

PRELIMINARY BRIDGE SELECTION REPORT

Sunset Road
Interstate 10 to River Rd

Sunset Rd over Rillito Creek

Prepared For:



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PCDOT Project No. 4SRRIV
CONSOR Project No. 2019-023

August 2020

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1.0 INTRODUCTION

The Pima County Department of Transportation (PCDOT), in coordination with the Arizona Department of Transportation (ADOT) and the City of Tucson Department of Transportation (TDOT), is investigating alternatives to extend Sunset Road from Interstate 10 (I-10) to River Road. The plan to connect Sunset Road from Silverbell Road to River Road was split into two segments.

The first segment connected Silverbell Road to the existing I-10 Eastbound Frontage Rd (EBFR). Segment I was completed in 2017 and consist of a three-lane roadway, which includes a two-way left turn lane and a 720-foot-long bridge over the Santa Cruz River. The bridge has a shared-use path along the southern side and a pedestrian walkway on the northern side that ties into the Loop.

The second segment is assumed to occur in conjunction with the reconstruction of the Sunset Road Traffic Interchange (TI) as part of ADOT’s widening of I-10 from Ruthrauff Road to Ina Road. The new TI will cross over I-10. Segment II will extend Sunset Road from the I-10 Westbound Frontage Road (WBFR) to River Road as well as raising the roadway from Santa Cruz River to the I-10 Eastbound Frontage Rd (EBFR) to meet the new TI. This segment includes constructing new bridges over Union Pacific Railroad (UPRR) and the Rillito Creek.

For ease of discussion, this project considers the Segment II portion of Sunset Road to run North-South, with I-10 running East-West.

1.1 PROJECT LOCATION

The project is located in the City of Tucson, Pima County, AZ (See Figure 1).

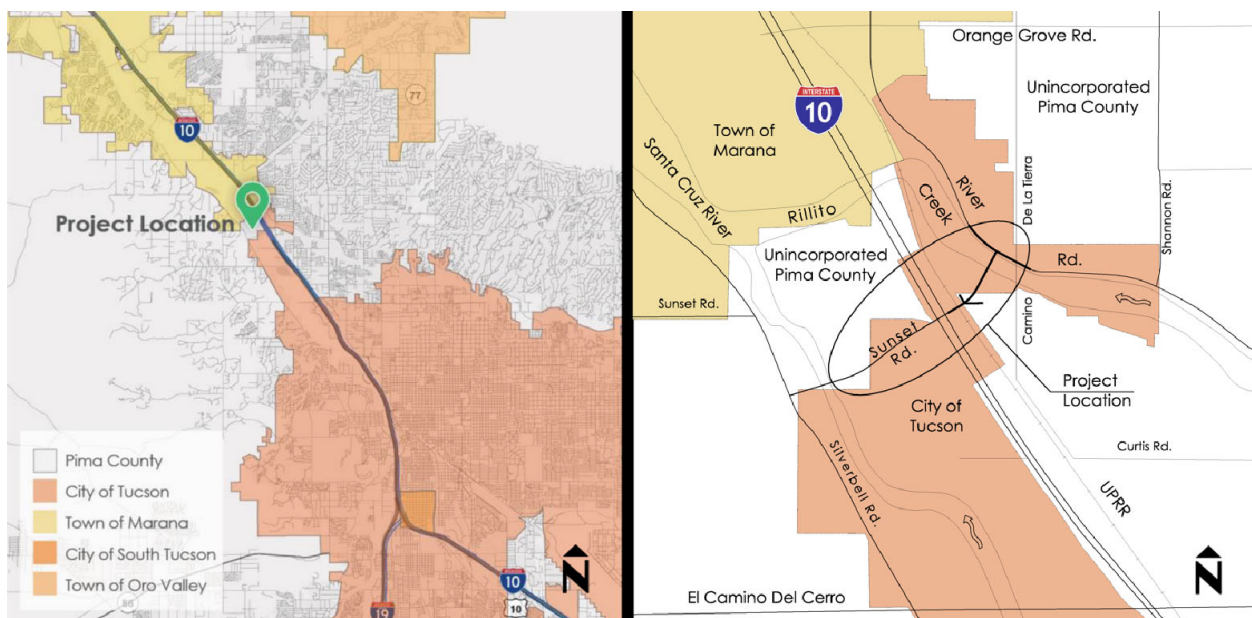


Figure 1 – Location & Vicinity Map

1.2 CURRENT PROJECT PROGRAMMING STATUS

The project is one of the 35 roadway projects included in the 2006 Regional Transportation Authority (RTA) 20-year multimodal plan.

1.3 ROADWAY CLASSIFICATION

Sunset Road is classified as a Rural Principal Arterial.

2.0 EXISTING UTILITIES

An overhead TEP power line presents potential conflicts with the construction of the proposed bridge. It will need to be verified and accurately located prior to final design. The overhead power line runs east/west on the south side of Rillito Creek. No other utility conflicts are anticipated.

3.0 EXISTING RIGHT-OF-WAY

Pima County Flood Control District owns the Rillito Creek channel and channel improvements. The alignment for the Rillito Creek Bridge lies within Tucson City limits. Right of way dedicated from the Flood Control District will be required to allow for the Rillito Creek Bridge's construction and operation.

