eastern side of the existing bridge and continuing onward along 1st Avenue. These poles also support several of the other utilities in the project limits. It is anticipated that these overhead lines would conflict with the proposed work and would have to be relocated.

Tucson Water

Tucson Water has a 36-inch diameter water main crossing the Rillito River north-to-south along the eastern side of the existing bridge at 1st Avenue. The 36-inch water main is encased in concrete and buried below grade in the river channel and is supported on vertical and battered steel piles. The proposed work is not anticipated to impact the buried water main. However, Tucson Water is considering replacing the water main in the future and realigning it to be supported below the deck of the new bridge. If this occurs, special considerations will have to be made during the final design of the bridge to accommodate this large water main to adequately distribute the load throughout the bridge.

Tucson Water also has an 8-inch diameter water line supported on the western face of the existing bridge, which crosses north-to-south over the Rillito River. Facilities for the relocation of the water line onto the proposed bridge can be accommodated.

2.5 Existing Right of Way

The existing right-of-way (R/W) at the proposed bridge location measures 90 feet full width and is centered along the Township Line between Township 13 South, Range 13 East, and Township 13 South, Range 14 East, with respect to the Gila and Salt River Base and Meridian. Therefore, there is 45 feet of R/W each side of the Township Line and the existing R/W centerline. The existing R/W widens to approximately 135 feet full width at the south approach to the bridge and 120 feet full width at the north approach to the bridge.

The existing and proposed bridge centerlines are aligned with the R/W centerline. The proposed bridge width will likely necessitate the acquisition of additional R/W. It is anticipated that the following parcels, belonging to Pima County Flood Control District, will require a partial R/W acquisition.

- APN 105-10-002B
- APN 105-10-2540
- APN 108-19-0020
- Two adjacent parcels having only legal descriptions, not Assessor Parcel Numbers (APN)

Some of the aforementioned parcels belonging to Pima County Flood Control District have existing easement agreements with Tucson Water and Tucson Electric Power.

3 Project Scope

Bridge selection drivers such as constructability, cost, bridge hydraulics, The Loop, and maintenance of traffic are summarized here and discussed in detail in the subsequent sections.

Constructability considerations, Driver No. 1, include designing components, establishing span configurations, and considering construction techniques familiar to local Arizona contractors. The precast prestressed concrete girder types evaluated are common throughout the state and reduce risk from flooding while constructing in the Rillito River. In addition, potential constructability issues such as construction of deep foundations near overhead TEP transmission lines were considered.

Cost is Driver No. 2. Determination of the most cost-effective bridge alternative that addresses each of the project drivers is thoroughly investigated in the remainder of this report. This is addressed through evaluation of four bridge alternatives containing varied span configurations and precast prestressed concrete bridge superstructure systems. Additionally, the cost implications of a closed median variation of the recommended bridge alternative are discussed. Estimated bridge construction costs are provided for all the bridge alternatives.

Hydrology and hydraulics, Driver No. 3, is a crucial consideration when establishing the total bridge length and vertical profile for the bridge. The bridge abutments have been placed behind the existing abutments to avoid conflicts between the new abutment foundations and the existing steel piles that support the existing abutments. Since the existing abutments are outside the delineated Floodway, this also helps achieve a no-rise condition, avoiding a LOMR process. Optimizing span lengths to minimize piers in the river channel also helps in preventing a raise in water surface elevation. The bridge vertical profile for each alternative studied was set to satisfy the PCRFCD hydraulic requirements for 100-yr freeboard, as prescribed in “Guidelines for Establishing Scour and Freeboard for Bridges in Pima County.”

The Loop, Driver No. 4, establishes the governing vertical clearance criterion for setting the vertical profile of the bridge. Due to an increase in bridge width and the steep slopes of The Loop approaches, the low chord elevation of the proposed bridge must be placed higher than existing to maintain the existing minimum vertical clearance above The Loop as it passes beneath the new bridge. Existing drainage structures beneath The Loop that empty into the Rillito River at the south bank immediately west of the bridge prevent The Loop profile from being lowered without extensive drainage modifications and regrading.

Additionally, modification to The Loop would likely require review by USACE and could potentially trigger a Section 408 permit process. Finally, modification of The Loop profile would also require compliance to current design standards as the current path exceeds the maximum allowable longitudinal grade. These modifications would require work well beyond the limits of the bridge construction on both the north and south sides of the river and would also require modification and/or elimination of existing connections to The Loop.

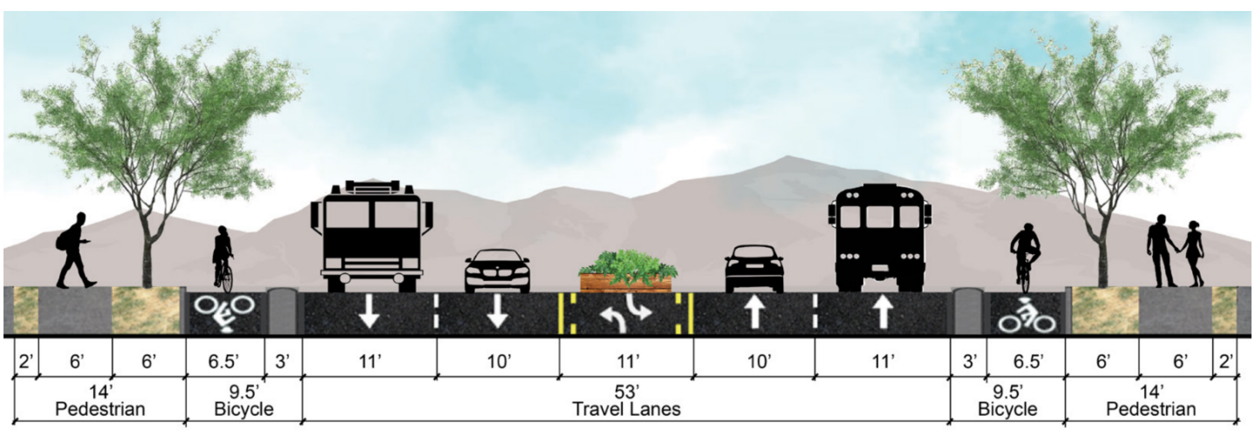
Maintenance of traffic, Driver No. 5, is also a consideration in the bridge alternative selection. The City of Tucson intends to keep 1st Avenue open to traffic during construction. Construction phasing of the bridge allows for one lane of traffic on 1st Avenue to be maintained in each direction during construction.

3.1 Proposed Roadway Geometry

The 2006 voter-approved RTA Plan included widening 1st Avenue to a six-lane divided roadway with bike lanes and sidewalks. However, the transportation context in Tucson has since changed, with the development of the Complete Steets framework. A Needs Assessment Study for the 1st Avenue corridor from River Road to Grant Road was conducted for COT, after which it was determined that a four-lane roadway, instead of a six-lane roadway, would be pursued.

The proposed roadway section at the bridge approaches consists of an 11’-0” median/left turn lane, two 10’-0” inner travel lanes, two 11’-0” outer travel lanes, two 6’-6” curb-protected bicycle lanes, and two 6’-0” sidewalks for a total roadway width of 100’-0”. A similar roadway typical section from the City of Tucson Street Design Guide 2021 is shown in Figure 6.

Figure 6. Proposed Roadway Typical Section (City of Tucson, 2021)



The proposed roadway alignment at the bridge will include a vertical crest curve to accommodate the profile raise needed to accommodate the proposed bridge. Overhead utility vertical clearance requirements will need to be maintained. The proposed roadway and bridge will be on a horizontal tangent and will likely follow the same centerline as the existing bridge, simplifying construction and allowing for maintenance of traffic on 1st Avenue during construction.

3.2 Proposed Bridge Geometry

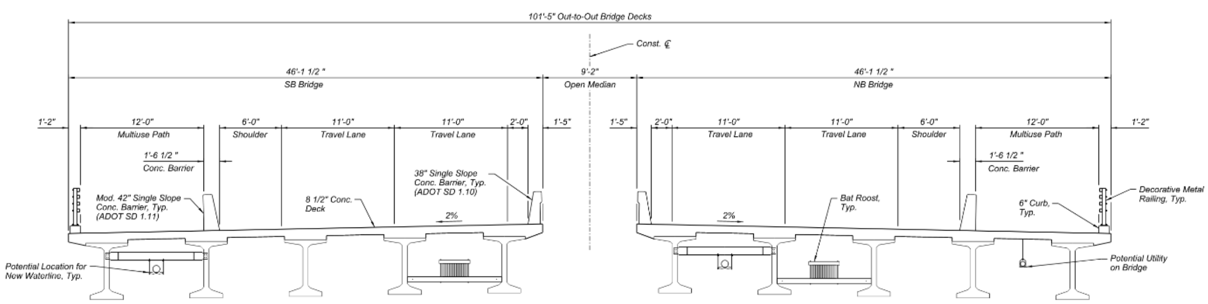
The proposed bridge has a total bridge length of 380’-3 3/4” back-to-back of abutments, which places the centerlines of the proposed bridge abutments approximately 7’-3” behind the centerlines of the existing bridge abutments. Based on this bridge length, 3-span and 4-span configurations were evaluated, as discussed further in Section 4. Piers were placed at locations that would produce cost-effective span configurations yielding equal-length girders.

Both span configurations have one or more piers that fall in line with existing piers. However, all existing piers would need to be removed to approximately five feet below finished grade, regardless of these conflicts, and only a few piles will need to be fully removed to avoid conflict with the proposed bridge’s deep foundations.

The proposed bridge has a 9’-2” wide “open median” separating northbound (NB) and southbound (SB) traffic, meaning the bridge is made up of two separate structures: a two-lane NB bridge and a two-lane SB bridge. A “closed median” version of the proposed bridge was also evaluated and is discussed in Section 4.4.1.

The proposed roadway will cross the Rillito River on adjacent NB and SB bridges, each carrying two 11’-0” travel lanes, one 6’-0” outer shoulder, one 2’-0” inner shoulder, and one 12’-0” multi-use path, as shown in Figure 7. Inboard 42” modified single slope concrete barriers are placed adjacent to the outer shoulders, resulting in clear roadway widths of 30’-0” on each structure. Along the inside and outside edges of each deck, 38” single slope concrete barriers and 1’-2” wide concrete curbs with decorative metal railing are provided, respectively. Each bridge is 46’-1 ½” wide, for a total out-to-out width of 101’-5”. The 38” and 42” concrete bridge barriers meet MASH-16 Test Level 4 and 5 requirements, respectively. Accommodations for carrying utilities and waterlines on the proposed bridge will also be provided as needed.

Figure 7. Proposed Bridge Typical Section



The northbound (NB) and southbound (SB) bridges each have their own profile grade line that follows the inside edge of the travel lane nearest the centerline. Each of the four bridge alternatives has a different vertical profile, to accommodate their different superstructure depths. The proposed vertical alignment along the 1st Avenue Bridge consists of a 475-foot crest vertical curve and was based on a superstructure depth of 6’-6”, which allows for a 66” deep girder and 12” of deck, including buildup. The entry and exit grades of the vertical curve are +1.90% and -2.30%, respectively. The NB and SB bridges each have a constant 2% deck cross slope away from the centerline. The profile is adjusted for each alternative based on the different superstructure depths.

This vertical profile places The Loop path a minimum of approximately 8’-5” below the bridge low chord elevation, which is an increase over the existing minimum clearance of 8’-3”. The bridge alternative cost estimates include the estimated roadway borrow and retaining wall quantities necessary to accommodate each alternative’s profile raise over existing at the bridge.

The proposed bridge has strip seal expansion joints per ADOT Structure Detail (SD) 3.03 and reinforced concrete approach slabs per ADOT SD 2.01.

3.3 Design Specifications and Loadings

The proposed bridge will be designed using the following codes and criteria:

Design Specifications:

- American Association of State Highway and Transportation Officials (AASHTO) Load and Resistance Factor Design (LRFD) Bridge Design Specifications, 9th Edition, 2020
- Arizona Department of Transportation (ADOT) Bridge Design Guidelines, AASHTO LRFD, current edition
- Pima County Guidelines for Establishing Scour and Freeboard for Bridges in Pima County, 2012 Edition

Construction Specifications:

- Pima Association of Governments (PAG) Standard Specifications for Public Improvements, 2015 Edition and the Special Provisions

Criteria:

- HL-93 Design Vehicle Live Loading
- The Bridge is located in Seismic Zone 1. Site Class and Seismic Coefficients will be determined at a later stage, after the bridge foundation investigation is completed

4 Bridge Alternatives

The following four bridge alternatives were considered for the 1st Avenue Bridge over the Rillito River:

- Alternative 1A: 3-Span Precast Prestressed Concrete Utah Bulb Tee Girder (UBT66) Bridge
- Alternative 1B: 4-Span Precast Prestressed Concrete Utah Bulb Tee Girder (UBT50) Bridge
- Alternative 2A: 3-Span Precast Prestressed Concrete AASHTO Box Beam (Type BIV) Bridge
- Alternative 2B: 4-Span Precast Prestressed Concrete AASHTO Box Beam (Type BII) Bridge

Girder depths referenced in each alternative were determined based on preliminary analysis. The following subsections describe the four bridge alternatives that were evaluated, before making a recommendation and discussing median options at the bridge. Appendix A contains cost estimates and Appendix B contains bridge plans for each of the alternatives.

4.1 Precast Prestressed Concrete Utah Bulb Tee Girder Alternatives

The versatile and economical Utah Bulb Tee (UBT) Girder superstructure type will be evaluated in 3-span and 4-span arrangements. UBT Girders have become favorable as of late due to their effectiveness and ability of precast manufacturers in the state to produce them. Using concrete strengths up to 9 ksi, these girders are generally more structurally efficient and have shallower structure depths than comparable AASHTO I-Girders.

Prior to the development of UBT Girders, AASHTO I-Girders were the standard in terms of performance and efficiency for precast concrete girders and were the preferred girder type for bridge projects across Arizona. However, AASHTO I-Girders require slightly deeper structure depths than UBT Girders for the same span length. Additionally, AASHTO I-Girders have larger cross-sectional concrete areas than their UBT counterparts, resulting in higher concrete costs. Furthermore, AASHTO I-Girders have narrower top flanges than UBT Girders, which increases the span length for the bridge deck, which may require a more heavily reinforced deck than would be required with a UBT girder. While AASHTO I-Girder systems are viable, their disadvantages when compared to UBT Girders have led the design team to consider UBT Girders over AASHTO I-Girders for the 1st Avenue Bridge crossing.

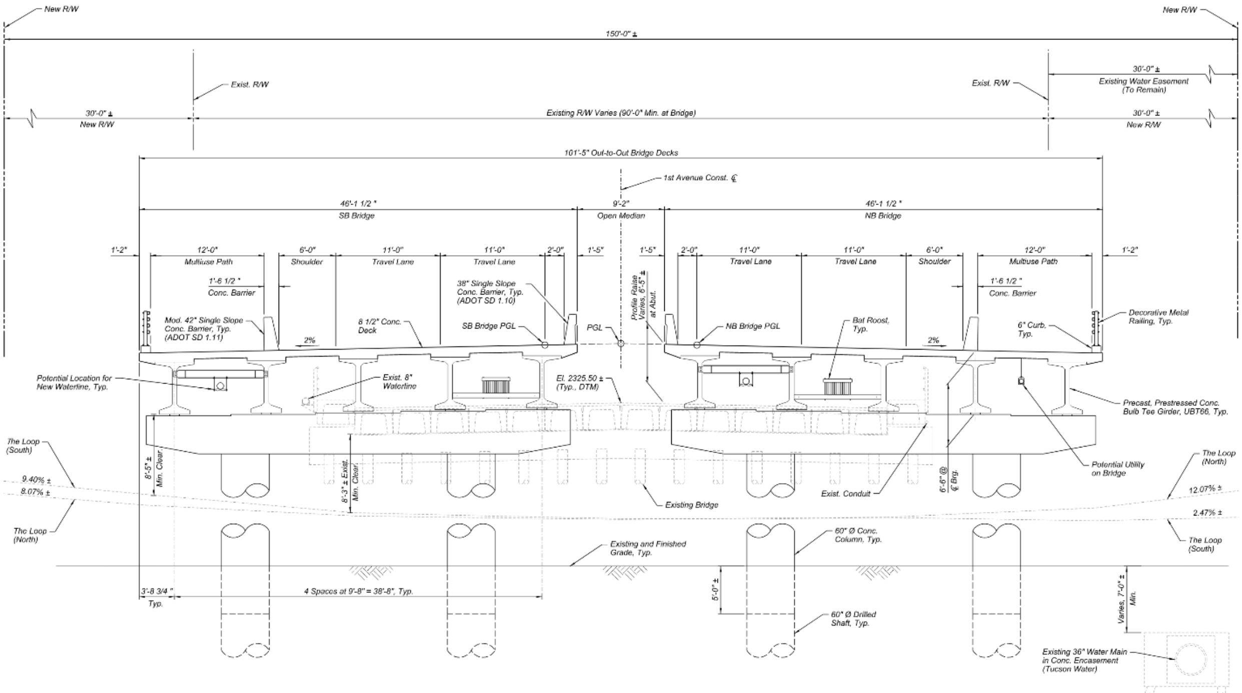
UBT Girders (Alternatives 1A & 1B) require a higher roadway profile than AASHTO Box Beams (Alternatives 2A & 2B), due to their deeper girder depth. Preliminary analysis has found the impact of the higher 1st Avenue roadway profile on driveways nearby the bridge would require reconstruction of the existing driveways to tie into the raised 1st Avenue.

4.1.1 Alternative 1A: 3-Span UBT66 Girder Bridge

This bridge alternative has a span arrangement consisting of two 124’-3” end spans and one 125’-6” interior span. All three spans are spaced to create equal centerline of bearing to centerline of bearing girder lengths.

Preliminary design indicates that a cross section consisting of 5 girder lines of UBT66 Girders (5’-6” deep) spaced at 9’-8” will be required on each structure (Figure 8). An 8.5” composite concrete deck is required with this girder spacing. This yields a superstructure depth at the ends/supports of 6’-6”. CIP concrete diaphragms are required at midspan as well as at the abutments and piers. Bat roosts, utilities, and waterlines can be accommodated by utilizing supports attached to the underside of the deck between girder lines. The NB and SB bridges each have substructure units consisting of two 5’-0” diameter concrete columns on 5’-0” diameter concrete drilled shafts spaced at 25’-0” on-center. The roadway vertical alignment for this alternative is the alignment mentioned in the proposed roadway and bridge geometry sections. This alternative raises the road profile approximately 6’-5” higher than existing at the abutments. The estimated bridge cons truction cost of this alternative is $10,329,264, which includes $1,321,430 in estimated approach roadway costs unique to this bridge alternative.

