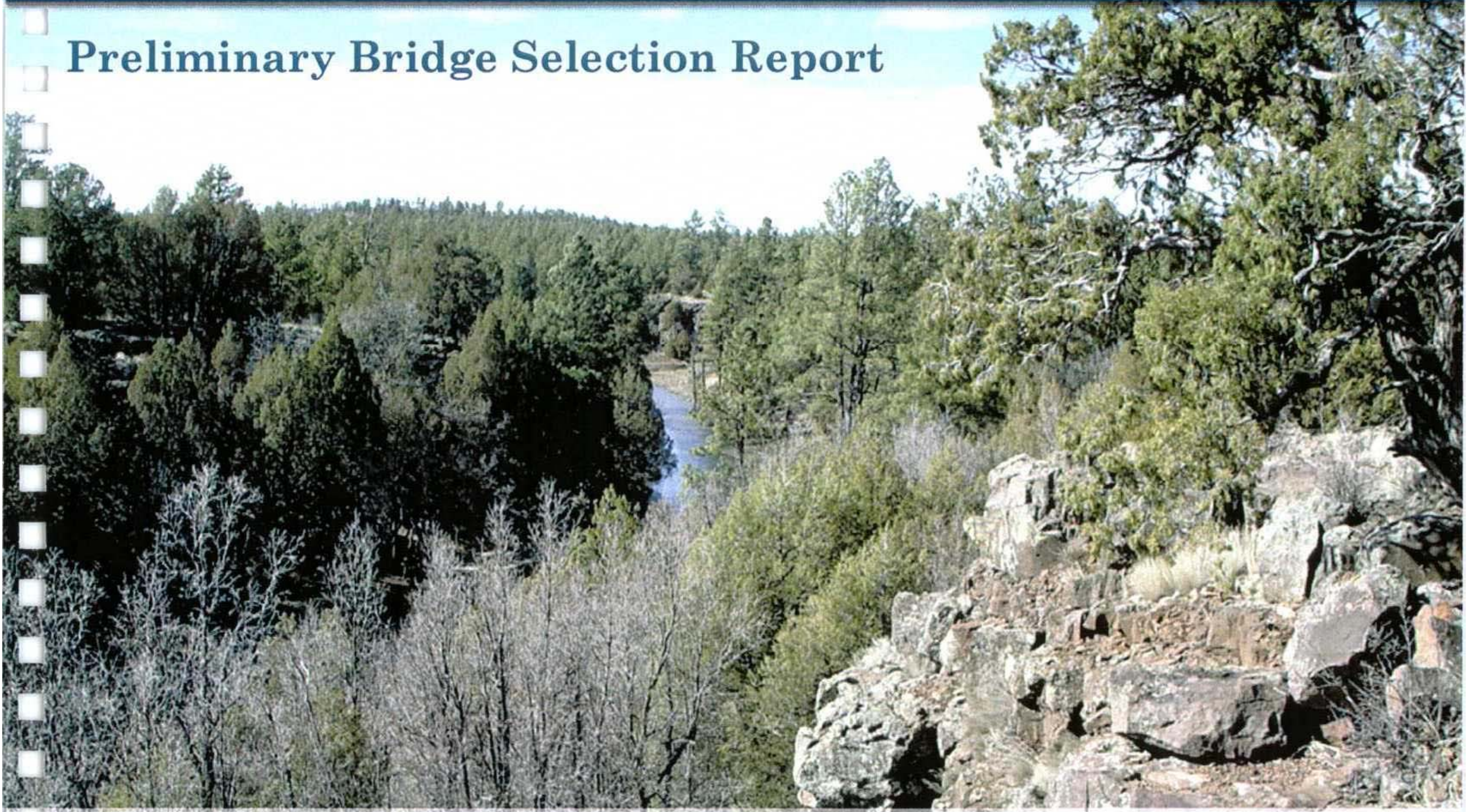
SCOTT RANCH ROAD, SR-260 TO PENROD ROAD

Preliminary Bridge Selection Report



Prepared By:

TYLIN INTERNATIONAL

60 East Rio Salado Parkway, Suite 501
Tempe, Arizona 85281
Phone: 480.968.8814
Fax: 480.921.0002

Prepared For:

City of Show Low Arizona 1953

ADOT TRACS NO. SS673 01C
Federal No. HPP-SLW-(200)A

JULY 2009

SCOTT RANCH ROAD
SR-260 TO PENROD ROAD

ADOT TRACS NO: SS673 01C
FEDERAL NO: HPP-SLW-(200)A

PRELIMINARY BRIDGE SELECTION REPORT

JULY 2009

PREPARED FOR:
CITY OF SHOW LOW

T.Y. LIN INTERNATIONAL
60 E RIO SALADO PKWY, SUITE 501
TEMPE, AZ 85281
TEL: (480) 968-8814 – FAX: (480) 921-0002

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1.0 BACKGROUND

The *Design Concept Report, Scott Ranch Road SR 260 to Penrod Road July 2009,* describes the development, evaluation and recommendations for an improvement proposed for the City of Show Low (COSL) in southern Navajo County, Arizona. The proposed improvements as related to this report consists of the construction of a new bridge over Show Low Creek.

Transportation improvement needs have been identified in the 2007 *Southern Navajo/Apache County Sub-Regional Transportation Plan,* which recognizes Scott Ranch Road as a key element of the region's transportation improvement plan. The purpose of this project is to provide an east-west connection between SR-260 and Penrod Road, crossing Show Low Creek. The new creek crossing will improve traffic circulation in this area especially during high flow periods along this stretch of Show Low Creek.

1.1 Project Location

The project's western terminus is the existing terminus of Scott Ranch Road, approximately 700 feet east of the intersection of Scott Ranch Road and SR-260, adjacent to the existing Home Depot. The eastern terminus is the point of intersection with Penrod Road, approximately 4.2 miles south of US-60. A Vicinity / Project Location Map is provided in Figure 1.

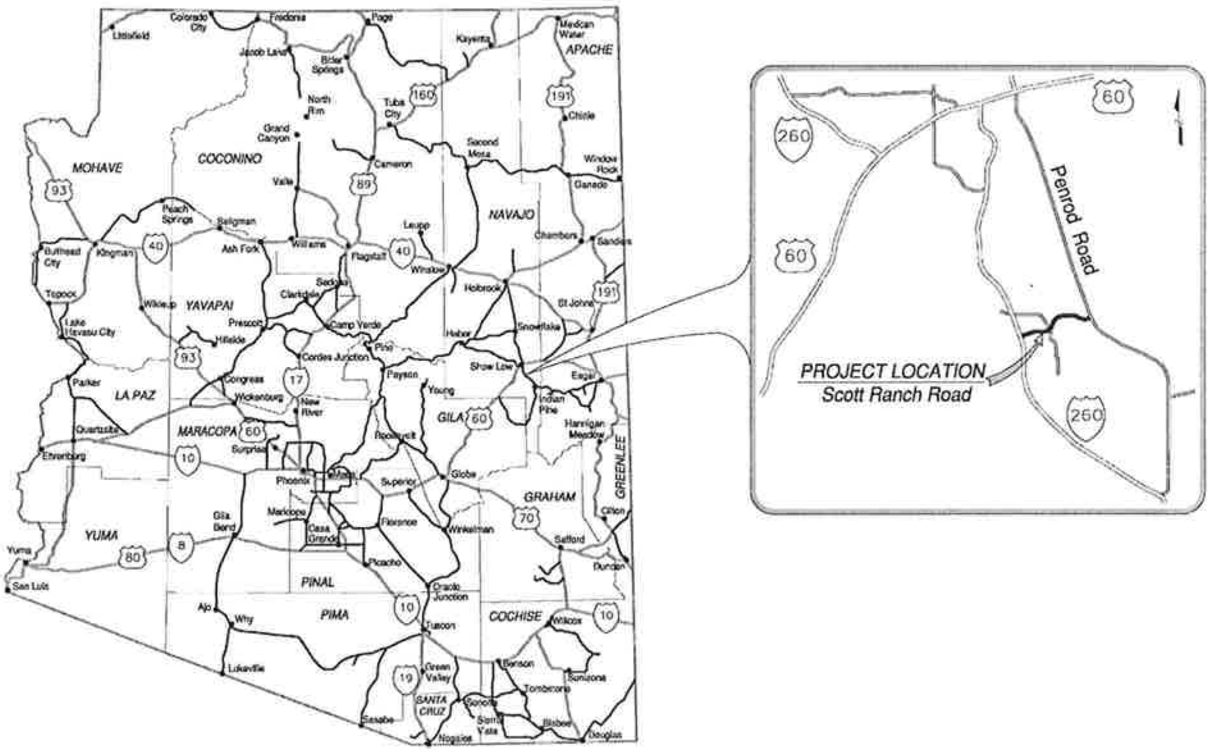

Figure 1 – Vicinity / Project Location Map

1.2 Project Description

The construction of Scott Ranch Road consists of constructing a new roadway and creek crossing for a total project length of 6,766 lineal feet (1.28Miles) measured from the existing terminus of Scott Ranch Road to the point of intersection with Penrod Road.