4.0 PROPOSED ROADWAY GEOMETRY

The roadway profile grade will be on a tangent with a 2% slope. The horizontal alignment will be tangent as it crosses the bridge with a skew angle of 0 degrees. Both the northbound and southbound lanes will consist of a 13'-0" inside through lane, a 12'-0" through lane, and a 6'-0" outside shoulder, for a clear roadway width of 31'-0" in each direction. The northbound and southbound lanes will be separated by a 6'-0" median.

5.0 PROPOSED BRIDGE GEOMETRY

The proposed bridge for all alternatives will be a three-span bridge with piers oriented to span the Army Corps of Engineers 404 jurisdictional areas within the main channel and overbanks of the creek. The abutments are located at a required minimum of 6'-0" from the edge of the existing multi-use recreational paths (Loop) to the face of the abutment on both sides for a total bridge length of 390'-1". The clear roadway width will be 31'-0" on both the northbound and southbound side, separated by a 6'-0" median. The bridge will utilize 6'-8½" sidewalk and a 1'-2" combination pedestrian-traffic bridge railing on the outside edges of the bridge resulting in an overall width of 83'-9". The bridge deck will be crowned with 2% cross slopes. The Sunset Road profile provides a minimum of 11'-9½" vertical clearance over the existing Loop at the south end of the bridge and a minimum of 15'-2" vertical clearance over the realigned Loop at the north end of the bridge for Alternative 1. For Alternative 2, the Sunset Road profile provides a minimum

of 11'-6" vertical clearance over the existing Loop at the south end of the bridge and a minimum of 14'-10½" vertical clearance over the realigned Loop at the north end of the bridge.

Freeboard requirements are specified in Section 8. Alternative 1 provides the 3'-0" minimum freeboard for the 100-year water surface elevation and the 1'-0" minimum freeboard for the 500-year water surface elevation. For Alternative 2, the freeboard for the 100-year water surface elevation meets the 3'-0" minimum requirement but falls about 3" short for the 500-year water surface elevation. Hence, Alternative 2 would require revising the Sunset Road profile slightly to meet the freeboard requirements. The superstructure depth will vary for each bridge alternative considered. All alternatives will include approach slabs.

6.0 DESIGN SPECIFICATIONS AND LOADINGS

The proposed bridge will be designed per the AASHTO LRFD Bridge Design Specifications and the ADOT Bridge Design Guidelines. The design live load will be HL93. It is not anticipated that the bridge will be designed for a special permit loading. Seismic design criteria will be determined as part of the geotechnical investigation and are included in the Final Geotechnical Report, dated August 3, 2020.

7.0 BRIDGE FOUNDATION INVESTIGATION

A Geotechnical Evaluation report was prepared by Golder and Associates, dated August 3, 2020. The report recommends drilled shaft foundations at the abutments and piers due to scour considerations which dictates the need for deep foundations at this location. Drilled shafts may require temporary casing to prevent caving in of the drilled holes.

8.0 PROPOSED BRIDGE HYDRAULICS

The crossing will be designed for a design flow associated with a 100-year storm event with a 3-foot minimum freeboard and a 500-year storm event with a 1-foot minimum freeboard. The 100-year high water surface elevation (HWSE) is estimated at 2224.04 with an anticipated pier and abutment scour of approximately 30 feet. The 500-year HWSE is estimated at 2231.09 feet with an anticipated pier and abutment scour of approximately 32 feet. The existing Rillito Creek soil cement bank protection will be altered to accommodate the new bridge abutments.

9.0 PROPOSED UTILITIES

The existing overhead power line may present a vertical clearance issue during construction of the proposed bridge. This clearance should be verified during final design. Conduits can be installed in the bridge barriers to carry the power for the new lighting along Sunset Road. No other utilities are expected to be supported on the proposed bridge.

10.0 PROPOSED RIGHT-OF-WAY

The proposed bridge spans the Rillito Creek which is owned by the Pima County Flood Control District (PCFCD) and lies within the Tucson City Limits. Therefore, an easement from City of Tucson will need to be established.

11.0 AESTHETICS

The Sunset Rd, Segment I project utilized a public artist to provide bridge aesthetics for the bridge over the Santa Cruz River. It is anticipated that public art will also be incorporated into the bridge for this segment of Sunset Rd from I-10 to River Rd. At a minimum for the Rillito Creek Bridge, selected paint colors and/or rustication patterns as well as decorative pedestrian fencing that provide a unified theme among the project corridor can be incorporated into the bridge during final design.

12.0 CONSTRUCTABILITY

The use of Prefabricated Bridge Element Systems (PBES) are investigated for the bridge due to construction over a waterway:

- Precast prestressed AASHTO girders
 - These girders are used for standard span lengths, as these girder types are more readily available in Arizona than BT girders and possibly provide a more competitive market.
- Precast prestressed concrete bulb tee girders.
 - These girders are more efficient than traditional AASHTO girders and are used for span lengths that traditional AASHTO girders are unable to span. In addition, their use may eliminate girder lines, possibly providing a more cost-effective design.

All alternatives use precast prestressed AASHTO girders or bulb tee girders over the Rillito Creek. These girders can be easily transported to the site by truck. There is sufficient room on site to set cranes and lift the girder into place. Concrete for cast-in-place portions of the substructure and superstructure can be easily transported to the site. The I-10 corridor as well as River Rd makes all equipment and materials delivery fairly standard for this project.