Figure 8. Bridge Alternative 1A Typical Section



The primary advantages of this alternative are as follows:

- Pier locations that:
  - maintain horizontal clearance to overhead transmission lines crossing the bridge, avoiding schedule delays and other costs associated with relocating these utilities
  - eliminate the need to modify construction techniques to construct drilled shaft foundations and erect girders in close proximity to high voltage power lines
- Fewer substructure units, which:
  - reduces risk during construction in the river due to the potential for high flows while the contractor is working in the river
  - improves hydraulic efficiency, reduces impacts to WSEL, and increases freeboard
  - reduces substructure costs and areas of permanent disturbance in the river channel
- Significantly more cost-effective than the box beam superstructure alternatives studied
- The contractor will spend less time in the river channel erecting girders, since there are 25%-66% fewer total girders than the other alternatives, potentially saving schedule, reducing construction risk, and avoiding unforeseen costs

- Waterlines and utilities may be attached between girder lines, rather than on the outside faces of the bridge as would be required for the box beam alternatives, for a greater aesthetic appeal

The primary disadvantages of this alternative are as follows:

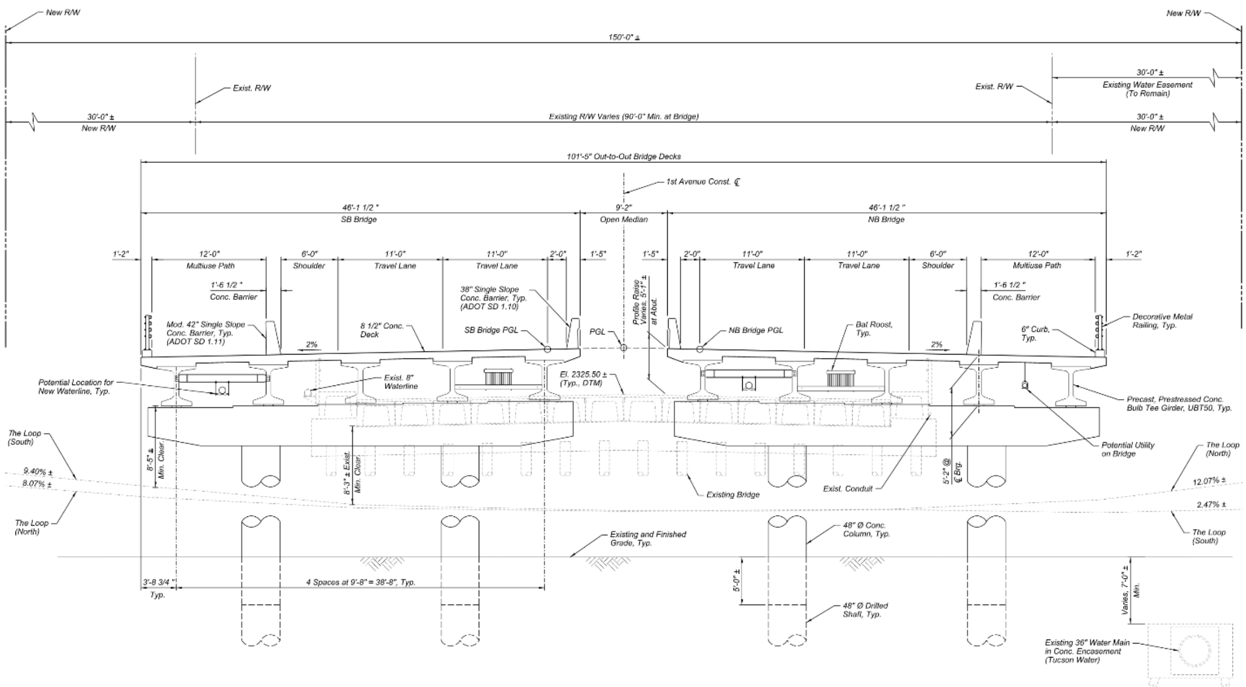
- Less cost-effective than Alternative 1B
- Highest roadway profile (due to having the deepest girders), which:
  - increases approach roadway costs (6'-5" ± profile raise over existing)
  - reduces vertical clearance to overhead transmission lines
- Bat roosts would likely be necessary, since UBT Girders would not provide the same bat habitat as the existing bridge's girders
- Two piers will partially coincide with existing piers and will require the full removal of any conflicting existing piles, as opposed to one coinciding pier in the 4-span alternatives. The existing steel piles are believed to be embedded 20 to 25 feet below existing grade. This relatively shallow depth should allow the piles to be fully removed without too much trouble

4.1.2 Alternative 1B: 4-Span UBT50 Girder Bridge

This bridge alternative has a span arrangement consisting of two 92'-10 1/2" end spans and two 94'-1 1/2" interior spans. All four spans are spaced to create equal centerline of bearing to centerline of bearing girder lengths.

Preliminary design indicates that a cross section consisting of 5 girder lines of UBT50 Girders (4'-2" deep) spaced at 9'-8" will be required on each structure (Figure 9). An 8.5" composite concrete deck is required with this girder spacing. This yields a superstructure depth at the ends/supports of 5'-2". CIP concrete diaphragms are required at midspan as well as at the abutments and piers. Bat roosts, utilities, and waterlines can be accommodated by utilizing supports attached to the underside of the deck between girder lines. The NB and SB bridges each have substructure units consisting of two 4'-0" diameter concrete columns on 4'-0" diameter concrete drilled shafts spaced at 22'-0" on-center. This alternative raises the road profile approximately 5'-1" higher than existing at the abutments. The estimated bridge construction cost of this alternative is $9,983,952, which includes $831,390 in estimated approach roadway costs unique to this bridge alternative.

Figure 9. Bridge Alternative 1B Typical Section



The primary advantages of this alternative are as follows:

- Lowest overall cost
- Fewer girder lines than box beam alternatives, resulting in cost and time savings
- Waterlines and utilities may be attached between girder lines, rather than on the outside faces of the bridge as would be required for the box beam alternatives, for a greater aesthetic appeal

The primary disadvantages of this alternative are as follows:

- Pier 3 location:
  - lacks the horizontal clearance from overhead transmission lines needed for construction equipment, which may cause schedule delays and other costs associated with relocating these utilities
  - may require specialized construction techniques to construct drilled shaft foundations and erect girders in close proximity to high voltage power lines
- One more pier structure located in the Rillito River than the 3-span alternatives, which:
  - increases risk during construction in the river due to the potential for high flows while the contractor is working in the river
  - reduces hydraulic efficiency, increases impacts to WSEL, and decreases freeboard
  - increases substructure costs and areas of permanent disturbance in the river channel
- High roadway profile (due to deep girders), which:

- increases approach roadway costs (5’-1” ± profile raise over existing)
- reduces vertical clearance to overhead transmission lines

- Bat roosts would likely be necessary, since UBT Girders would not provide the same bat habitat as the existing bridge’s girders

4.2 Precast Prestressed Concrete AASHTO Box Beam Alternatives

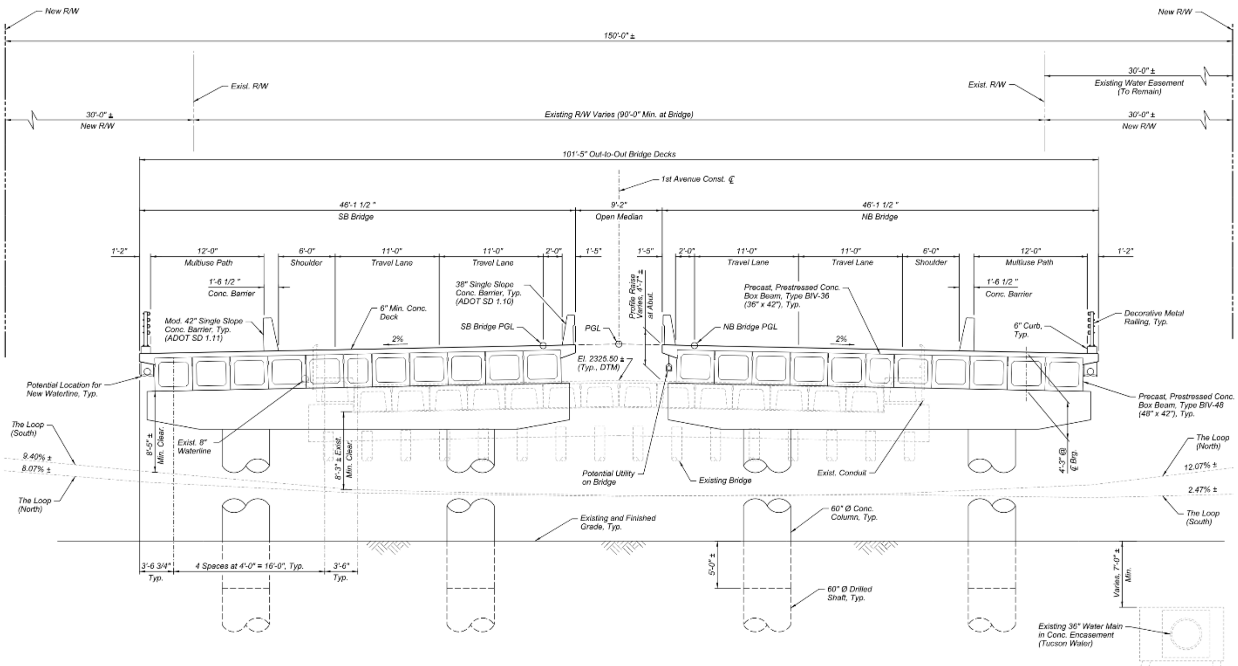
The shallow and straightforward AASHTO Box Beam superstructure type will be evaluated for the same 3-span and 4-span arrangements as the UBT superstructure alternatives. Adjacent box beam bridges, which are generally constructed with a cast-in-place (CIP) reinforced concrete deck and transverse tie rods to achieve composite behavior, are a feasible structure type when trying to minimize the vertical profile and when constructing over a river or live traffic. For precast structures, they are one of the shallowest superstructure options for a given span length. The side-by-side arrangement, combined with having the end diaphragms and intermediate diaphragms cast with the member, eliminates diaphragm and deck forming in the field. This expedites construction and improves safety. Deck overhangs may or may not be needed depending on the bridge width.

4.2.1 Alternative 2A: 3-Span AASHTO Type BIV Box Beam Bridge

This bridge alternative has a span arrangement consisting of two 124’-3” end spans and one 125’-6” interior span. All three spans are spaced to create equal centerline of bearing to centerline of bearing girder lengths.

Preliminary design indicates that a cross section consisting of 11 girder lines of adjacent AASHTO Type BIV Box Beams (3’-6” deep) will be required on each structure (Figure 10). The center girder line of each bridge will be a Type BIV-36 Box Beam (36” wide) with the remaining girder lines being made up of Type BIV-48 Box Beams (48” wide). The CIP reinforced concrete deck depth will vary from 6” at midspan to 9” at the ends/supports. This yields a superstructure depth at the ends/supports of 4’-3”. CIP concrete diaphragms are required only at the piers. Utilities and waterlines may be attached either directly to the side of the box beam or suspended beneath the deck overhang. The NB and SB bridges each have substructure units consisting of two 5’-0” diameter concrete columns on 5’-0” diameter concrete drilled shafts spaced at 25’-0” on-center. This alternative raises the road profile approximately 4’-7” higher than existing at the abutments. The estimated bridge construction cost of this alternative is $12,926,424, which includes $633,000 in estimated approach roadway costs unique to this bridge alternative.

Figure 10. Bridge Alternative 2A Typical Section



The primary advantages of this alternative are as follows:

- Lower roadway profile than Alternatives 1A and 1B (due to having shallow girders), which:
    - decreases approach roadway costs (4’-7” ± profile raise over existing)
    - increases vertical clearance to overhead transmission lines
- Pier locations that:
    - maintain horizontal clearance to overhead transmission lines crossing the bridge, avoiding schedule delays and other costs associated with relocating these utilities
    - eliminate the need to modify construction techniques to construct drilled shaft foundations and erect girders in close proximity to high voltage power lines
- Fewer substructure units, which:
    - reduces risk during construction in the river due to the potential for high flows while the contractor is working in the river
    - improves hydraulic efficiency, reduces impacts to WSEL, and increases freeboard
    - reduces substructure costs and areas of permanent disturbance in the river channel
- The side-by-side arrangement combined with diaphragms being cast with the precast units eliminates diaphragm and deck forming in the field, which expedites construction and improves safety

- Bat roosts are unnecessary, since the gaps between adjacent box beams provide habitat for bats, similar to the existing bridge

The primary disadvantages of this alternative are as follows:

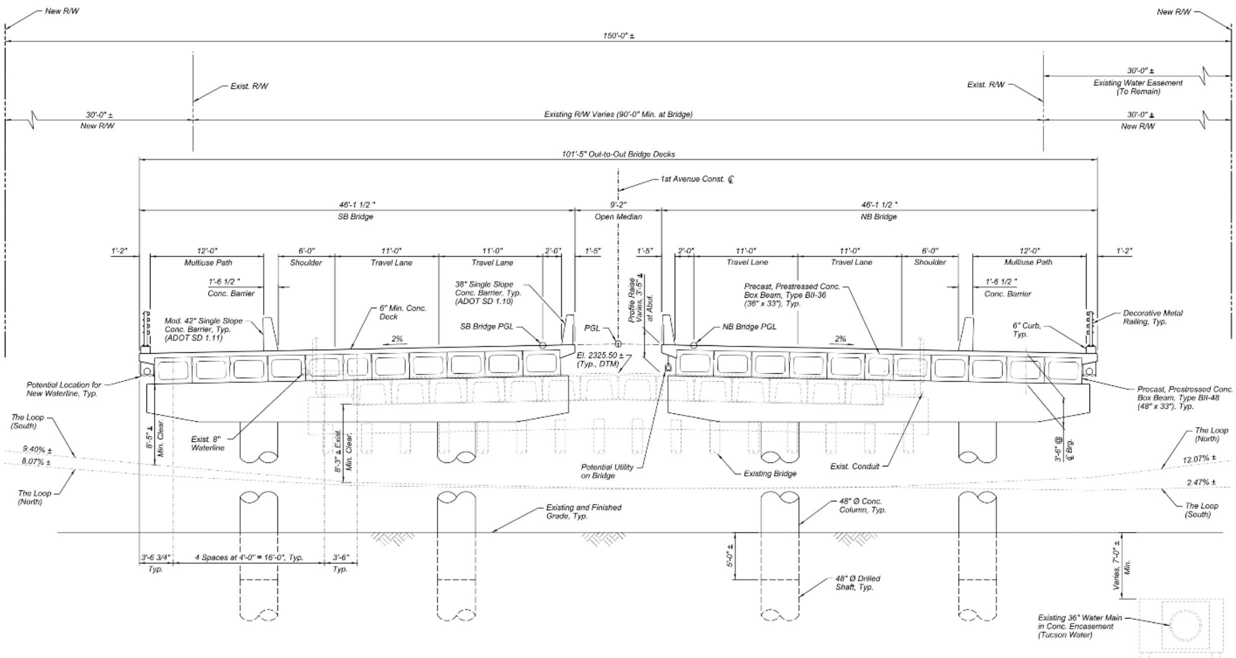
- Significantly more costly than bulb tee superstructure alternatives
- The contractor will spend more time in the river channel erecting girders, since there are more than double the number of girders than for Alternative 1A, potentially impacting schedule and increasing construction risk
- Two piers will partially coincide with existing piers and will require the full removal of any conflicting existing piles, as opposed to one coinciding pier in the 4-span alternatives. The existing steel piles are believed to be embedded 20 to 25 feet below existing grade. This relatively shallow depth should allow the piles to be fully removed without too much trouble
- Utilities must be attached to the outside face of the bridge, which is not typically aesthetically pleasing

4.2.2 Alternative 2B: 4-Span AASHTO Type BII Box Beam Bridge

This bridge alternative has a span arrangement consisting of two 92’-10 1/2” end spans and two 94’-1 1/2” interior spans. All four spans are spaced to create equal centerline of bearing to centerline of bearing girder lengths.

Preliminary design indicates that a cross section consisting of 11 girder lines of adjacent AASHTO Type BII Box Beams (2’-9” deep) will be required on each structure (Figure 11). The center girder line of each bridge will be a Type BII-36 Box Beam (36” wide) with the remaining girder lines being made up of Type BII-48 Box Beams (48” wide). The CIP reinforced concrete deck depth will vary from 6” at midspan to 9” at the ends/supports. This yields a superstructure depth at the ends/supports of 3’-6”. CIP concrete diaphragms are required only at the piers. Utilities and waterlines may be attached either directly to the side of the box beam or suspended beneath the deck overhang. The NB and SB bridges each have substructure units consisting of two 4’-0” diameter concrete columns on 4’-0” diameter concrete drilled shafts spaced at 22’-0” on-center. This alternative raises the road profile approximately 3’-5” higher than existing at the abutments. The estimated bridge construction cost of this alternative is $13,283,496, which includes $428,770 in estimated approach roadway costs unique to this bridge alternative.

Figure 11. Bridge Alternative 2B Typical Section



The primary advantages of this alternative are as follows:

- Lowest roadway profile (due to having the shallowest girders), which:
  - decreases approach roadway costs (3'-5" ± profile raise over existing)
  - increases vertical clearance to overhead transmission lines
- The side-by-side arrangement combined with diaphragms being cast with the precast units eliminates diaphragm and deck forming in the field, which expedites construction and improves safety
- Bat roosts are unnecessary, since the gaps between adjacent box beams provide habitat for bats, similar to the existing bridge

The primary disadvantages of this alternative are as follows:

- Highest overall cost
- Pier 3 location:
  - lacks the horizontal clearance from overhead transmission lines needed for construction equipment, which may cause schedule delays and other costs associated with relocating these utilities
  - may require specialized construction techniques to construct drilled shaft foundations and erect girders in close proximity to high voltage power lines
- One more pier structure located in the Rillito River than the 3-span alternatives, which:
  - increases risk during construction in the river due to the potential for high flows while the contractor is working in the river

  - reduces hydraulic efficiency, increases impacts to WSEL, and decreases freeboard
  - increases substructure costs and areas of permanent disturbance in the river channel
- The contractor will spend more time in the river channel erecting girders, since there are nearly triple the number of girders than for Alternative 1A, potentially impacting schedule and increasing construction risk
- Utilities must be attached to the outside face of the bridge, which is not typically aesthetically pleasing

4.3 Alternative Summary Table & Driver Scores

The evaluated bridge alternatives are summarized in the following table.

Table 3. Bridge Alternative Summary Table

1st Avenue Bridge: Alternative Summary Table				
Alternatives	Alternative 1A	Alternative 1B	Alternative 2A	Alternative 2B
	3-Span UBT66 Girder Bridge	4-Span UBT50 Girder Bridge	3-Span AASHTO Type BIV Box Beam Bridge	4-Span AASHTO Type BII Box Beam Bridge
Bridge Length	380’-3 3/4”	380’-3 3/4”	380’-3 3/4”	380’-3 3/4”
Total Bridge Width	101’-5”	101’-5”	101’-5”	101’-5”
No. of Girder Lines	10	10	22	22
Depth of Girders	66”	50”	42”	33”
Deck Thickness	8.5”	8.5”	Varies 6” (min.) to 9” (max.)	Varies 6” (min.) to 9” (max.)
Superstructure Depth	6’-6”	5’-2”	4’-3”	3’-6”
No. of Piers	2	3	2	3
Pier Column Diam.	5 ft	4 ft	5 ft	4 ft
Drilled Shaft Diam.	5 ft	4 ft	5 ft	4 ft
Estimated Bridge Construction Cost	$10,329,264	$9,983,952	$12,926,424	$13,283,496

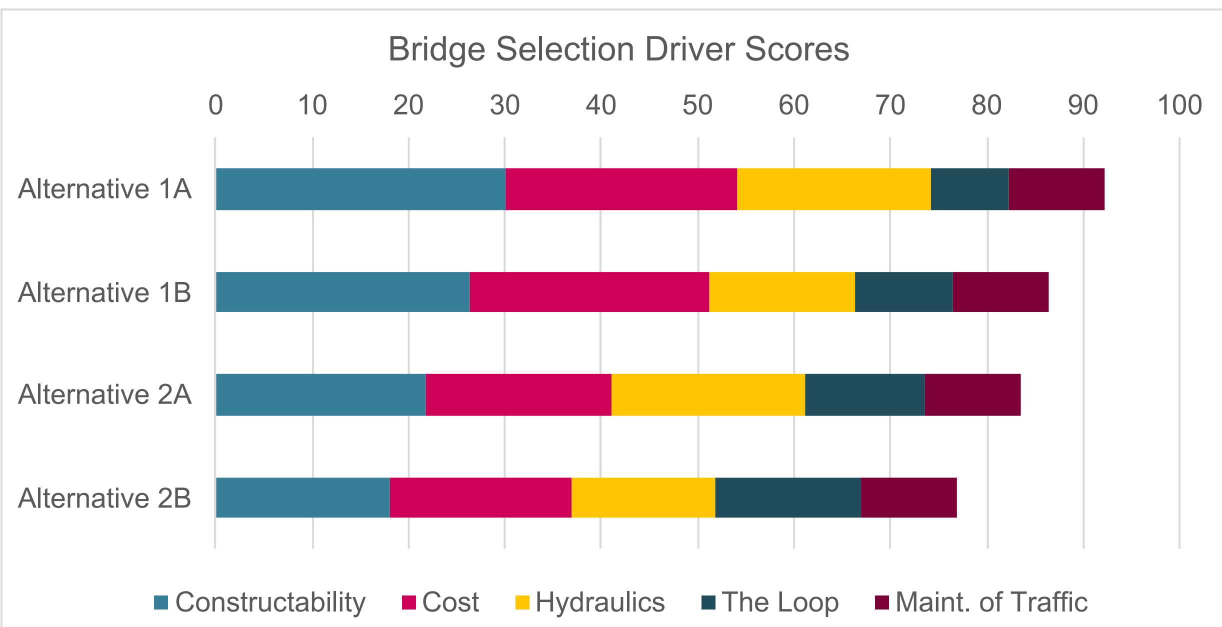
In addition to the direct comparison in Table 3, each of the four bridge alternatives was also assigned a weighted score based on how well it addressed each of the five bridge selection drivers outlined in Section 3 Project Scope. The table below shows a breakdown of the weighted scores. Constructability (30% of total score) considers the number of spans and girder lines to be constructed, as well as potential conflicts with utilities. Cost (25% of total score) is scaled according to the estimated bridge construction cost for each alternative. Hydraulics (20% of total score) considers impacts to water surface elevation and disturbance to the riverbed. The Loop (15% of total score) accounts for the profile raise necessary for each alternative to provide adequate vertical clearance above The Loop. Maintenance of Traffic (10% of score) is based on ability to maintain through traffic during construction, which all alternatives achieve.

Table 4. Bridge Selection Driver Score Breakdown

	Constructability	Cost	Hydraulics	The Loop	Maint. of Traffic	Total Score
	30%	25%	20%	15%	10%	
Alternative 1A	30	24	20	8	10	**92**
Alternative 1B	26	25	15	10	10	**86**
Alternative 2A	22	19	20	12	10	**83**
Alternative 2B	18	19	15	15	10	**77**

The bridge selection driver scores in Table 5 are also provided in bar chart format below in Figure 12.

Figure 12. Bridge Selection Driver Score Chart



4.4 Recommended Bridge Alternative

While all four alternatives are viable, the 3-Span Precast Prestressed Concrete Utah Bulb Tee Girder Type UBT66 Bridge (Alternative 1A) is preferred as it most effectively addresses constructability concerns, hydraulic efficiency, freeboard requirements, construction risk, aesthetic considerations, and is a close second in overall cost-effectiveness. As shown in Figure 12, Alternative 1A also received the highest overall bridge selection driver score.

Alternative 1A has a far lower estimated bridge construction cost than the box beam alternatives, with Alternatives 2A and 2B estimated to cost $2.6M and $3.0M more, respectively. The primary advantages of Alternatives 2A and 2B are decreased roadway profiles at the bridge due to shallower girders being used, but this is heavily outweighed by the higher estimated bridge construction costs. Alternatives 2A and 2B are therefore not recommended.

While the 4-Span Utah Bulb Tee Type UBT50 Bridge (Alternative 1B) is estimated to be approximately $345K less than the recommended alternative in terms of estimated costs at this preliminary stage, this advantage is outweighed by several factors. The most important factor is the constructability issues with constructing Pier 3 in such close proximity to the overhead high-voltage TEP transmission lines. Other factors include higher construction risk due to additional pier construction in the riverbed and an undesirable raise in water surface elevation due to lesser hydraulic efficiency than the 3-span alternatives. Alternative 1B is therefore not recommended.

Alternative 1A, a 3-Span Precast Prestressed Concrete Utah Bulb Tee Girder Type UBT66 Bridge, most effectively addresses the project drivers and is a close second for the most cost-effective alternative and is therefore the recommended bridge alternative for the 1st Avenue Bridge over the Rillito River.

4.4.1 Bridge Median Considerations

Since the 3-Span Precast Prestressed Concrete Utah Bulb Tee Girder Type UBT66 Bridge has been determined to be the preferred structure type for the 1st Avenue Bridge over the Rillito River, it is now necessary to determine whether the bridge should be constructed with an open median (as presented up until this point) or with a closed median. This decision is primarily based on cost. Detailed cost estimates for the open median structure (Alternative 1A) as well as the closed median variation (Alternative 1A with Closed Median) are included in Appendix A. Bridge plans are provided for the closed median variation, in addition to the main bridge alternatives, in Appendix B.

Open and closed median bridges have both been constructed in the Tucson area to convey major roadways over watercourses. Examples include the open median bridge constructed to carry La Cholla Blvd over the Rillito River and the closed median bridge constructed to carry Swan Rd over the Rillito River. Plan views of these example bridges are provided in Figure 13. Similarly, approach views of these bridges can be compared in Figure 14 and Figure 15.

Figure 13. Plan View of Example Open Median (Left) and Closed Median (Right) Bridges

A bridge with median constructed on the bridge deck, i.e. a closed median, can easily be modified by removing a portion of the median to include additional lanes if future growth requires widening. This variation is more aesthetically pleasing than an open median because it is more visually unobstructed since it does not require construction of a concrete bridge barrier along the median edge of each bridge deck. Furthermore, it does not require impact attenuators to be constructed in the median at the approaches to the bridge. The median is also an additional location that could be aesthetically enhanced with stamped or colored concrete or paving. In the event of an accident that blocks both lanes in one direction, emergency vehicles could cross over the raised median to cross the bridge, thereby enhancing safety.

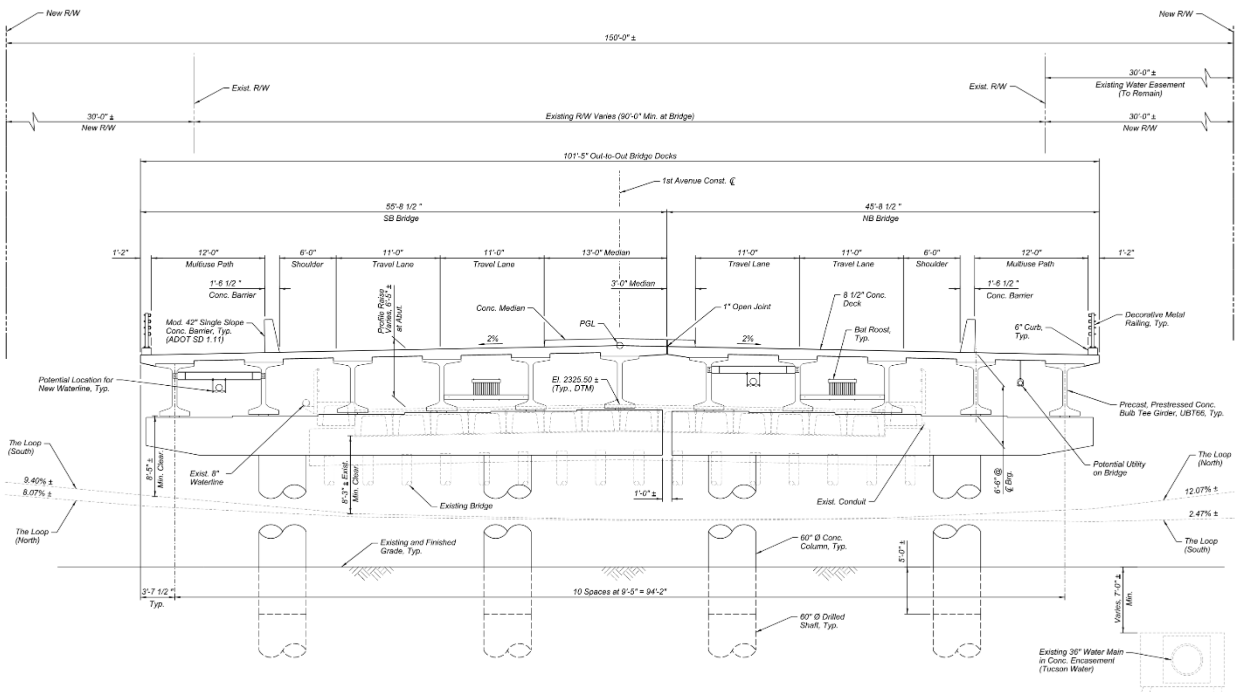
The open median configuration requires that concrete bridge barriers be constructed along the inside traffic lanes for the full length of the bridge. Impact attenuators are also required to be constructed in the median at the bridge approaches to prevent errant vehicles from impacting the bridge barrier head-on or going into the river between the two structures. Impact attenuators require periodic maintenance when they are struck by a vehicle. Future widening of an open median bridge would require additional substructure, girders, and deck construction and could be done to the center between the two structures, but it would not be preferred.

Figure 14. Approach View of Example Open Median Bridge (La Cholla Blvd over the Rillito River)

Figure 15. Approach View of Example Closed Median Bridge (Swan Rd over the Rillito River)

The closed median variation of the preferred bridge alternative (Alternative 1A) would use the same span configuration and superstructure type as the open median alternative. Preliminary design indicates that a cross section consisting of 11 girder lines of UBT66 Girders (5’-6” deep) spaced at 9z’-5” will be required for the closed median variation (Figure 16). This is only one girder line more than the open median alternative. The closed median bridge would still allow traffic to be maintained during construction through phased construction (see Appendix C). The estimated bridge construction cost of the closed median variation of Alternative 1A is $10,767,283, which includes $1,291,430 in estimated approach roadway costs unique to this bridge alternative.

Figure 16. Bridge Alternative 1A with Closed Median Typical Section



The cost of the additional impact attenuators, associated maintenance, and concrete bridge barriers along the inside lanes for the open median is still less than the cost of additional bridge deck, girders, and pier size needed to support the raised median in the closed median variation. Although the cost per square foot of the closed median bridge is less than that of the open median bridge, the overall cost increase is an estimated $440K to build the closed median variation.

To reduce costs with the closed median alternative, it would be necessary to eliminate one girder line. This would require a median width of approximately 6 feet, which may be problematic with left turning movements in the vicinity of the bridge approaches. Additionally, this would require temporary shoring to accommodate the raised 1st Avenue profile and maintain traffic on the newly constructed portion of the roadway during construction. This may require an additional construction phase to complete the bridge and roadway construction, but the impact on cost and schedule would be minor. With the wider median, as shown in Figure 16, temporary shoring would likely not be required as the grade differential could be made up by sloping the embankment fill through the median.

COT and Pima Association of Governments (PAG) have indicated a preference for the least-cost option between the open and closed median alternatives. Therefore, since the cost savings between an open and closed median structure are significant and the other major project drivers are held constant in the comparison, the open median structure as originally presented in Alternative 1A is still the recommended alternative.

5 Proposed Foundations

The geotechnical investigation for the project will occur after the bridge span arrangement is finalized. The As-Built drawings for the existing 1st Avenue Bridge over the Rillito River include geotechnical information from vertical auger borings performed at 6 locations prior to the construction of the existing bridge in 1961, with depths varying from 41' to 55' deep. These previous boring locations happen to fall within the general vicinities of the proposed abutments and piers of the selected bridge alternative.

The previous borings generally indicated interbedded layers of river-run alluvial deposits. The upper 30' tended to consist of loose to medium dense soils, classified as coarse sand and coarse gravel. The next 25' of depth tended to consist of dense to very dense soils, classified as sand and gravel. Silt and clay were encountered throughout the boring depths. Notably, the two previous borings located near the proposed location for abutment 1 encountered small boulders and auger refusal at approximately 40' of depth.

Bridges constructed in Arizona that cross rivers such as the Rillito River have historically used CIP abutment/pier cap beams supported on drilled shafts. Based on the review of the geotechnical information available from the existing bridge's As-Built drawings and historical data, drilled shafts will be the preferred foundation type. A detailed abutment and pier analysis will be conducted during final design to determine the number, spacing, diameter and depth of all abutment and pier drilled shafts. It is typical practice for the transition between pier columns and drilled shafts to occur at 5'-0" below the thalweg elevation, as shown in the bridge plans in Appendix B.

6 Proposed Bridge Hydraulics

The major hydraulic goals for the project were briefly discussed previously but are summarized here:

- Achieve a "no-rise" water surface elevation change, avoiding a CLOMR process
- Provide 3-feet of freeboard from the 100-yr event water surface elevation, since the Rillito River is considered a major watercourse (Q100 > 10,000 CFS), per the PCRFCD hydraulic requirements prescribed in "Guidelines for Establishing Scour and Freeboard for Bridges in Pima County"

The Preliminary Drainage Report prepared by HDR Engineering, dated January 2025, evaluated the hydraulic effects of the existing bridge and different proposed bridge alternatives. The report found that there was a small decrease in the 100-yr water surface elevation for the 3-span alternatives and a small increase for the 4-span alternatives. These values are based on the North American Vertical Datum (NAVD) of 1988 and can be seen in the table below.

Table 5. 100-Year Water Surface Elevations at 1st Avenue Bridge

Bridge Model	WSEL (ft)	Change in WSEL from Existing (ft)
Existing Bridge	2319.61	+/- 0.0
3-Span Bridge (Alts 1A & 2A)	2319.54	- 0.07
4-Span Bridge (Alts 1B & 2B)	2319.75	+ 0.14

According to this analysis, the recommended 3-span bridge alternative (Alternative 1A) meets the “no-rise” requirement for the 100-yr water surface elevation and may even marginally decrease it.

Based on the bridge vertical profile, bridge cross section, and superstructure depth for the recommended 3-span alternative (Alternative 1A), a low chord elevation of 2323.64 was established at Abutment 2. The calculated freeboard for the 100-yr storm event is therefore approximately 4.10 ft, exceeding the required minimum of 3-feet of freeboard from the 100-yr WSEL. Note that clearance above The Loop controls the height of the bridge, not hydraulic freeboard.

Due to the channelized section, there will only be pier scour and long-term scour to account for during bridge design. It appears that abutment and contraction scour will not factor into the overall bridge design. Table 6 provides preliminary scour results from the Preliminary Drainage Report. As further evaluation of potential long-term scour is completed, the scour depths will be adjusted. Similarly, results will be adjusted as geotechnical information about bed material is acquired.

Table 6. Preliminary Scour at 1st Avenue Bridge

Bridge Model	100-yr Scour Depth (ft)	100-yr Scour Elevation (ft)
3-Span Bridge (Alts 1A & 2A)	13.47	2294.69
4-Span Bridge (Alts 1B & 2B)	11.75	2296.41

7 Environmental

7.1 Biological Resources

Biological resources in the project area include vegetation in the Rillito River riverbed, landscaped plants, and animals that may inhabit the area. The vegetative community throughout the area is dominated by desert broom (*Baccharis sarothroides*) and mesquite trees (*Prosopis* spp.).

A Biological Evaluation (BE) will be prepared for the project. Vegetation in the Rillito River includes native plant species that may be protected by the Arizona Native Plant Law and the Pima County Native Plant Preservation Ordinance. Migratory and nesting birds protected by the Migratory Bird Treaty Act may inhabit or nest in trees, and burrowing owls have the potential to be found in the project area. Noxious and invasive plant species have been documented in the project area. Mitigation measures would be included in the Biological Evaluation to protect these species.

7.2 Water Resources

The Rillito River bisects the project area and flows from east to west. The Rillito River is an ephemeral drainage and flows only in response to precipitation events. Within the project area, the bank-to-bank width varies, but is approximately 300 to 350 feet. However, the active channel width is much smaller and varies between 40 and 70 feet.

The project is located within a Federal Emergency Management Agency (FEMA) floodplain (Flood Insurance Rate Map 04019C1687L, effective date 06/16/2011). The Rillito River is in a Zone AE floodplain, which is an area that presents a 1% annual chance of flooding. A Zone X floodplain is also mapped on the north and south sides of the Rillito River, which is an area that presents a 0.2% annual chance of flooding.

The Rillito River is considered a potential Water of the United States (WUS). An Approved Jurisdictional Delineation (AJD) will be prepared for the project. Depending on the project impacts in WUS, Clean Water Act Section 404 permitting may be required for the project. The project would likely qualify for a Nationwide Permit 14. Additionally, because more than 1 acre of ground would be disturbed, a Stormwater Pollution Prevention Plan (SWPPP) would be developed and implemented prior to construction.

7.3 Cultural Resources

The AZSITE cultural resource database and the Tucson Historic Preservation website were consulted to determine known cultural resources within a half-mile of the proposed project area. In that cultural resources review area, 20 percent of the area has been previously surveyed for cultural resources. The project area has been completely surveyed during multiple projects for cultural resources; however, these surveys took place more than 10 years ago. According to the Arizona State Historic Preservation Office’s Guidance Point No. 5, the project area likely would require new archaeological survey.

Five previously documented archaeological sites, three structures (including two bridges and the Rillito Racetrack “Chute”), and one historic district (the “Rillito Race Track Historic

District") are within the review area. Among these properties, one historic bridge (based on the age of the structure) and the historic district are within the project area.

The historic bridge is the First Avenue Bridge No. 09617, which has been determined not eligible for inclusion in the National Register of Historic Places (National Register). The "Rillito Race Track Historic District" is listed in the National Register under Criterion A. (The Rillito Racetrack "Chute," a component of the "Rillito Race Track Historic District", has been listed in the National Register individually under Criterion A; this structure is not within the project area.)

A Class I cultural resources overview should be prepared for the project. The overview should contain an inventory of known cultural resources in the vicinity of the project area. Consultation with Native American tribes is recommended to identify Traditional Cultural Places. A Class III archaeological survey of the project area might also be warranted.

7.4 Visual Resources

The study area is characterized by foreground views of the existing roadway and bridge, middle ground views of adjacent commercial buildings and the riverbed of the Rillito River, and background views of the Santa Catalina Mountains to the north and the Rincon Mountains to the east. Sensitive viewers in the study area include people walking and bicycling along The Loop multiuse pathway in the Rillito River Park. The Rillito River Park includes decorative curvilinear walls and pavement treatments that are adjacent to 1st Avenue. The decorative walls are mimicked at the entrance to Rillito Park, approximately 0.2 mile north of the bridge. The project would have a minor adverse impact on visual resources in the study area. Proposed mitigation measures include retaining or replacing the decorative walls and pavement treatments adjacent to 1st Avenue at Rillito River Park and at Rillito Park, incorporating aesthetic treatments for the bridge, and adding landscaping. These mitigation measures would be in keeping with City planning documents that emphasize attractive urban environments and roadways and that value urban forests and green infrastructure.

7.5 Noise

The project would not be considered a Type I project because the project would not add capacity or substantially alter the horizontal or vertical alignment. Sensitive noise receptors are found within the project area and adjacent to 1st Avenue. A noise report will be prepared for the project. Because the proposed project improvements would not increase capacity, or significantly alter the vertical or horizontal alignment, the project likely would not significantly increase noise in the area.

7.6 Air Quality

An Air Quality Assessment Report will be prepared for the project. The project area is in an attainment area of the U.S. Environmental Protection Agency (EPA) National Ambient Air Quality Standards. The highest measured concentrations of criteria pollutants in the region are well below the National Ambient Air Quality Standards (NAAQS).

Given the project scope and size, a fugitive dust activity permit from the Pima County Department of Environmental Quality would likely be required for construction.

7.7 Hazardous Materials

A corridor Initial Site Assessment (ISA) for hazardous materials has been prepared for the project. Preliminary results indicate that there are five sites of concern within the project area that warrant further investigation. There were three sites of moderate concern and two sites of high concern. All sites are located north of the Rillito River near the intersection with River Road. Two of the sites indicate the potential for petroleum contamination and one site indicates the potential for chlorinated solvents contamination. The ISA recommends that the construction contractor selected for the project be notified of the location and contaminant type that might be encountered during construction. Prior to construction, lead-based paint and asbestos containing materials evaluations will be conducted for the bridge.

8 Aesthetics

RTA requires 1% of the construction cost for major road improvement projects to be allocated to public art. The Arts Foundation for Tucson and Southern Arizona is the Local Arts Agency of record for City of Tucson and will manage the public art process for this project.

Painting of the bridge, decorative steel fencing, and rustication patterns on the abutments, wingwalls, piers and barriers are potential alternatives for artistic enhancements of the bridge. The design team will coordinate with City of Tucson and a local artist during final design to implement desired aesthetic treatments.