13.0 CONSTRUCTION ACCESS AND STAGING AREA

Access to the construction site can be from I-10, River Road, or both. The contractor will likely set up multiple safe access points. There is ample space within the PCDOT right-of-way for materials stockpiling, laydown areas, and equipment storage. This area is located west of Sunset Road in the former Pima County Parks and Recreation maintenance yard.

14.0 TRAFFIC CONTROL

No traffic control is needed since this is a new alignment.

15.0 BRIDGE ALTERNATIVES

The bridge type selection process evaluates the structural, functional, and aesthetic requirements of a bridge with respect to constructability, cost, and schedule constraints. The constraints imposed by existing and final conditions include, but are not limited to, cultural/environmental, drainage, geotechnical, right-of-way, roadway geometry, topography, traffic, utilities, and combinations thereof.

The recommended alternative is that which offers the best structural, functional, and aesthetic solution and satisfies applicable constraints to the maximum practicable extent.

Constructability over a waterway is a major challenge associated with the construction of the Sunset Rd over Rillito Creek bridge. A three-span, precast prestressed (PC/PS) concrete girder superstructure is considered best suited to span the Rillito Creek. Other structure types, such as a cast-in-place post tensioned box girder superstructure, would require falsework over Rillito Creek, and are not desirable.

15.1 ALTERNATIVE 1 – PC/PS AASHTO GIRDER

Superstructure:

Alternative 1 utilizes a three-span configuration, with span 1 and span 3 having an equal span of 128'-1" and span 2 spanning 129'-5". Since the spans are all very close in length, each span in the three-span superstructure consists of 10 girder lines of precast prestressed AASHTO Type V Modified girders (63" deep) spaced at 8'-5 $\frac{5}{8}$ " with 3'-9 $\frac{3}{16}$ " overhangs, resulting in an out-to-out deck width of 83'-9". The deck is 8" thick, and the overall structure depth is 6'-2". The girders are assumed to use 0.6" prestressing strands with a 28-day concrete strength of 8,250 psi.

Substructure:

The abutments and piers have a skew angle of 0°. The abutments are full height abutments approximately 86'-3" long, supported on a single row of drilled shafts. Wingwalls should be cast-in-place retaining walls. Mechanically stabilized earth (MSE) retaining walls are not a good alternative for this bridge due to scour considerations.

The pier is approximately 83'-9" long and consists of a drop cap beam supported on four 4'-0" diameter columns. Each column is assumed to be supported on a single drilled shaft.

Cost Estimate:

- Total Structure Cost: \$5,737,206
- Cost per SF: \$175.62
- Cost estimate includes 30% contingency

15.2 ALTERNATIVE 2 – PC/PS BULB TEE GIRDER

Superstructure:

Alternative 2 also utilizes a three-span configuration with span 1 and span 3 spanning 128'-1" and span 2 spanning 129'-5". Since the spans are all very close in length, each span in the three-span superstructure consists of 9 girder lines of precast prestressed BT66 girders (66" deep) spaced at 9'-6³/₈" with 3'-9" overhangs, resulting in an out-to-out deck width of 83'-9". The deck in this alternative is 8¹/₂" thick, and the overall structure depth is 6'-5¹/₂". The girders are assumed to use 0.6" prestressing strands with a 28-day concrete strength of 8,250 psi.

Substructure:

The abutments and piers have a skew angle of 0°. The abutments are full height abutments approximately 86'-3" long, supported on a single row of drilled shafts. Wingwalls should be cast-in-place retaining walls. Mechanically stabilized earth (MSE) retaining walls are not a good alternative for this bridge due to scour considerations.

The pier is approximately 83'-9" long and consists of a drop cap beam supported on four 4'-0" diameter columns. Each column is assumed to be supported on a single drilled shaft.

Cost Estimate:

- Total Structure Cost: \$6,030,011
- Cost per SF: \$184.58
- Cost estimate includes 30% contingency

16.0 RECOMMENDED ALTERNATIVE

The recommended alternative is Alternative 1 – PC/PS AASHTO Girders. Although a girder line can be eliminated by using bulb tee girders, AASHTO girders tend to be more widely available in Arizona than bulb tee girders, thus providing a more competitive market. This is also reflected in the cost estimate. Alternative 1 is the least expensive alternative with an estimated cost of \$5.74 million. In addition, due to the bulb tee girders being 3" deeper than the AASHTO girder, and the extra 1/2" required for the deck due to the larger spacing of the bulb tee girders, the freeboard for this alternative will no longer meet the required criteria for the 500-year water surface elevation. If Alternative 2 was chosen, there would be an additional cost to raise the profile grade to meet the freeboard criteria.

17.0 REFERENCES

Initial Geotechnical Report: Sunset Road: Interstate 10 to River Rd, Golder and Associates, August 3, 2020.

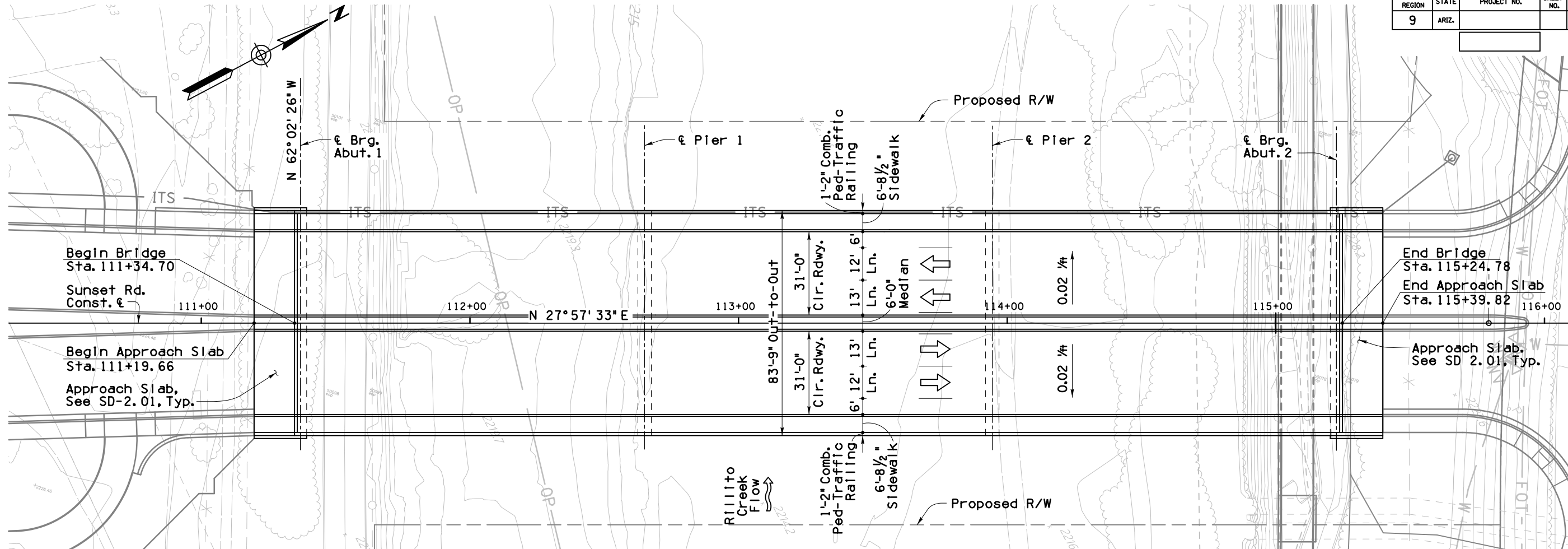
AASHTO LRFD Bridge Design Specifications, 8th Edition, 2017, American Association of State Highway and Transportation Officials (AASHTO).

Arizona Department of Transportation (ADOT) Bridge Design Guidelines

Drainage Design Overview for Sunset Road, Interstate 10 to River Road, WSP, August 2020

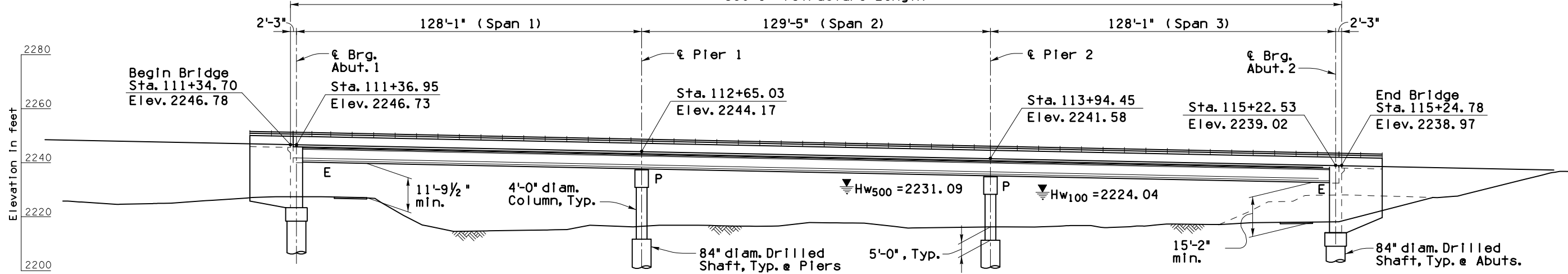
APPENDIX A - PLANS, ELEVATIONS AND TYPICAL SECTIONS

F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	RECORD DRAWING
9	ARIZ.				



GENERAL PLAN
 1" = 20'
 New 3-Span Precast-Prestressed Concrete
 AASHTO Type V Mod. Girder Bridge
 Skew = 0°
 Contour Interval = 1 ft.

390'-1" (Structure Length)



ELEVATION
 1" = 20'