9 Constructability and Cost

The recommended bridge alternative is the second most cost-effective, but most effectively balances and addresses all project drivers as previously detailed in this report. The recommended alternative includes constructability considerations for construction near overhead electric transmission lines, construction techniques familiar to local Arizona contractors, and provides design elements well suited for managing risk in an ephemeral river environment.

Maintenance of traffic is achieved through phased bridge construction, which allows for one lane of traffic in each direction during construction. Bridge construction phasing drawings for the preferred bridge alternative (Alternative 1A) as well as the closed median variation are provided in Appendix C.

There are four bridge construction phases:

1. Remove northbound side of existing bridge, while maintaining one lane of traffic in each direction on the remaining half of the existing bridge
2. Build new northbound bridge, while maintaining one lane of traffic in each direction on the remaining half of the existing bridge
3. Remove remaining southbound half of existing bridge, while maintaining one lane of traffic in each direction on the new northbound bridge

4. Build new southbound bridge, while maintaining one lane of traffic in each direction on the new northbound bridge

Due to the logistics involved in placing and shoring up roadway fill to accommodate such a substantial profile increase at the bridge, all while maintaining traffic, the overall roadway construction schedule may require an additional phase that would not be required with a more minimal profile raise.

A detailed breakdown of costs is contained in Appendix A. The estimated unit costs are based on unit prices from recent construction projects, when possible, with emphasis on similar projects. The cost estimate provided excludes contingencies and mobilization costs given this is included in the overall project cost estimate. This cost estimate does not include typical bid item costs for structural excavation and structural backfill as those costs are included in the concrete bid item costs, in accordance with the PAG Standard Specifications. The cost estimates include the estimated roadway borrow and retaining wall quantities necessary to accommodate each alternative's profile raise over existing at the bridge.

10 References

City of Tucson. (2021). *Street Design Guide*. Complete Streets Tucson. https://www.tucsonaz.gov/Departments/Transportation-Mobility/Streets/Complete-Streets-Tucson

Federal Emergency Management Agency. (1999/2012). *Flood Insurance Study: Pima County, Arizona and Incorporated Areas*. https://content.civicplus.com/api/assets/9d20c7dd-0f2d-4151-a626-952edb56c432?cache=1800

Pima County Regional Flood Control District. (2012). *Guidelines for Establishing Scour and Freeboard for Bridges in Pima County*. https://dot.pima.gov/pdfs/DOC082212-08222012110744.pdf

Appendix A. Cost Estimates

COST ESTIMATE

1st Ave Bridge
3-Span Precast Prestressed Utah Bulb Tee Girder (UBT66) – 66" Depth

Roadway Name:	1st Avenue	**Project Number:**	
Project Name:	COT 1st Ave Bridge – Grant to River	**Prepared By:**	GWS, DL
Bridge Name:	1st Ave Bridge	**Date:**	1/22/2025

Item #	Item Description	Unit	Quantity	Unit Cost	Cost
2020002	Removal of Bridge	L.S.	1	$ 300,000.00	$ 300,000.00
2030901	Borrow	C.Y.	6,967	$ 50.00	$ 348,350.00
6010003	Structural Concrete (f'c = 3,500)	C.Y.	730	$ 1,400.00	$ 1,022,000.00
6010005	Structural Concrete (f'c = 4,500)	C.Y.	1,204	$ 1,400.00	$ 1,685,600.00
6010200	Concrete Retaining Wall	S.F.	6,522	$ 140.00	$ 913,080.00
6011150	Single Slope Bridge Concrete Barrier and Transition (38")	L.F.	1,222	$ 200.00	$ 244,400.00
6011151	Single Slope Bridge Concrete Barrier and Transition (42")	L.F.	822	$ 200.00	$ 164,400.00
6011345	Bridge Deck Joint Assembly (Strip Seal Joint)	L.F.	176	$ 400.00	$ 70,400.00
6011371	Approach Slab (SD-2.01)	S.F.	2,782	$ 60.00	$ 166,920.00
6014974	Precast , P/S Member (UBT66 Girder)	L.F.	3,735	$ 730.00	$ 2,726,550.00
6015101	Restrainers, Vertical Earthquake (Fixed)	EACH	32	$ 300.00	$ 9,600.00
6015102	Restrainers, Vertical Earthquake (Expansion)	EACH	32	$ 400.00	$ 12,800.00
6050001	Reinforcing Steel	LB.	507,220	$ 1.20	$ 608,664.00
6090005	Drilled Shaft (5' Diameter)	L.F.	1,424	$ 1,200.00	$ 1,708,800.00
7020002	Impact Attenuation Device (Special)	EACH	4	$ 15,000.00	$ 60,000.00
9300153	Miscellaneous Work (Concrete Curb with Decorative Metal Railing)	L.F.	822	$ 350.00	$ 287,700.00
				Total:	**$ 10,329,264.00**

Bridge Deck Area = 35,083 S.F.
Cost per Sq. Ft. = 295 $/S.F.

COST ESTIMATE

1st Ave Bridge
3-Span Precast Prestressed Utah Bulb Tee Girder (UBT66) with Closed Median – 66" Depth

Roadway Name:	1st Avenue	**Project Number:**	
Project Name:	COT 1st Ave Bridge – Grant to River	**Prepared By:**	GWS, DL
Bridge Name:	1st Ave Bridge	**Date:**	1/22/2025

Item #	Item Description	Unit	Quantity	Unit Cost	Cost
2020002	Removal of Bridge	L.S.	1	$ 300,000.00	$ 300,000.00
2030901	Borrow	C.Y.	6,967	$ 50.00	$ 348,350.00
6010003	Structural Concrete (f'c = 3,500)	C.Y.	776	$ 1,400.00	$ 1,086,400.00
6010005	Structural Concrete (f'c = 4,500)	C.Y.	1,322	$ 1,400.00	$ 1,850,800.00
6010200	Concrete Retaining Wall	S.F.	6,522	$ 140.00	$ 913,080.00
6011151	Single Slope Bridge Concrete Barrier and Transition (42")	L.F.	822	$ 200.00	$ 164,400.00
6011345	Bridge Deck Joint Assembly (Strip Seal Joint)	L.F.	200	$ 400.00	$ 80,000.00
6011371	Approach Slab (SD-2.01)	S.F.	3,054	$ 60.00	$ 183,240.00
6014974	Precast , P/S Member (UBT66 Girder)	L.F.	4,109	$ 730.00	$ 2,999,205.00
6015101	Restrainers, Vertical Earthquake (Fixed)	EACH	40	$ 300.00	$ 12,000.00
6015102	Restrainers, Vertical Earthquake (Expansion)	EACH	40	$ 400.00	$ 16,000.00
6050001	Reinforcing Steel	LB.	546,640	$ 1.20	$ 655,968.00
6090005	Drilled Shaft (5' Diameter)	L.F.	1,424	$ 1,200.00	$ 1,708,800.00
7020002	Impact Attenuation Device (Special)	EACH	2	$ 15,000.00	$ 30,000.00
9080150	Concrete Median Pavement	S.F.	6,567	$ 20.00	$ 131,340.00
9300153	Miscellaneous Work (Concrete Curb with Decorative Metal Railing)	L.F.	822	$ 350.00	$ 287,700.00
				Total:	**$ 10,767,283.00**

Bridge Deck Area = 38,570 S.F.
Cost per Sq. Ft. = 280 $/S.F.

COST ESTIMATE

1st Ave Bridge
4-Span Precast Prestressed Utah Bulb Tee Girder (UBT50) – 50" Depth

Roadway Name:	1st Avenue	**Project Number:**	
Project Name:	COT 1st Ave Bridge – Grant to River	**Prepared By:**	GWS, DL
Bridge Name:	1st Ave Bridge	**Date:**	1/22/2025

Item #	Item Description	Unit	Quantity	Unit Cost	Cost
2020002	Removal of Bridge	L.S.	1	$ 300,000.00	$ 300,000.00
2030901	Borrow	C.Y.	4,435	$ 50.00	$ 221,750.00
6010003	Structural Concrete (f'c = 3,500)	C.Y.	718	$ 1,400.00	$ 1,005,200.00
6010005	Structural Concrete (f'c = 4,500)	C.Y.	1,186	$ 1,400.00	$ 1,660,400.00
6010200	Concrete Retaining Wall	S.F.	3,926	$ 140.00	$ 549,640.00
6011150	Single Slope Bridge Concrete Barrier and Transition (38")	L.F.	1,222	$ 200.00	$ 244,400.00
6011151	Single Slope Bridge Concrete Barrier and Transition (42")	L.F.	822	$ 200.00	$ 164,400.00
6011345	Bridge Deck Joint Assembly (Strip Seal Joint)	L.F.	176	$ 400.00	$ 70,400.00
6011371	Approach Slab (SD-2.01)	S.F.	2,782	$ 60.00	$ 166,920.00
6014974	Precast , P/S Member (UBT50 Girder)	L.F.	3,725	$ 770.00	$ 2,868,250.00
6015101	Restrainers, Vertical Earthquake (Fixed)	EACH	48	$ 300.00	$ 14,400.00
6015102	Restrainers, Vertical Earthquake (Expansion)	EACH	32	$ 400.00	$ 12,800.00
6050001	Reinforcing Steel	LB.	511,410	$ 1.20	$ 613,692.00
6090004	Drilled Shaft (4' Diameter)	L.F.	1,744	$ 1,000.00	$ 1,744,000.00
7020002	Impact Attenuation Device (Special)	EACH	4	$ 15,000.00	$ 60,000.00
9300153	Miscellaneous Work (Concrete Curb with Decorative Metal Railing)	L.F.	822	$ 350.00	$ 287,700.00
				Total:	**$ 9,983,952.00**

Bridge Deck Area = 35,083 S.F.
Cost per Sq. Ft. = 285 $/S.F.

COST ESTIMATE

1st Ave Bridge
3-Span Precast Prestressed AASHTO Box Beam (BIV) – 42" Depth

Roadway Name:	1st Avenue	**Project Number:**	
Project Name:	COT 1st Ave Bridge – Grant to River	**Prepared By:**	GWS, DL
Bridge Name:	1st Ave Bridge	**Date:**	1/22/2025

Item #	Item Description	Unit	Quantity	Unit Cost	Cost
2020002	Removal of Bridge	L.S.	1	$ 300,000.00	$ 300,000.00
2030901	Borrow	C.Y.	3,410	$ 50.00	$ 170,500.00
6010003	Structural Concrete (f'c = 3,500)	C.Y.	556	$ 1,400.00	$ 778,400.00
6010005	Structural Concrete (f'c = 4,500)	C.Y.	846	$ 1,400.00	$ 1,184,400.00
6010200	Concrete Retaining Wall	S.F.	2,875	$ 140.00	$ 402,500.00
6011150	Single Slope Bridge Concrete Barrier and Transition (38")	L.F.	1,222	$ 200.00	$ 244,400.00
6011151	Single Slope Bridge Concrete Barrier and Transition (42")	L.F.	822	$ 200.00	$ 164,400.00
6011345	Bridge Deck Joint Assembly (Strip Seal Joint)	L.F.	176	$ 400.00	$ 70,400.00
6011371	Approach Slab (SD-2.01)	S.F.	2,782	$ 60.00	$ 166,920.00
6014960	Precast, P/S Member (Box Beam Type BIV-36)	L.F.	747	$ 840.00	$ 627,480.00
6014964	Precast, P/S Member (Box Beam Type BIV-48)	L.F.	7,470	$ 840.00	$ 6,274,800.00
6050001	Reinforcing Steel	LB.	404,770	$ 1.20	$ 485,724.00
6090005	Drilled Shaft (5' Diameter)	L.F.	1,424	$ 1,200.00	$ 1,708,800.00
7020002	Impact Attenuation Device (Special)	EACH	4	$ 15,000.00	$ 60,000.00
9300153	Miscellaneous Work (Concrete Curb with Decorative Metal Railing)	L.F.	822	$ 350.00	$ 287,700.00
				Total:	**$ 12,926,424.00**

Bridge Deck Area = 35,083 S.F.
Cost per Sq. Ft. = 369 $/S.F.

COST ESTIMATE

1st Ave Bridge
4-Span Precast Prestressed AASHTO Box Beam (BII) – 33" Depth

Roadway Name:	1st Avenue	**Project Number:**	
Project Name:	COT 1st Ave Bridge – Grant to River	**Prepared By:**	GWS, DL
Bridge Name:	1st Ave Bridge	**Date:**	1/22/2025

Item #	Item Description	Unit	Quantity	Unit Cost	Cost
2020002	Removal of Bridge	L.S.	1	$ 300,000.00	$ 300,000.00
2030901	Borrow	C.Y.	2,355	$ 50.00	$ 117,750.00
6010003	Structural Concrete (f'c = 3,500)	C.Y.	630	$ 1,400.00	$ 882,000.00
6010005	Structural Concrete (f'c = 4,500)	C.Y.	850	$ 1,400.00	$ 1,190,000.00
6010200	Concrete Retaining Wall	S.F.	1,793	$ 140.00	$ 251,020.00
6011150	Single Slope Bridge Concrete Barrier and Transition (38")	L.F.	1,222	$ 200.00	$ 244,400.00
6011151	Single Slope Bridge Concrete Barrier and Transition (42")	L.F.	822	$ 200.00	$ 164,400.00
6011345	Bridge Deck Joint Assembly (Strip Seal Joint)	L.F.	176	$ 400.00	$ 70,400.00
6011371	Approach Slab (SD-2.01)	S.F.	2,782	$ 60.00	$ 166,920.00
6014958	Precast, P/S Member (Box Beam Type BII-36)	L.F.	745	$ 890.00	$ 663,050.00
6014962	Precast, P/S Member (Box Beam Type BII-48)	L.F.	7,450	$ 890.00	$ 6,630,500.00
6050001	Reinforcing Steel	LB.	426,130	$ 1.20	$ 511,356.00
6090005	Drilled Shaft (4' Diameter)	L.F.	1,744	$ 1,000.00	$ 1,744,000.00
7020002	Impact Attenuation Device (Special)	EACH	4	$ 15,000.00	$ 60,000.00
9300153	Miscellaneous Work (Concrete Curb with Decorative Metal Railing)	L.F.	822	$ 350.00	$ 287,700.00
				Total:	**$ 13,283,496.00**

Bridge Deck Area = 35,083 S.F.
Cost per Sq. Ft. = 379 $/S.F.

Appendix B. Bridge Plans

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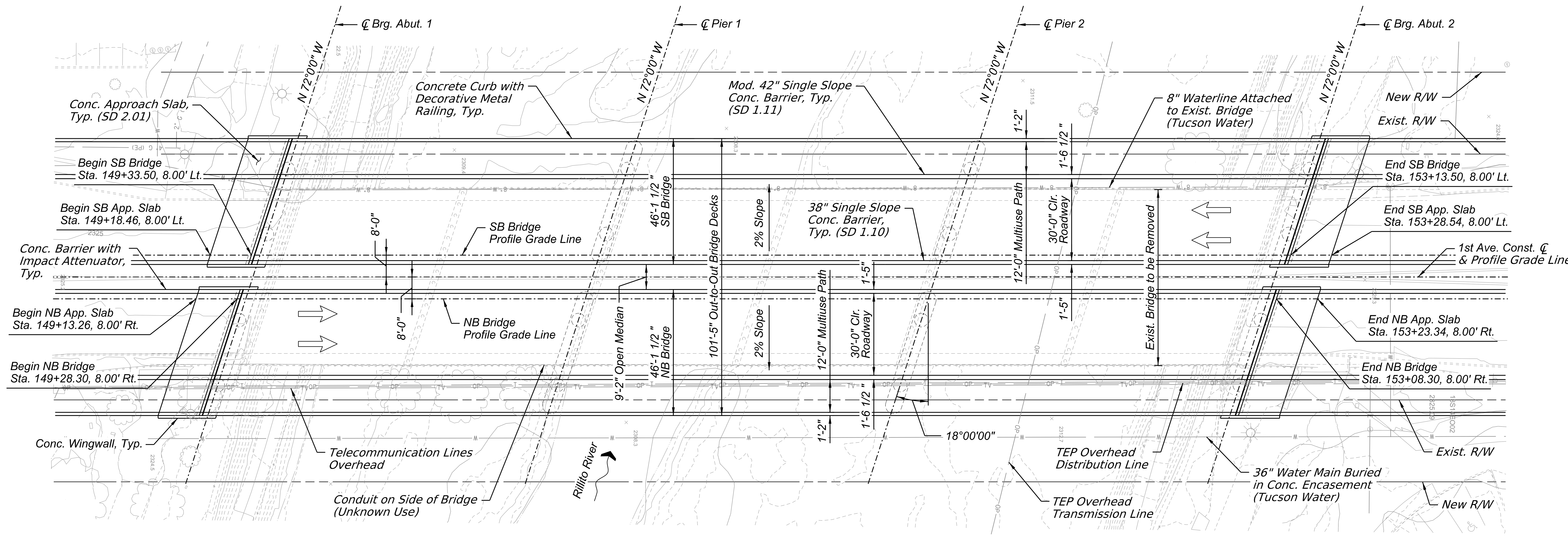
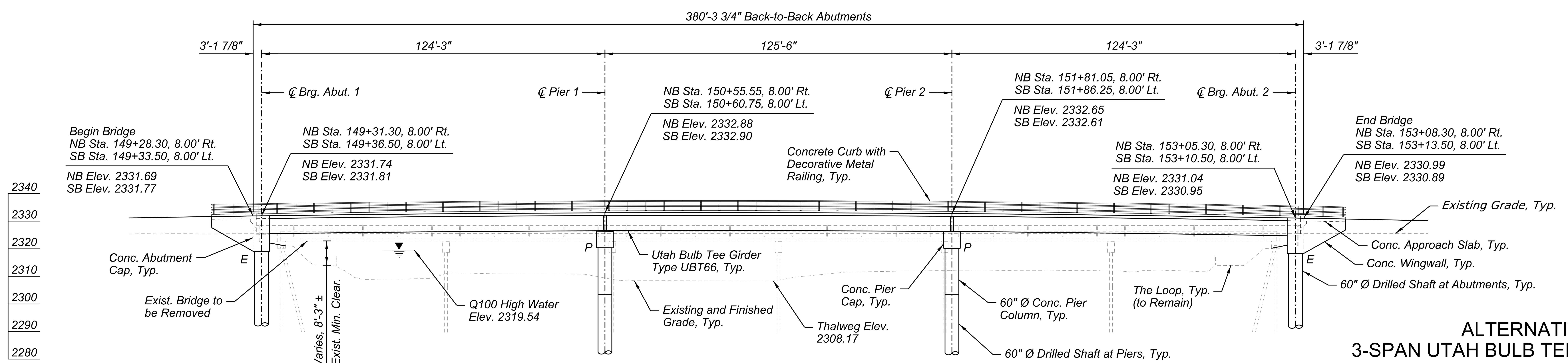


GENERAL PLAN

New 3-Span Utah Bulb Tee Girder Type UBT66 Bridge with Open Median
Skew: 18° 00' 00" Rt.
Contour Interval: 1'-0"
Scale: 1" =20'-0"



Note: Stations are along the 1st Avenue Construction Centerline. Dimensions and Elevations are along the NB or SB Bridge Profile Grade Line at Top of Deck unless noted otherwise.

ELEVATION

NB Bridge Shown, SB Bridge Similar
Scale: 1" =20'-0"

ALTERNATIVE 1A:
3-SPAN UTAH BULB TEE GIRDER (UBT66)
(RECOMMENDED ALTERNATIVE)

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- 1ST AVENUE -
GRANT ROAD TO RIVER ROAD

NO.	DATE	REVISION	BY	CHKD.	APPR.