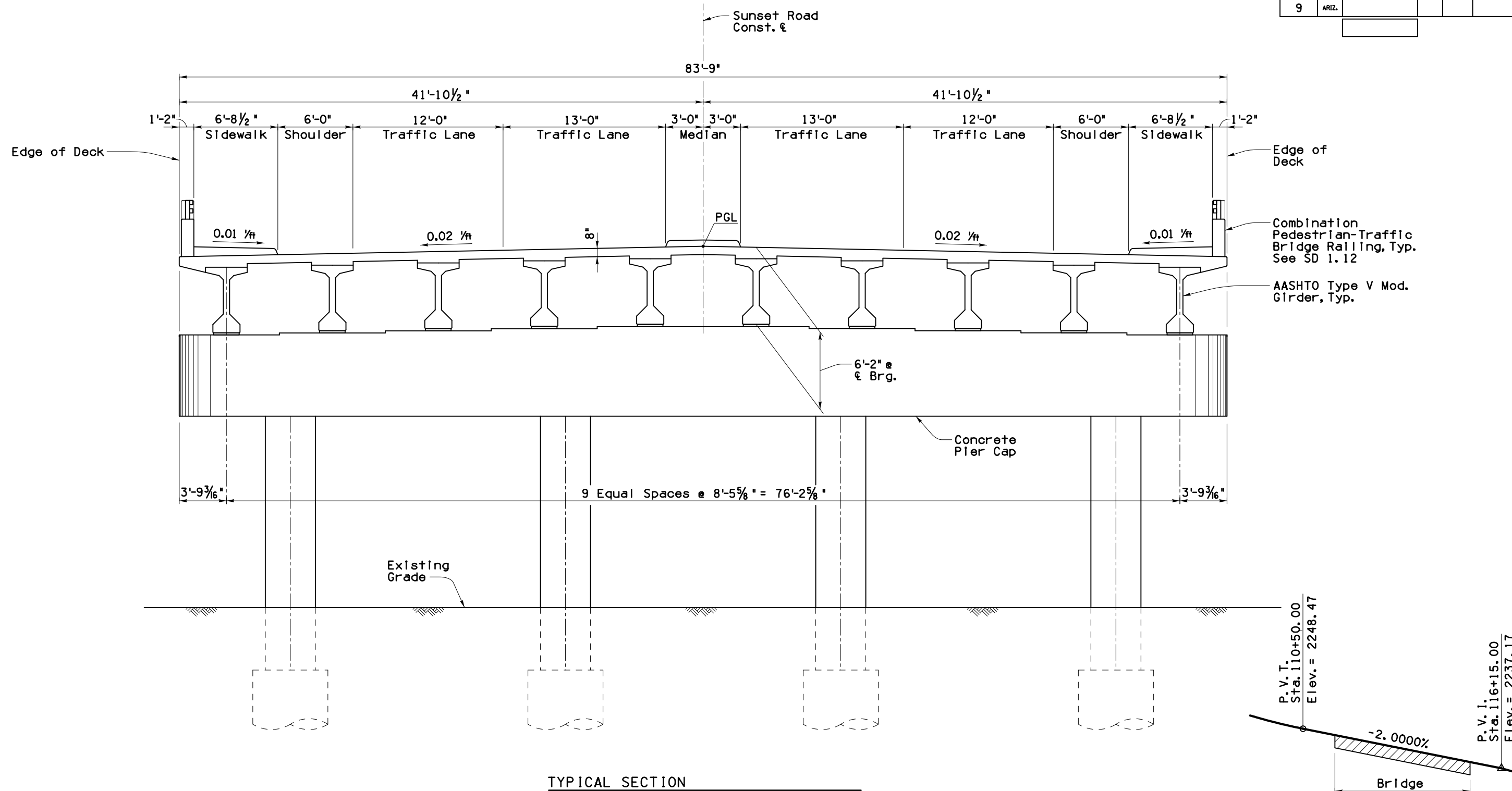
Notes:

- All Stations, Elevations & Dimensions are at Sunset Road Const. ξ .
- Contractor to verify utility line locations.



DESIGN	KGR, KRH	08-20	PIMA COUNTY DEPARTMENT OF TRANSPORTATION	PRELIMINARY STAGE I Review NOT FOR CONSTRUCTION OR RECORDING
DRAWN	JHS, MJL	08-20		
CHECKED	CGP	08-20		
CONSOR 15300 Northway Rd., Suite 200, Tucson, AZ 85719 (520) 238-1530			BRIDGE OVER RILLITO CREEK PLAN & ELEVATION ALT. 1 (AASHTO GIRDER)	
ROUTE	I-10		LOCATION	SUNSET ROAD: I-10 TO RIVER ROAD
TRACS NO.			SHEET	OF

F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	RECORD DRAWING
9	ARIZ.				



TYPICAL SECTION
 1/4" = 1'-0"

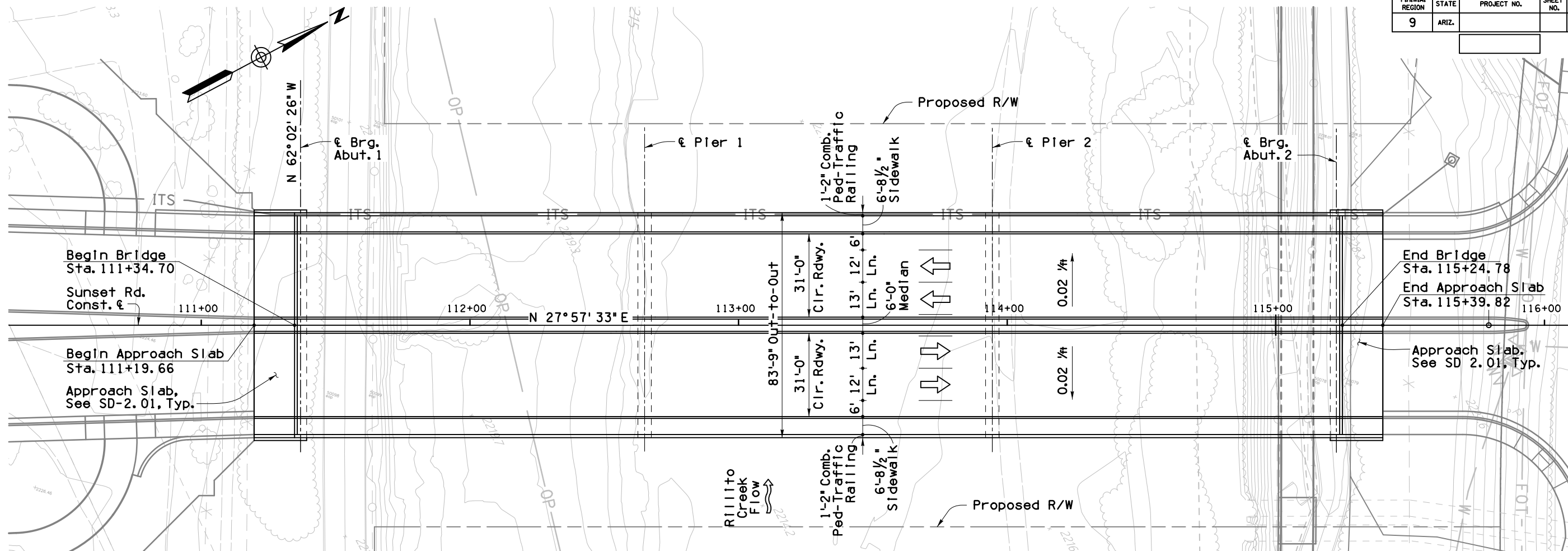
PROFILE GRADE
 No Scale

DATE: _____ LOCATION: _____ REVISIONS: _____ FINISHED PLANS: _____ SURVEY NO.: _____ DATE: _____ LOCATION: _____ REVISIONS: _____ FINISHED PLANS: _____ SURVEY NO.: _____



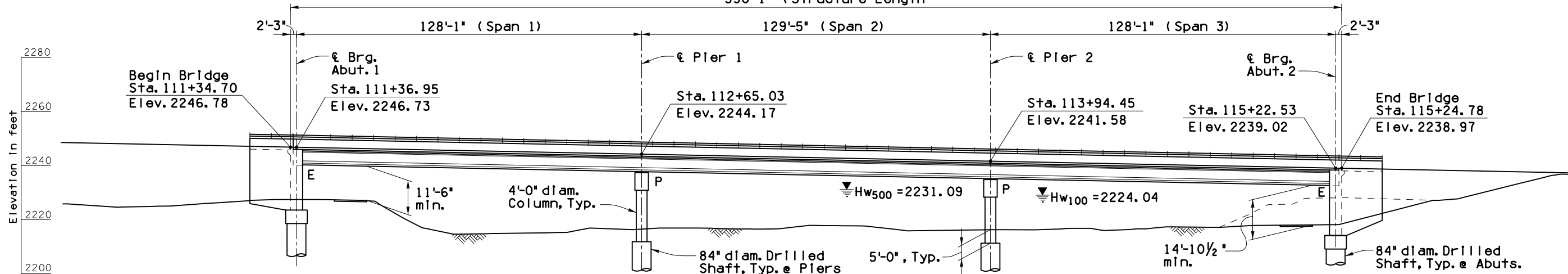
DESIGN	KGR, KRH	08-20	PIMA COUNTY DEPARTMENT OF TRANSPORTATION	PRELIMINARY STAGE I Review NOT FOR CONSTRUCTION OR RECORDING
DRAWN	JHS, MJL	08-20		
CHECKED	CGP	08-20		
CONSOR		BRIDGE OVER RILLITO CREEK TYPICAL SECTION ALT. 1 (AASHTO GIRDER)		
ROUTE	I-10	LOCATION	SUNSET ROAD: I-10 TO RIVER ROAD	
TRACS NO.				SHEET OF

F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	RECORD DRAWING
9	ARIZ.				



GENERAL PLAN
 1" = 20'
 New 3-Span Precast-Prestressed Concrete
 BT66 Girder Bridge
 Skew = 0°
 Contour Interval = 1 ft.

390'-1" (Structure Length)



ELEVATION
 1" = 20'

Notes:

- All Stations, Elevations & Dimensions are at Sunset Road Const. ξ .
- Contractor to verify utility line locations.



DESIGN	NAME	DATE	PIMA COUNTY DEPARTMENT OF TRANSPORTATION	PRELIMINARY STAGE I Review NOT FOR CONSTRUCTION OR RECORDING
DRAWN	KGR, KRH	08-20		
CHECKED	JHS, MJL	08-20		
	CGP	08-20	BRIDGE OVER RILLITO CREEK PLAN & ELEVATION ALT. 2 (BT GIRDER)	
ROUTE	I-10			
TRACS NO.	SUNSET ROAD: I-10 TO RIVER ROAD		SHEET OF	