Initial BSR
Preliminary
Not For
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Approvals	Signatory	Date

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OF
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DRWN. BY GWS 01/2025 DSGN. BY DL 01/2025 CHKD. BY TWB 01/2025 PLAN NO. R-2025-XXX

Printed by: $USER$
Print Scale: $SCALESHORT$
Pentable: $PENTBL$$
Plotdriver: $PLTDRV$$
Project ID: $PROJECTID$
Client Number: 012149

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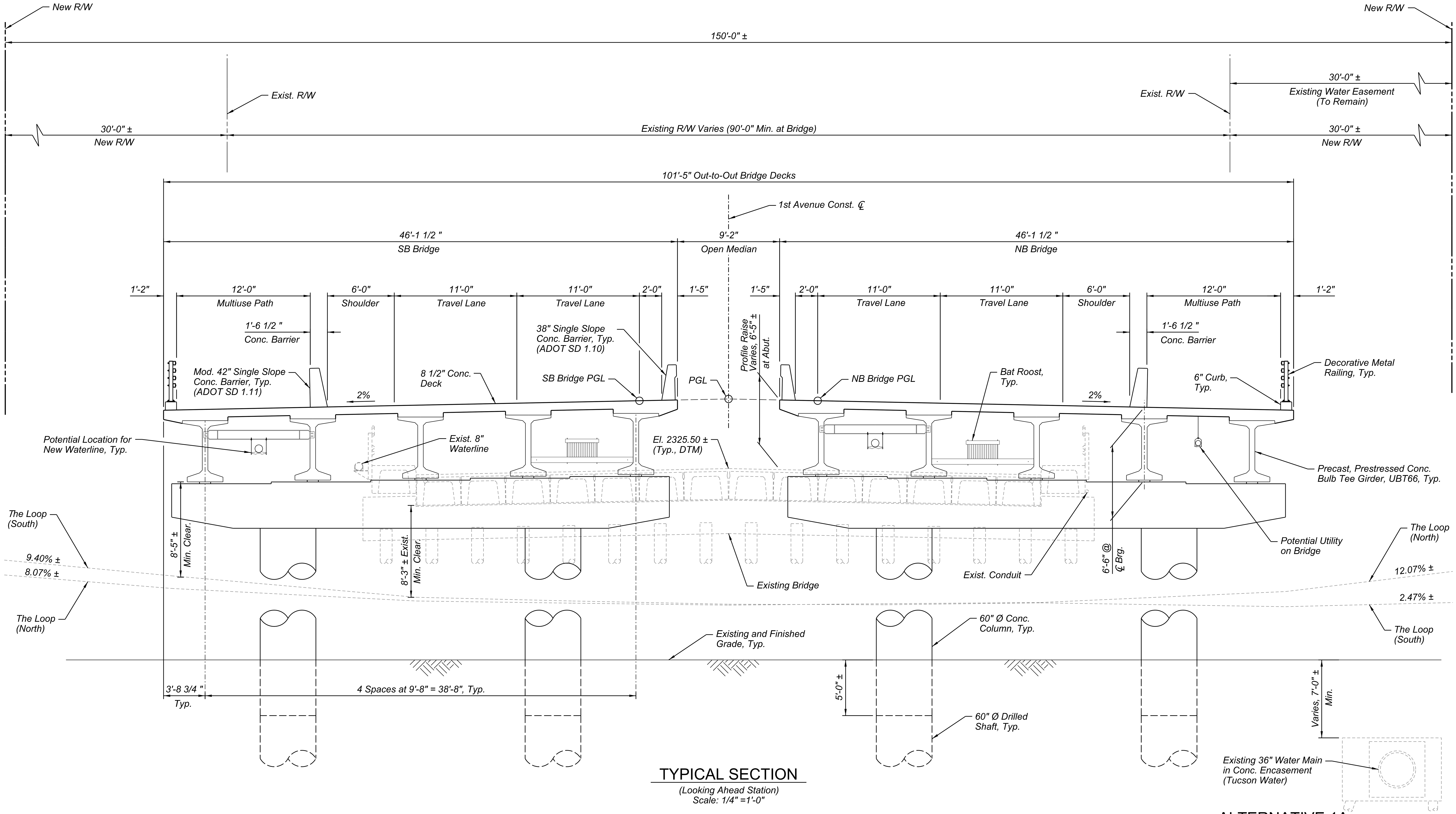
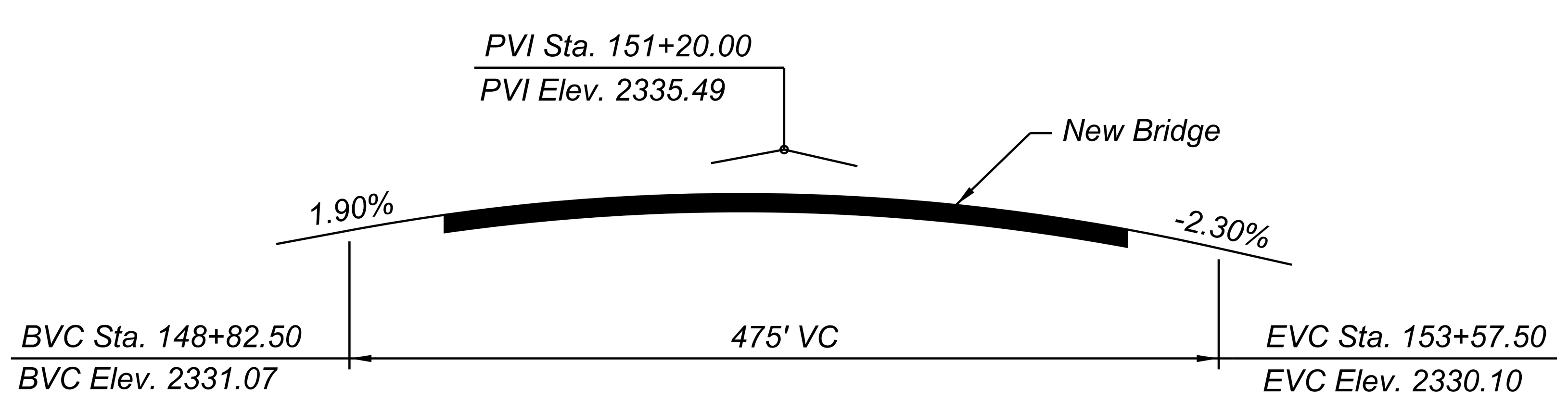


TYPICAL SECTION

(Looking Ahead Station)
Scale: 1/4" =1'-0"



PROFILE GRADE

PGL at 1st Avenue Const. ℄ Shown
No Scale

ALTERNATIVE 1A:
3-SPAN UTAH BULB TEE GIRDER (UBT66)
(RECOMMENDED ALTERNATIVE)

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- 1ST AVENUE -
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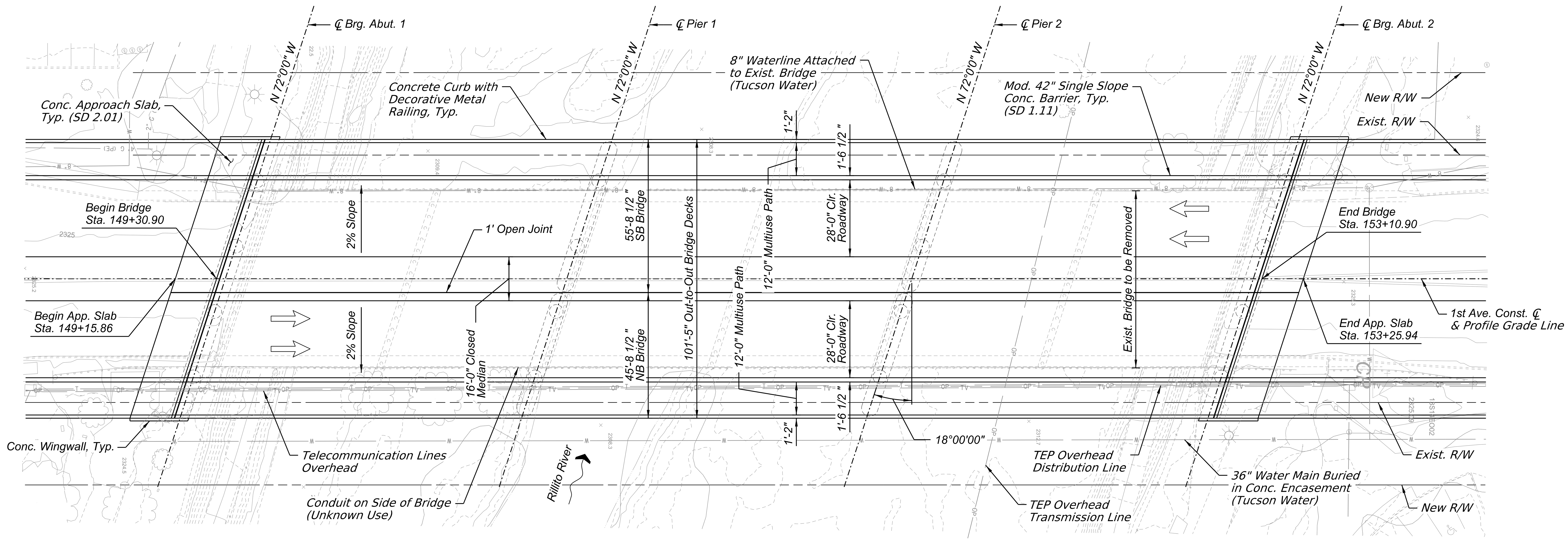
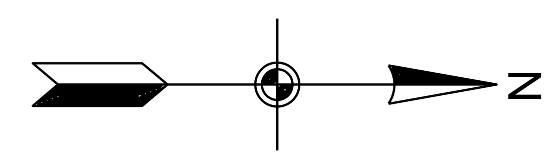
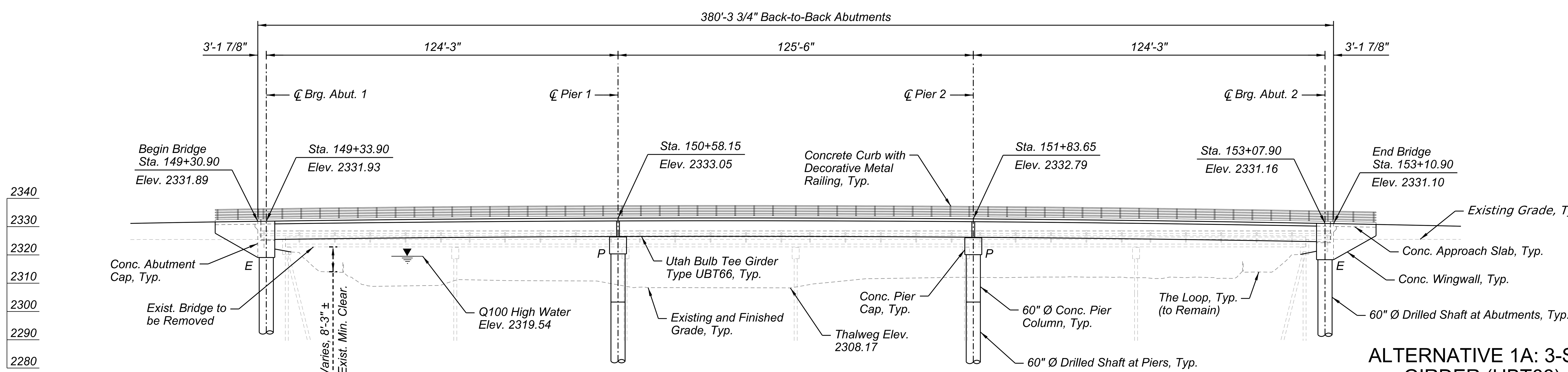


GENERAL PLAN

New 3-Span Utah Bulb Tee Girder Type UBT66 Bridge with Closed Median
Skew: 18° 00' 00" Rt.
Contour Interval: 1'-0"
Scale: 1" =20'-0"





ELEVATION

Scale: 1" =20'-0"

ALTERNATIVE 1A: 3-SPAN UTAH BULB TEE GIRDER (UBT66) - CLOSED MEDIAN

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Plotdriver: $PLTDRVS$
Project ID: $PROJECTID$
Client Number: 012149

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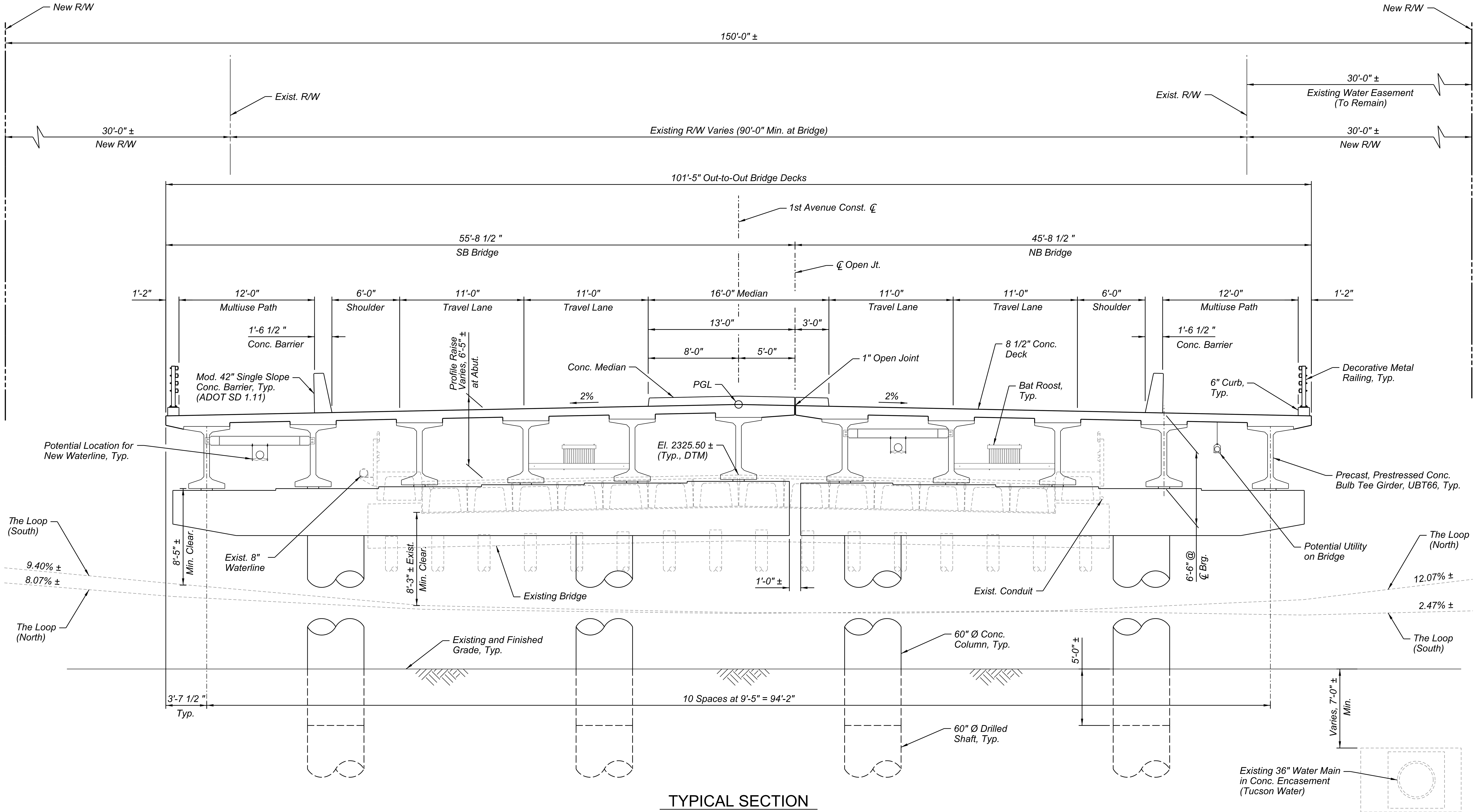

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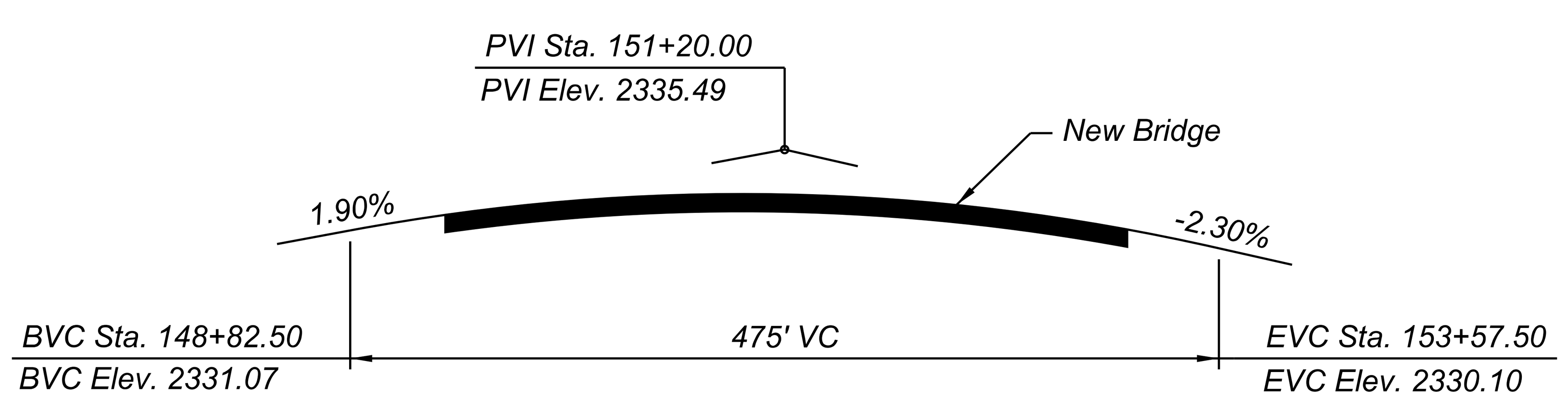
(Looking Ahead Station)
Scale: 1/4" =1'-0"



PROFILE GRADE

PGL at 1st Avenue Const. ℄ Shown
No Scale

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Print Scale: $SCALESHORT$

Pentable: $PENTBL$$
Plotdriver: $PLTDRVS$

Project ID: $PROJECTID$
Client Number: 012149

ALTERNATIVE 1A: 3-SPAN UTAH BULB TEE GIRDER (UBT66) - CLOSED MEDIAN

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PLAN NO. R-2025-XXX

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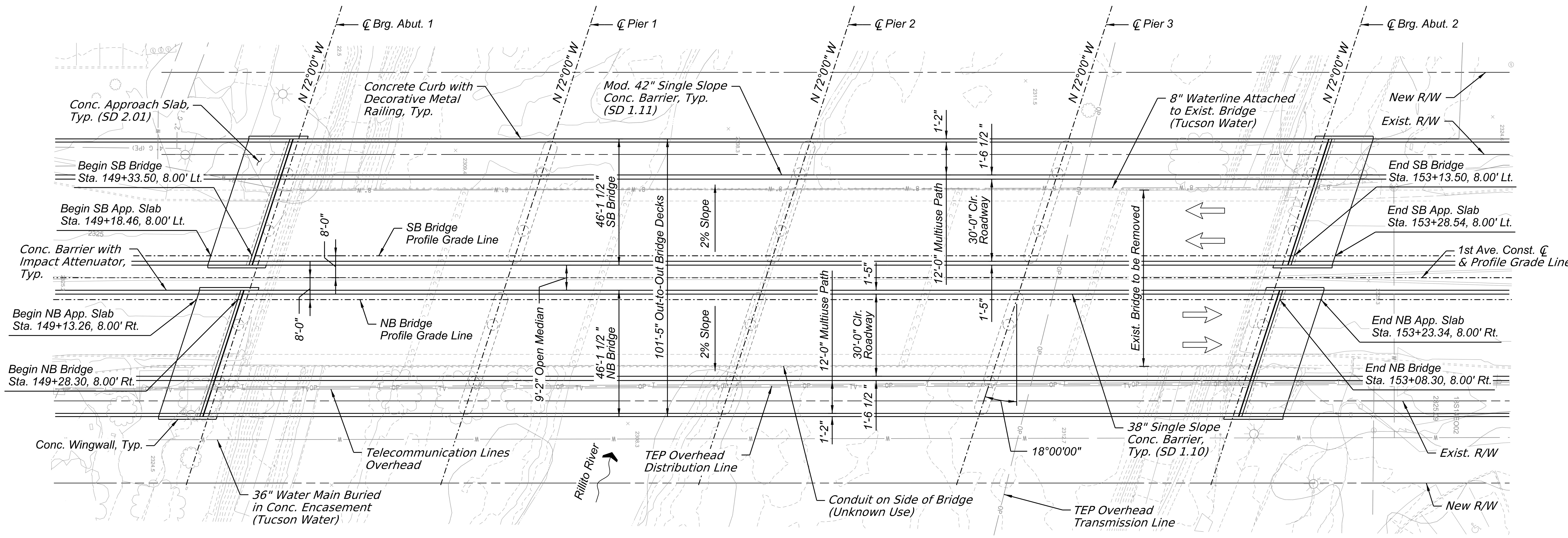
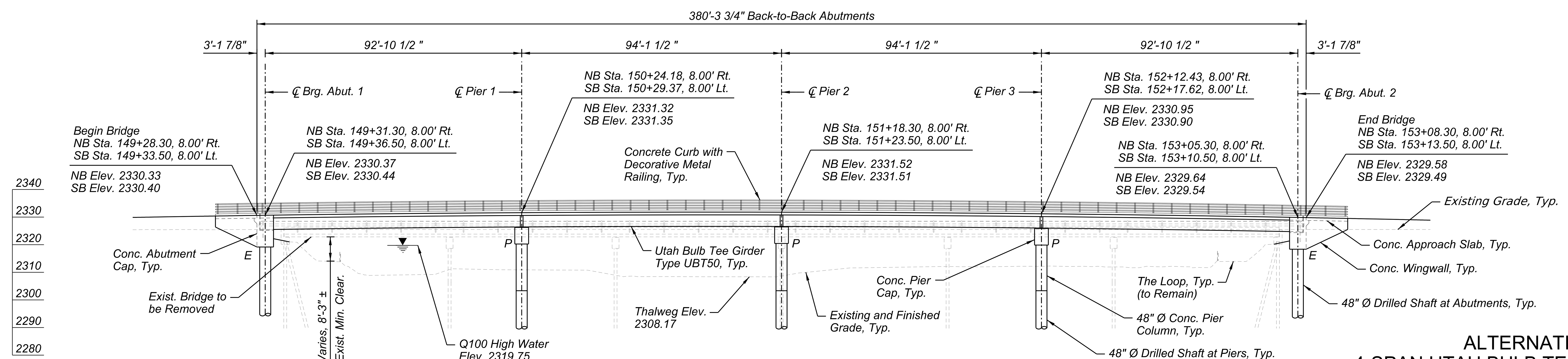


GENERAL PLAN

New 4-Span Utah Bulb Tee Girder Type UBT50 Bridge with Open Median
Skew: 18° 00' 00" Rt.
Contour Interval: 1'-0"
Scale: 1" =20'-0"



Note: Stations are along the 1st Avenue Construction Centerline. Dimensions and Elevations are along the NB or SB Bridge Profile Grade Line at Top of Deck unless noted otherwise.