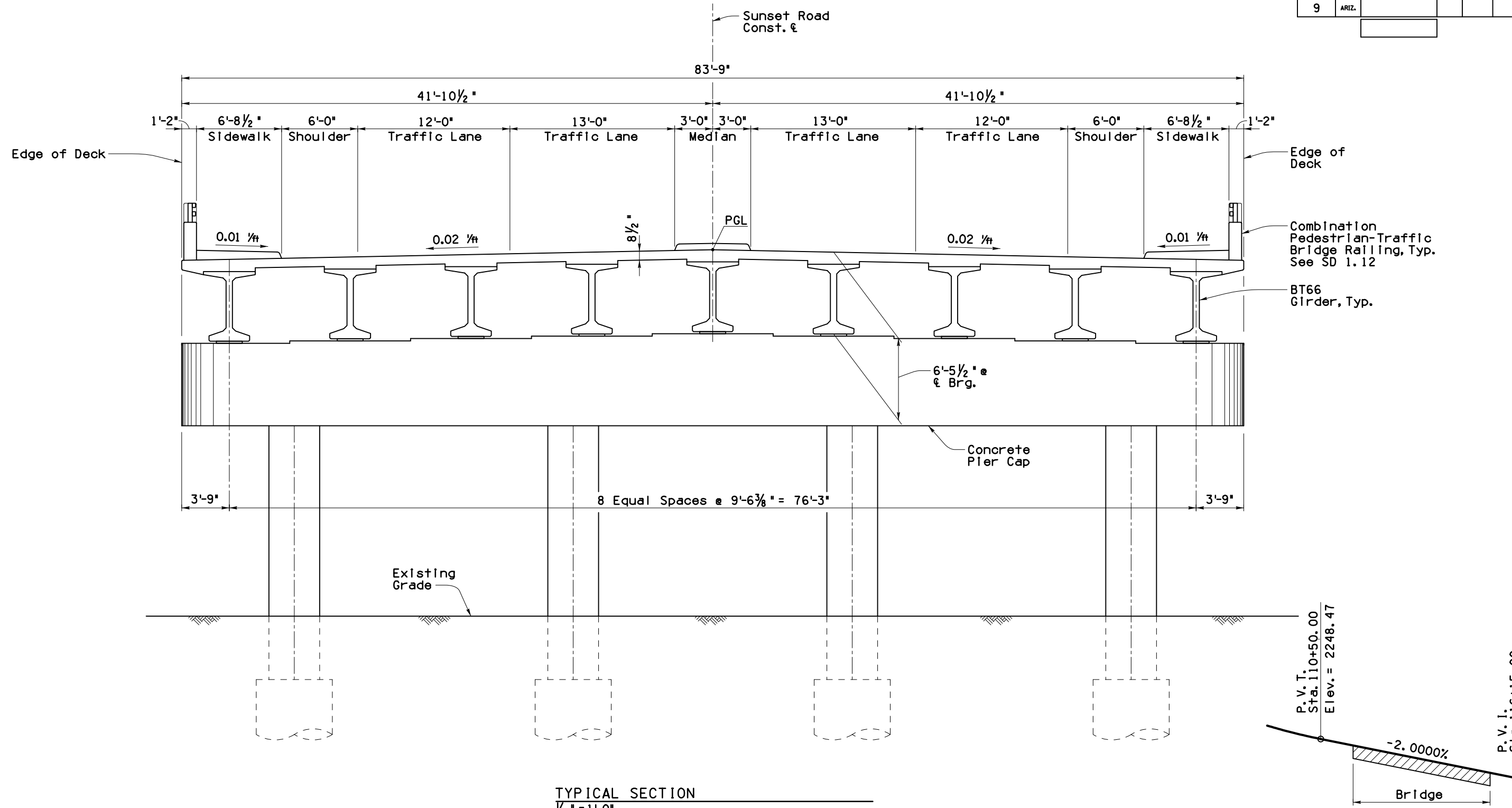
TRACS NO.

SUNSET ROAD: I-10 TO RIVER ROAD

SHEET OF

OF

F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	RECORD DRAWING
9	ARIZ.				



TYPICAL SECTION
 1/4" = 1'-0"

PROFILE GRADE
 No Scale

DATE: LOCATION: REVISIONS: FINISHED PLANS: SURVEY NO. DATE: LOCATION: REVISIONS: FINISHED PLANS: SURVEY NO.



DESIGN	KGR, KRH	08-20	PIMA COUNTY DEPARTMENT OF TRANSPORTATION	PRELIMINARY STAGE I Review NOT FOR CONSTRUCTION OR RECORDING
DRAWN	JHS, MJL	08-20		
CHECKED	CGP	08-20		
CONSOR		BRIDGE OVER RILLITO CREEK TYPICAL SECTION ALT. 2 (BT GIRDER)		SHEET _____ OF _____
ROUTE	I-10	LOCATION	SUNSET ROAD: I-10 TO RIVER ROAD	
TRACS NO.				OF

APPENDIX B - COST ESTIMATES

Sunset Rd over Rillito Creek - Alternative 1
(Three Span Bridge 390' long with AASHTO Girder Type V Mod)

LUMP SUM STRUCTURE ITEMS					
ITEM NUMBER	DESCRIPTION	UNIT	UNIT COST	QUANTITY	COST
2030501	STRUCTURAL EXCAVATION	CU.YD.	\$45.00	795	\$35,775
2030506	STRUCTURE BACKFILL	CU.YD.	\$60.00	565	\$33,900
6010005	STRUCTURAL CONCRETE (CLASS S) (F'C = 4,500)	CU.YD.	\$500.00	2515	\$1,257,500
6011132	COMBINATION PEDESTRIAN-TRAFFIC BRIDGE RAILING	L.FT.	\$125.00	840	\$105,000
6011347	DECK JOINT ASSEMBLY (3X3 COMPRESSION SEAL)	L.FT.	\$175.00	168	\$29,400
6011371	APPROACH SLAB (SD 2.01)	SQ.FT.	\$20.00	2527	\$50,540
6014955	PRECAST, P/S MEMBER (AASHTO TYPE 5 MOD. GR.)	L.FT.	\$278.00	3842	\$1,068,076
6015101	RESTRAINERS, VERTICAL EARTHQUAKE (FIXED)	L.FT.	\$200.00	27	\$5,400
6015102	RESTRAINERS, VERTICAL EARTHQUAKE (EXPANSION)	L.FT.	\$300.00	27	\$8,100
6050002	REINFORCING STEEL	LB.	\$1.00	490244	\$490,244
SUBTOTAL:					\$3,083,935
CONTINGENCY: 30%					\$925,181
TOTAL COST:					\$4,009,116
BRIDGE COST/SF (WITHOUT OTHER ITEMS):					\$122.72
OTHER ITEMS					
6090084	DRILLED SHAFT FOUNDATION (84")	L.FT.	\$900.00	1456	\$1,310,400
9080150	CONCRETE MEDIAN PAVEMENT	SQ.FT.	\$7.50	2520	\$18,900
SUBTOTAL:					\$1,329,300
CONTINGENCY: 30%					\$398,790
TOTAL COST:					\$1,728,090
BRIDGE COST/SF (OTHER ITEMS):					\$52.90
TOTAL					
SUBTOTAL:					\$4,413,235
CONTINGENCY: 30%					\$1,323,971
TOTAL COST:					\$5,737,206
BRIDGE COST/SF (WITH OTHER ITEMS):					\$175.62

Structure Name: **Sunset over Rillito Creek**
 Superstructure Type: **AASHTO Girder Type V Mod**
 Substructure Type: **Multi Column Piers & Seat Type Abutments**
 Foundation Type: **Drilled Shafts**
 No. of Spans: **3**
 Span Lengths (ft): **128.08, 129.42, 128.08**
 Skew (deg): **0°**

Total Length (ft): **390.08**
 Width (Out to Out) (ft): **83.75**
 Area (sq ft): **32,669.20**

Sunset Rd over Rillito Creek - Alternative 2

(Three Span Bridge 390' long with BT66 Girder)

LUMP SUM STRUCTURE ITEMS					
ITEM NUMBER	DESCRIPTION	UNIT	UNIT COST	QUANTITY	COST
2030501	STRUCTURAL EXCAVATION	CU.YD.	\$45.00	795	\$35,775
2030506	STRUCTURE BACKFILL	CU.YD.	\$60.00	565	\$33,900
6010005	STRUCTURAL CONCRETE (CLASS S) (F'C = 4,500)	CU.YD.	\$500.00	2588	\$1,294,000
6011132	COMBINATION PEDESTRIAN-TRAFFIC BRIDGE RAILING	L.FT.	\$125.00	840	\$105,000
6011347	DECK JOINT ASSEMBLY (3X3 COMPRESSION SEAL)	L.FT.	\$175.00	168	\$29,400
6011371	APPROACH SLAB (SD 2.01)	SQ.FT.	\$20.00	2527	\$50,540
6014973	PRECAST, P/S MEMBER (BULB-TEE TYPE BT66)	L.FT.	\$360.00	3458	\$1,244,880
6015101	RESTRAINERS, VERTICAL EARTHQUAKE (FIXED)	EACH	\$200.00	24	\$4,800
6015102	RESTRAINERS, VERTICAL EARTHQUAKE (EXPANSION)	EACH	\$300.00	24	\$7,200
6050002	REINFORCING STEEL	LB.	\$1.00	503675	\$503,675
SUBTOTAL:					\$3,309,170
CONTINGENCY: 30%					\$992,751
TOTAL COST:					\$4,301,921
BRIDGE COST/SF (WITHOUT OTHER ITEMS):					\$131.68
OTHER ITEMS					
6090084	DRILLED SHAFT FOUNDATION (84")	L.FT.	\$900.00	1456	\$1,310,400
9080150	CONCRETE MEDIAN PAVEMENT	SQ.FT.	\$7.50	2520	\$18,900
SUBTOTAL:					\$1,329,300
CONTINGENCY: 30%					\$398,790
TOTAL COST:					\$1,728,090
BRIDGE COST/SF (OTHER ITEMS):					\$52.90
TOTAL					
SUBTOTAL:					\$4,638,470
CONTINGENCY: 30%					\$1,391,541
TOTAL COST:					\$6,030,011
BRIDGE COST/SF (WITH OTHER ITEMS):					\$184.58

Structure Name: **Sunset over Rillito Creek**
 Superstructure Type: **BT66 Girders**
 Substructure Type: **Multi Column Piers & Seat Type Abutments**
 Foundation Type: **Drilled Shafts**
 No. of Spans: **3**
 Span Lengths (ft): **128.08, 129.42, 128.08**
 Skew (deg): **0°**

Total Length (ft):	390.08
Width (Out to Out) (ft):	83.75
Area (sq ft):	32,669.20