ELEVATION

NB Bridge Shown, SB Bridge Similar
Scale: 1" =20'-0"

ALTERNATIVE 1B:
4-SPAN UTAH BULB TEE GIRDER (UBT50)

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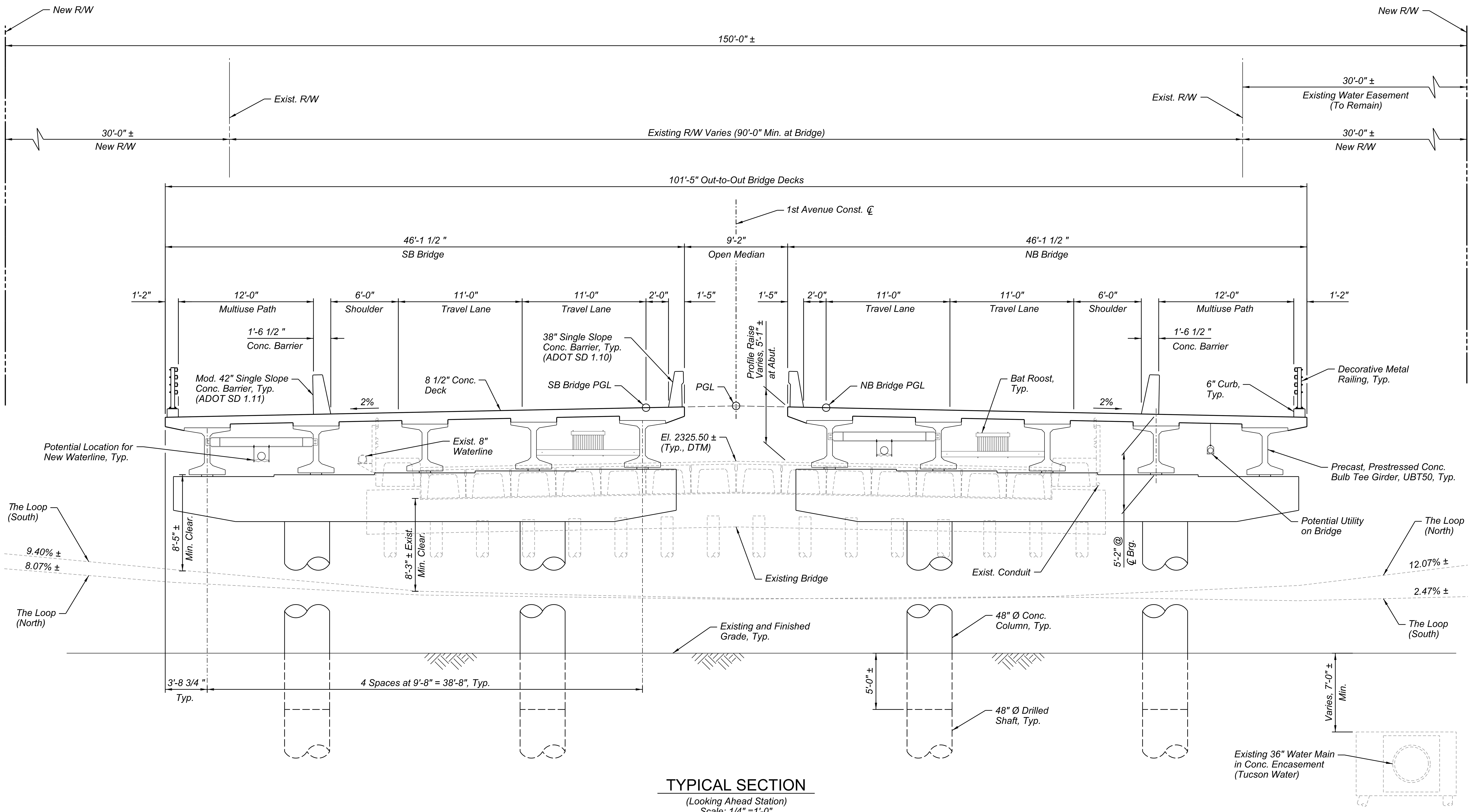
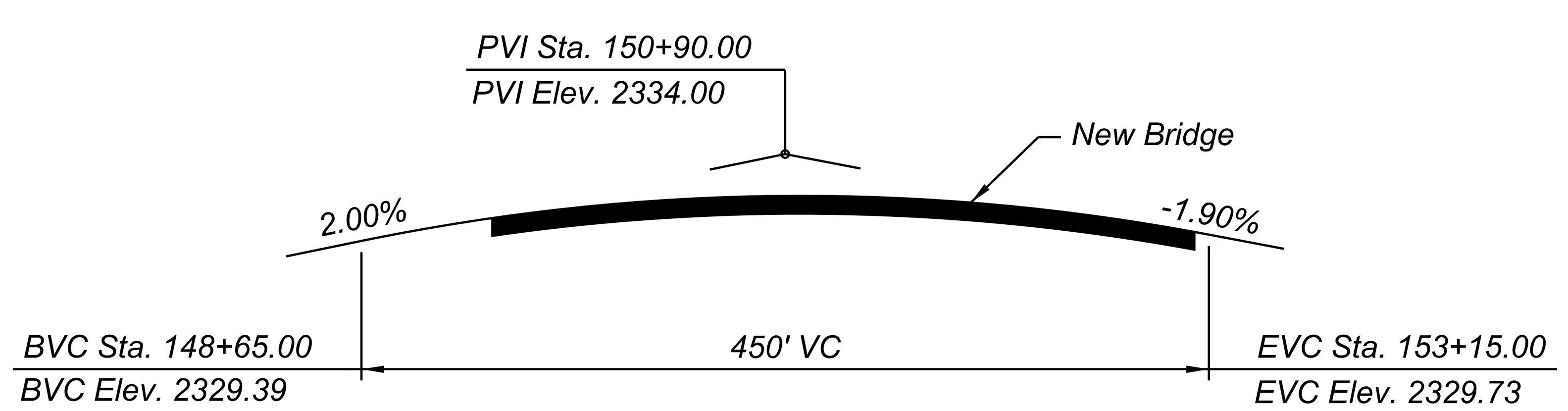
PLAN NO. R-2025-XXX



TYPICAL SECTION

(Looking Ahead Station)
Scale: 1/4" =1'-0"



PROFILE GRADE

PGL at 1st Avenue Const. ℄ Shown
No Scale

ALTERNATIVE 1B:
4-SPAN UTAH BULB TEE GIRDER (UBT50)

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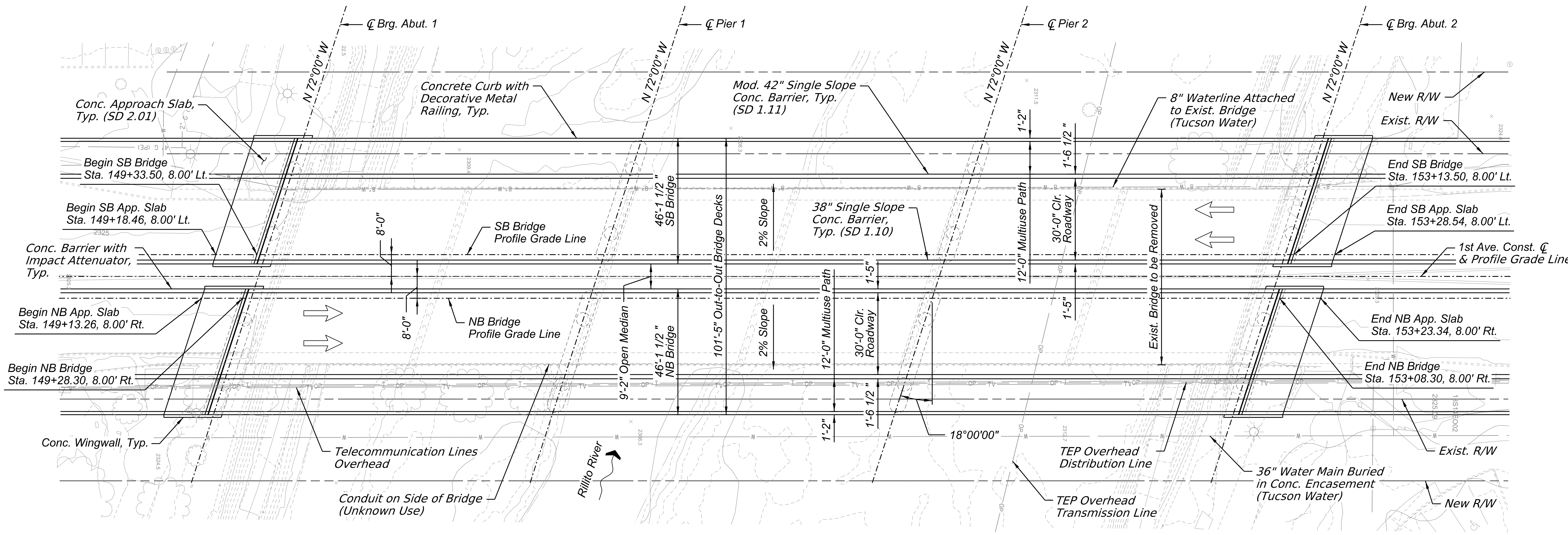
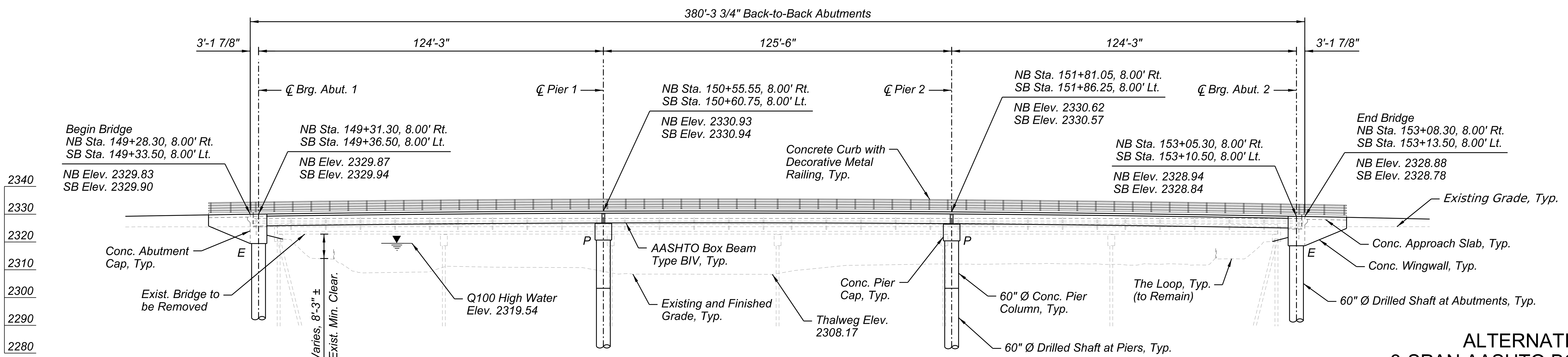


GENERAL PLAN

New 3-Span AASHTO Box Beam Type BIV Bridge with Open Median
Skew: 18° 00' 00" Rt.
Contour Interval: 1'-0"
Scale: 1" =20'-0"



Note: Stations are along the 1st Avenue Construction Centerline. Dimensions and Elevations are along the NB or SB Bridge Profile Grade Line at Top of Deck unless noted otherwise.

ELEVATION

NB Bridge Shown, SB Bridge Similar
Scale: 1" =20'-0"

ALTERNATIVE 2A:
3-SPAN AASHTO BOX BEAM (BIV)

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DEPARTMENT OF TRANSPORTATION/ENGINEERING DIVISION

- 1ST AVENUE -
GRANT ROAD TO RIVER ROAD

NO.	DATE	REVISION	BY	CHKD.	APPR.

Initial BSR
Preliminary
Not For
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Approvals	Signatory	Date

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OF

DRWN. BY GWS 01/2025 DSGN. BY DL 01/2025 CHKD. BY TWB 01/2025

REF. ______ SCALE: ______
PLAN NO. R-2025-XXX

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Print Scale: $SCALESHORT$
Pentable: $PENTBL$$
Plotdriver: $PLTDRV$$
Project ID: $PROJECTID$
Client Number: 012149

OpenRoads Designer v10.12.02.4
1/24/2025
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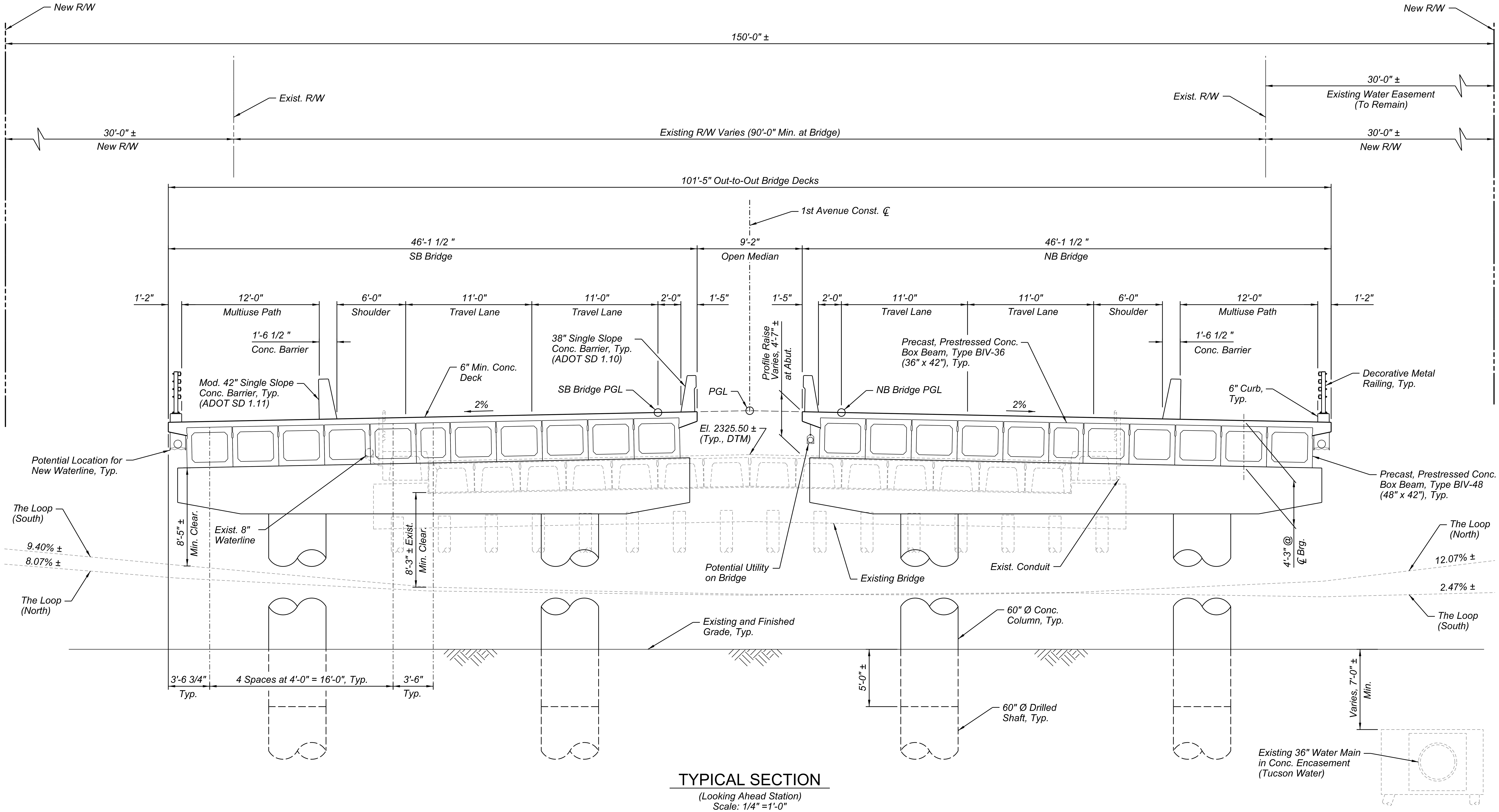
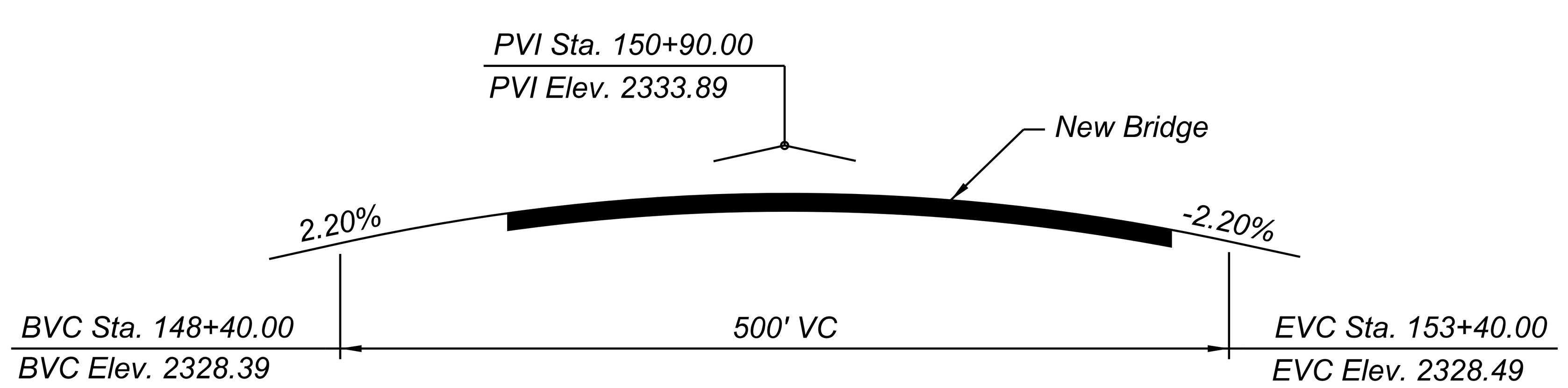
Client Number: 012149



TYPICAL SECTION

(Looking Ahead Station)
Scale: 1/4" =1'-0"



PROFILE GRADE

PGL at 1st Avenue Const. ℄ Shown
No Scale

ALTERNATIVE 2A:
3-SPAN AASHTO BOX BEAM (BIV)

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CITY OF TUCSON

DEPARTMENT OF TRANSPORTATION/ENGINEERING DIVISION

- 1ST AVENUE -
GRANT ROAD TO RIVER ROAD

NO.	DATE	REVISION	BY	CHKD.	APPR.

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DRWN. BY GWS 01/2025 DSGN. BY DL 01/2025 CHKD. BY TWB 01/2025

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PLAN NO. R-2025-XXX

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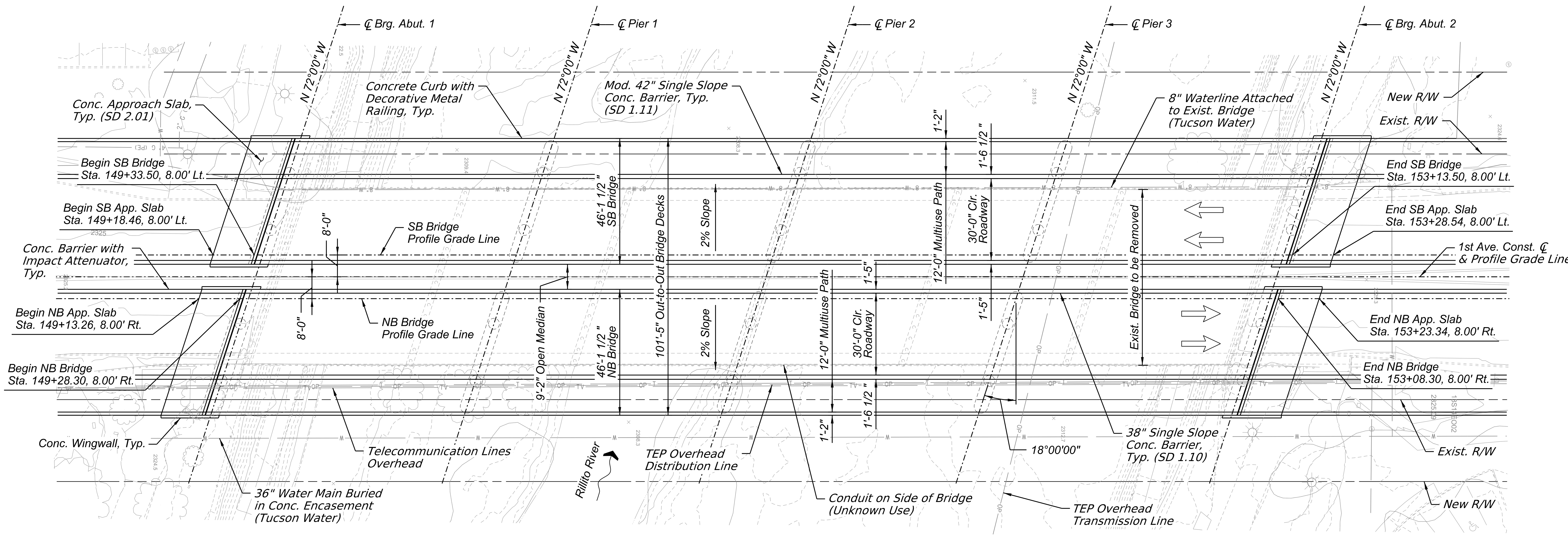
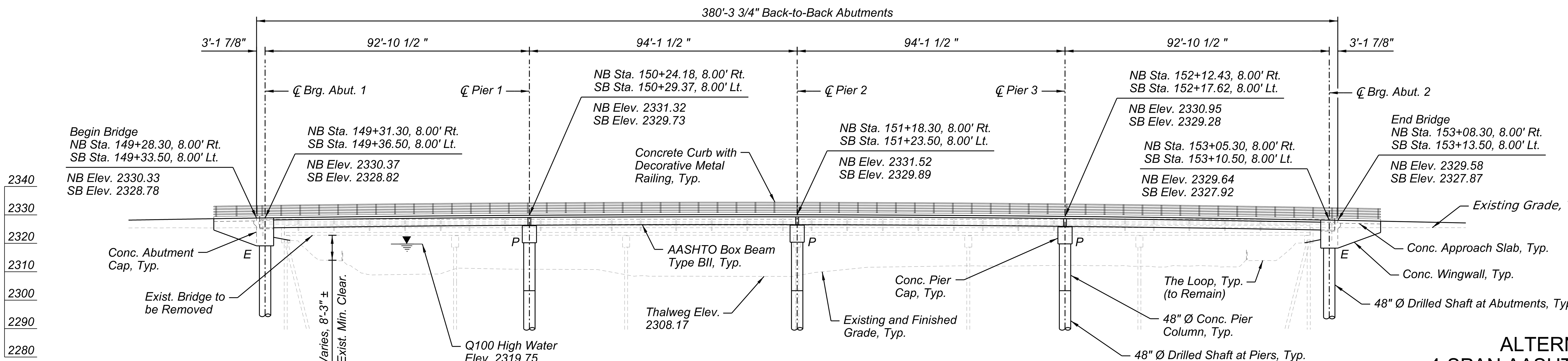


GENERAL PLAN

New 4-Span AASHTO Box Beam Type BII Bridge with Open Median
Skew: 18° 00' 00" Rt.
Contour Interval: 1'-0"
Scale: 1" =20'-0"



Note: Stations are along the 1st Avenue Construction Centerline. Dimensions and Elevations are along the NB or SB Bridge Profile Grade Line at Top of Deck unless noted otherwise.

ELEVATION

NB Bridge Shown, SB Bridge Similar
Scale: 1" =20'-0"

ALTERNATIVE 2B: 4-SPAN AASHTO BOX BEAM (BII)

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CITY OF TUCSON

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- 1ST AVENUE -
GRANT ROAD TO RIVER ROAD

Initial BSR
Preliminary
Not For
Construction

NO.	DATE	REVISION	BY	CHKD.	APPR.

Approvals	Signatory	Date

Approved ______ 20 ___
TRANSPORTATION DIRECTOR
OF
REF. ______ SCALE: ______

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PLAN NO. R-2025-XXX

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Project ID: $PROJECTID$
Client Number: 012149

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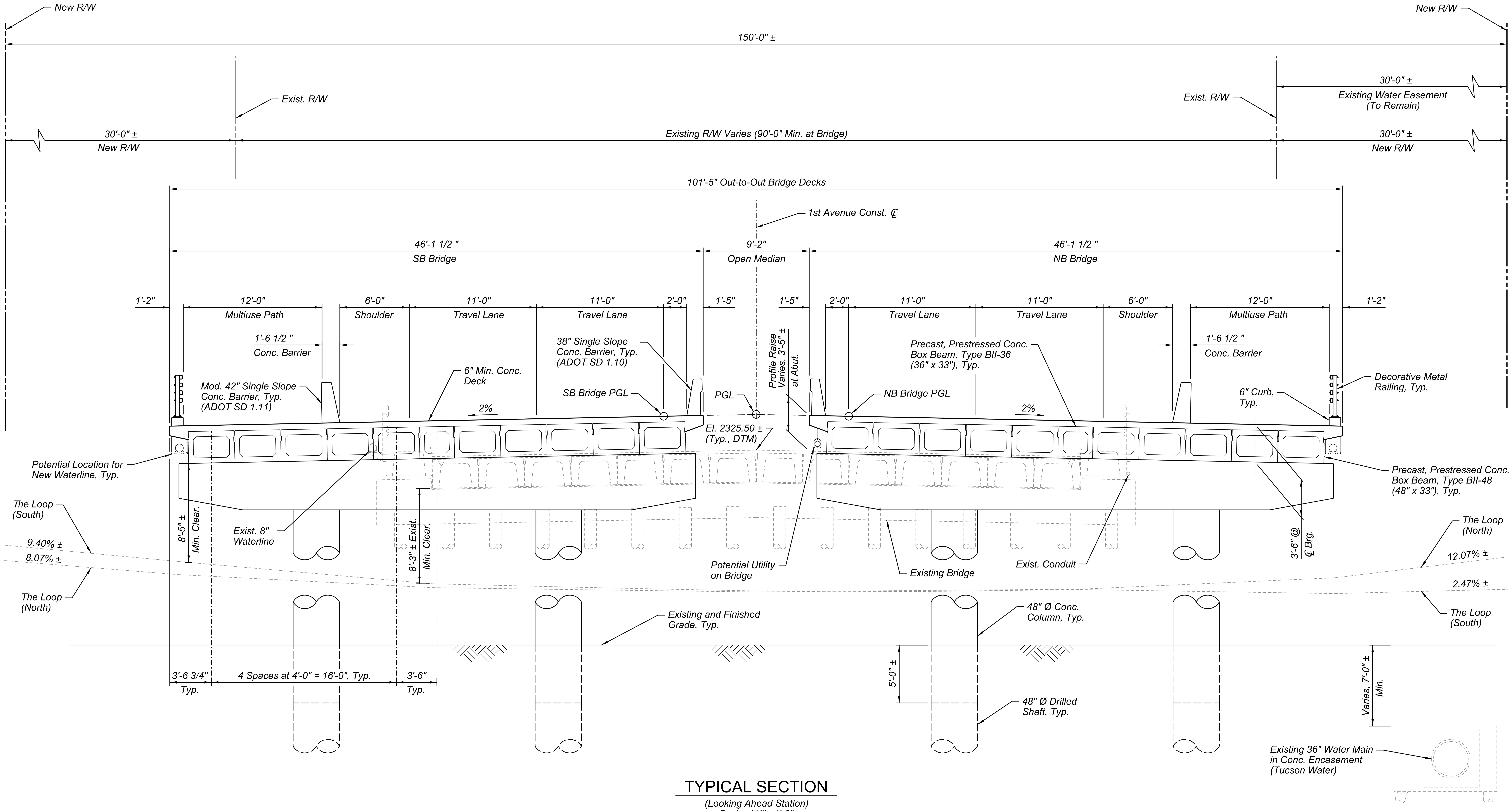
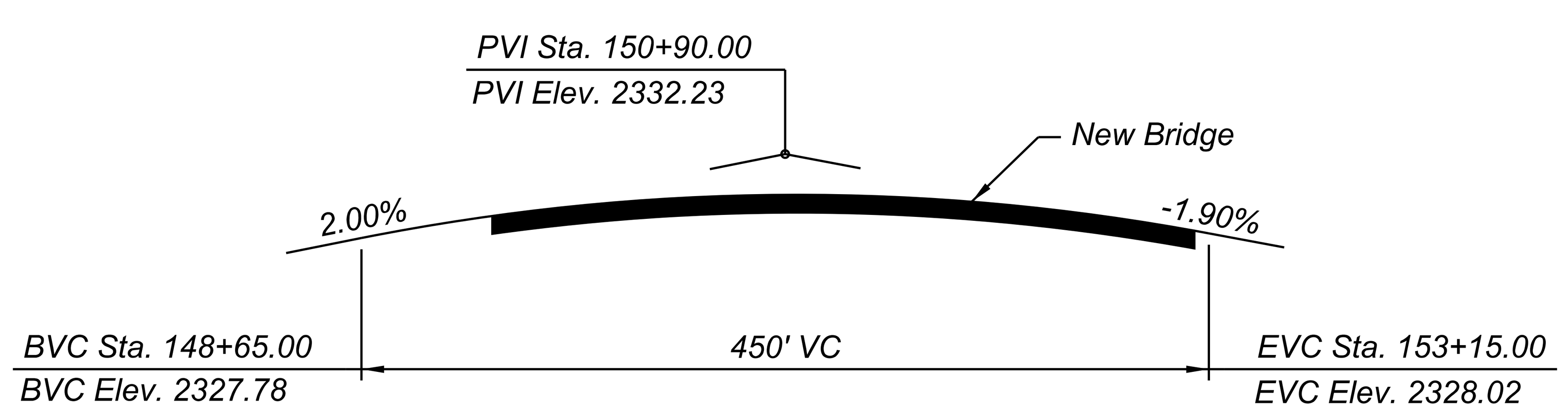


TYPICAL SECTION

(Looking Ahead Station)
Scale: 1/4" =1'-0"



PROFILE GRADE

PGL at 1st Avenue Const. ℄ Shown
No Scale

ALTERNATIVE 2B:
4-SPAN AASHTO BOX BEAM (BII)

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DEPARTMENT OF TRANSPORTATION/ENGINEERING DIVISION

- 1ST AVENUE -
GRANT ROAD TO RIVER ROAD

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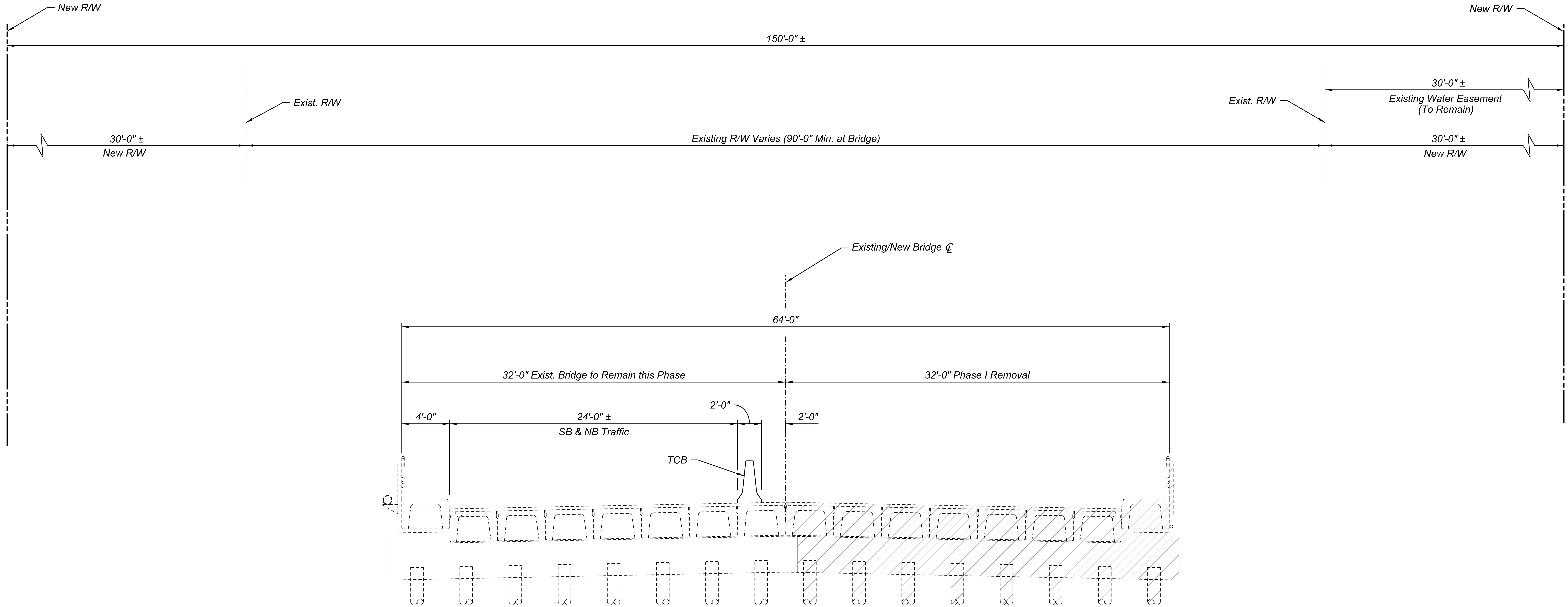
PLAN NO. R-2025-XXX

Appendix C. Bridge Construction Phasing



Phase I

Remove Northbound Side of Existing Bridge

CONSTRUCTION PHASING:
UBT66 OPEN MEDIAN
PHASE I

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GRANT ROAD TO RIVER ROAD

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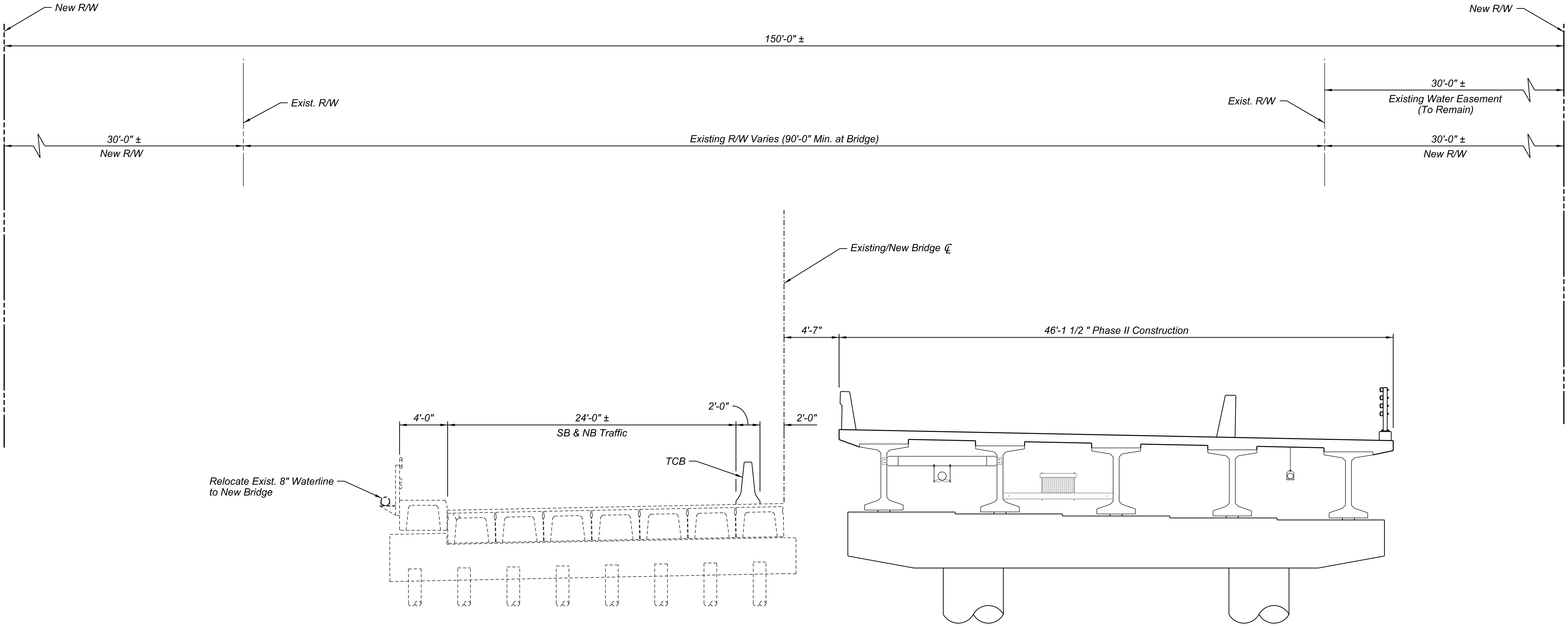

Phase II

Build New Northbound Bridge

CONSTRUCTION PHASING:
UBT66 OPEN MEDIAN
PHASE II

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- 1ST AVENUE -
GRANT ROAD TO RIVER ROAD

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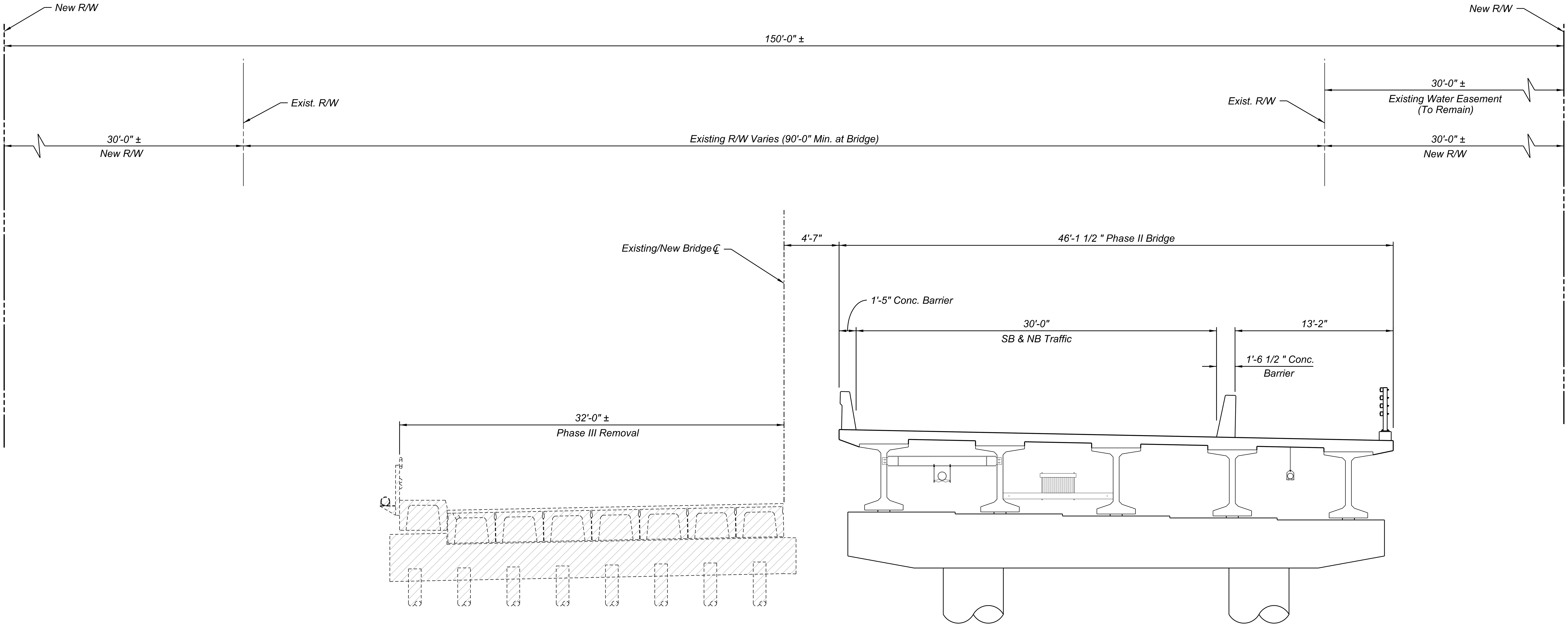

Phase III

Remove Remaining Southbound Existing Bridge

CONSTRUCTION PHASING:
UBT66 OPEN MEDIAN
PHASE III

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- 1ST AVENUE -
GRANT ROAD TO RIVER ROAD

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PLAN NO. R-2025-XXX

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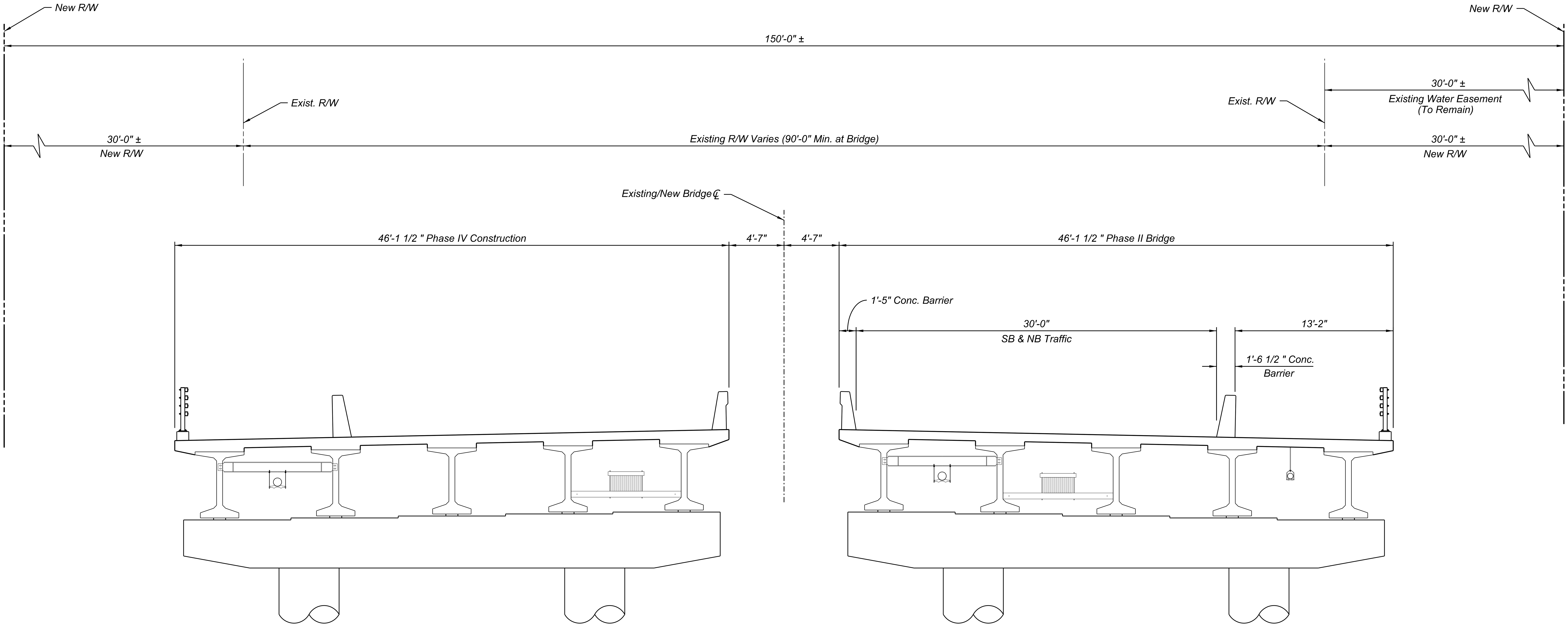

Phase IV

Build New Southbound Bridge

CONSTRUCTION PHASING:
UBT66 OPEN MEDIAN
PHASE IV

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- 1ST AVENUE -
GRANT ROAD TO RIVER ROAD

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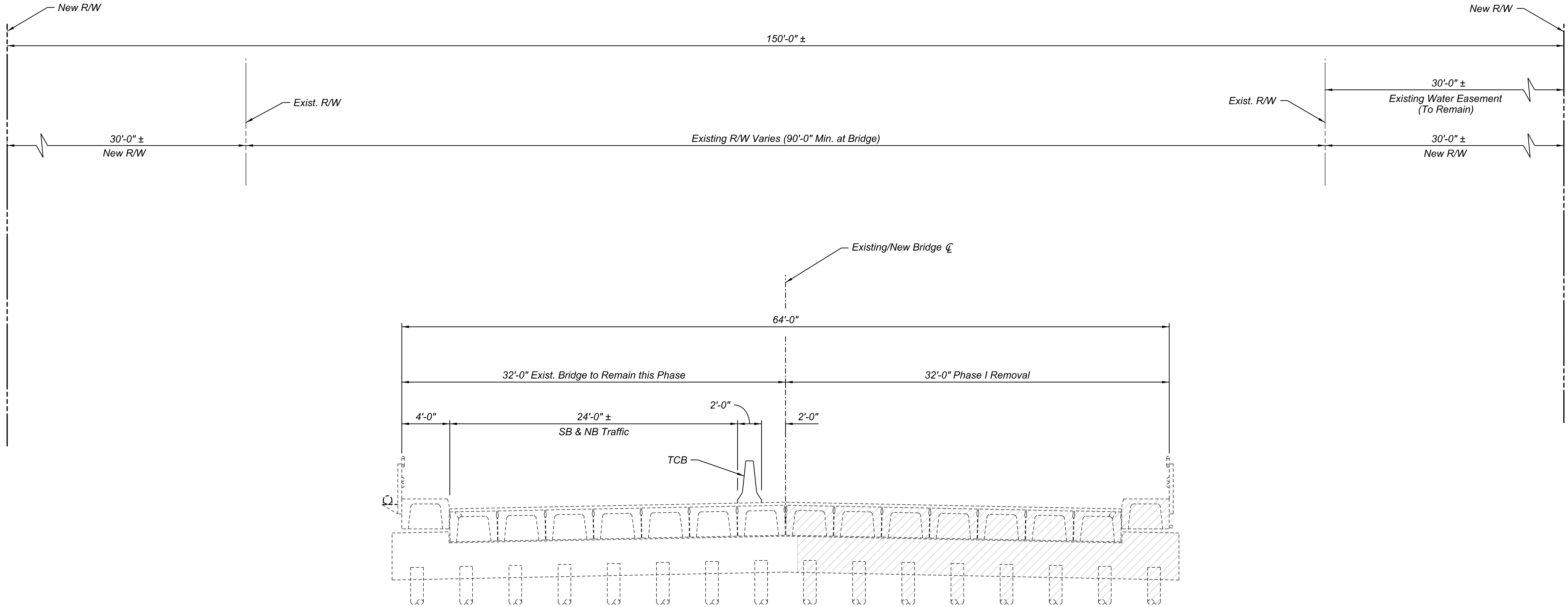

Phase I

Remove Northbound Side of Existing Bridge

CONSTRUCTION PHASING:
UBT66 CLOSED MEDIAN
PHASE I

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- 1ST AVENUE -
GRANT ROAD TO RIVER ROAD

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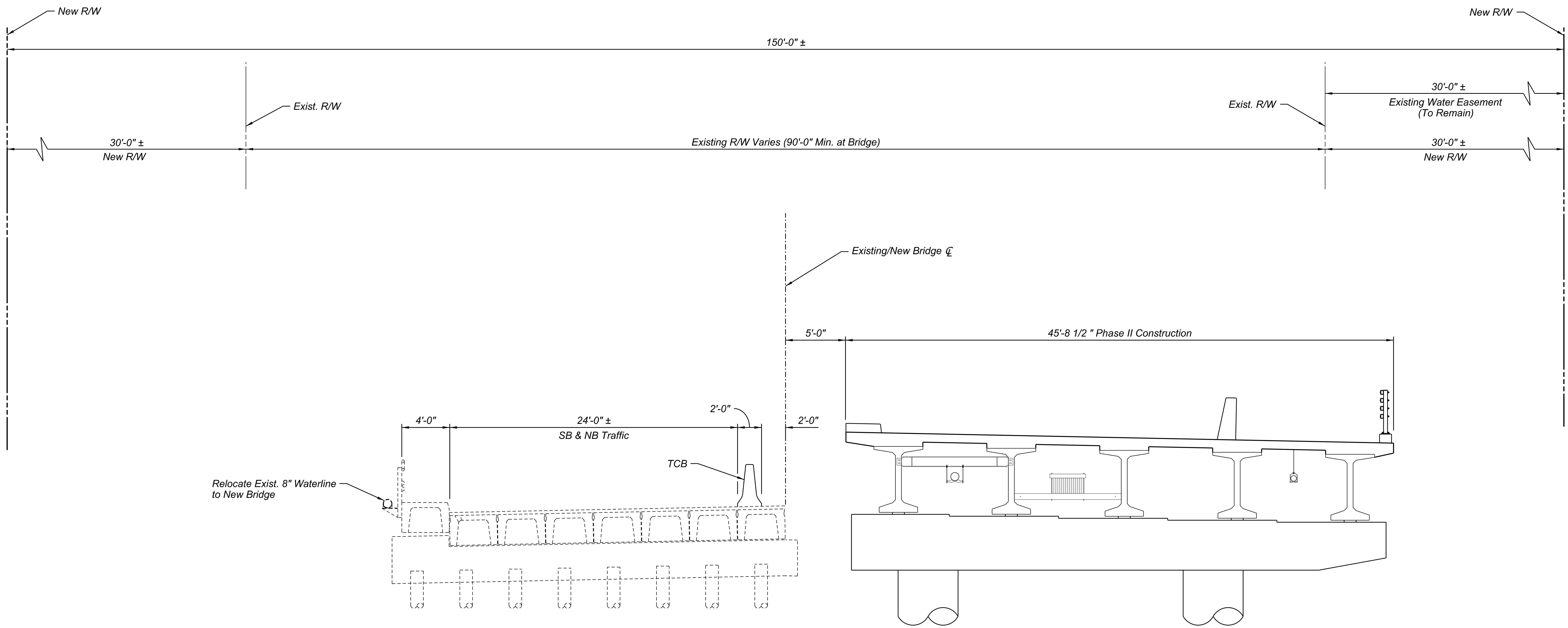

Phase II

Build New Northbound Bridge

CONSTRUCTION PHASING:
UBT66 CLOSED MEDIAN
PHASE II

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- 1ST AVENUE -
GRANT ROAD TO RIVER ROAD

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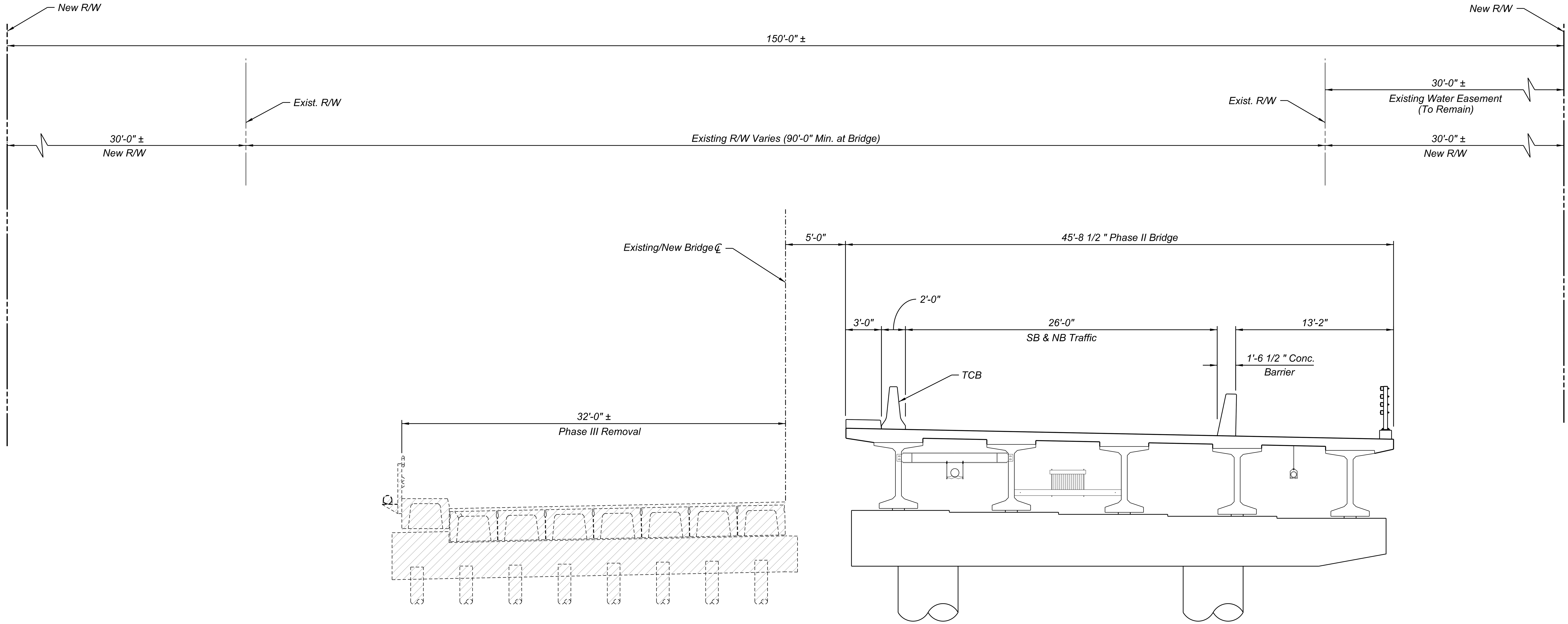

Phase III

Remove Remaining Southbound Existing Bridge

CONSTRUCTION PHASING:
UBT66 CLOSED MEDIAN
PHASE III

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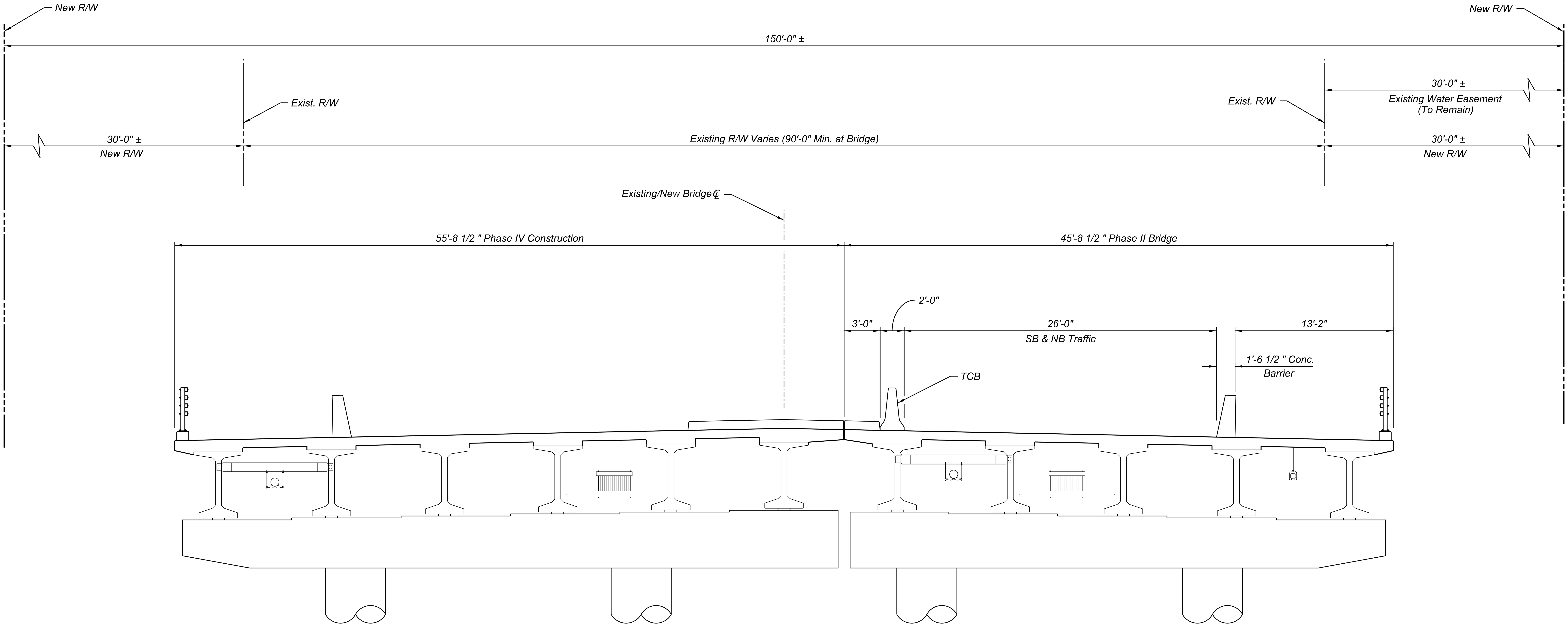

Phase IV

Build New Southbound Bridge

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Client Number: 012149

CONSTRUCTION PHASING:
UBT66 CLOSED MEDIAN
PHASE IV

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