Existing utilities within the right-of-way have been identified in the *Design Concept Report Scott Ranch Road & Bridge – SR 260 to Penrod Road (DCR).* There will be a need to extend utilities across the new bridge. The size and amount will be determined during final design.

New drainage facilities have been identified in the *DCR*.

This Draft Bridge Selection Report addresses the alternatives studied in order to recommend a preferred structure type for the crossing of Show Low Creek.

1.3 Bridge Types and Configurations

The bridge type selection process is an assessment of the functional, project, and site specific parameters with respect to the economic and practical constraints for various bridge types at any given location. These constraints typically are imposed by items such as constructability, construction sequencing, traffic control, structural capacity/performance, roadway geometrics and bridge site constraints. Generally, the bridge types and configurations that are thought to be economical, practical, serviceable and aesthetically pleasing for that site are evaluated with these constraints taken into consideration. Economics and constructability are typically the governing constraints but on occasion another parameter may have a significant influence on the evaluation. The final recommended bridge type and configuration is that which best meets all of the applicable constraints.

Recent bridge construction history for the Arizona Department of Transportation has predominately consisted of concrete construction. The two primary bridge types utilized for most creek structures are the cast-in-place post-tensioned concrete box girder and the precast prestressed concrete AASHTO girder.

Cast-in-place post-tensioned concrete box girder bridges are very efficient bridge types that are constructed on falsework. Local contractors are very familiar with the required construction methods and have collected a sufficient amount of falsework material for this method of construction. This bridge type has minimal long term deflections. It generally has good reserved future capacity and has minimal maintenance cost. This structure type can accommodate varying bridge geometry and can span maximum openings of 300 feet.

The precast prestressed concrete AASHTO girder is typically used where rapid construction is desired or where falsework is not ideal. These girders are manufactured in Phoenix or Tucson and can be erected rapidly using one or two cranes. The main advantage of the precast girder system is the lack of falsework and minimal formwork for superstructure construction. This can greatly reduce construction restrictions over traffic or difficult access areas. The most efficient spans for individual girders are less than 140 feet. However, precast girders can be spliced together for longer spans. In addition, these girders have been used in combination with a cast-in-place structure. The resulting bridge spans can range efficiently up to 240 feet.

Composite steel girder bridges generally offer similar functional characteristics as precast girders and have been successfully utilized in Arizona. However, due to the location of fabrication plants and the general cost of structural steel, they have not been found to be as economical as concrete construction in this area.

The derivation of the bridge layout and span configuration is established through an evaluation of items including but not limited to economics, constructability, traffic control, structural capacity/performance, environmental issues, site and/or project constraints, roadway geometrics, embankment slopes, clear zones, drainage, and aesthetics. Several of these items are evaluated on a quantitative basis while others require engineering judgment and are more qualitative.

Abutment type and placement for typical structures range from stub abutments placed at the top of the embankment slope, which produces a maximum span length, to full-height abutments placed toward the bottom of the embankment slope, which produces a minimum span length. Stub abutments are supported on drilled shafts when located in fill slopes and drilled shafts or spread footings when located in cut slopes. Full-height abutments are supported on spread footings, large drilled shafts with transition caps or multiple rows of drilled shafts. For typical applications, in addition to supporting the bridge, these abutments essentially perform as standard retaining walls. In special cut slope cases though, abutments have been constructed as soil nailed walls and soldier pile walls. Similarly, in special fill slope cases, abutments have been constructed in conjunction with Mechanically Stabilized Earth (MSE) walls with the current trend placing a pier-type bent in front of the MSE wall.

Piers for bridge structures are typically multi-column bents due to the extreme width of the roadway on the structure. The pier caps are integral for post-tensioned box girder bridges but typically consist of a non-integral supporting beam for precast girder bridges. The columns are typically shaped to accommodate artwork designs and/or rustication and are supported by spread footings or individual drilled shafts with a transition cap. Spread footings, depending on soil conditions and columns spacing, can be isolated or continuous footings.

The technical design specifications and guidelines followed in the development of this bridge selection report for the new bridge are:

- AASHTO LRFD Bridge Design Specifications, Fourth Edition, 2007 and the 2008 Interim Revisions.
- ADOT LRFD Bridge Design Guidelines

1.4 Site Geology & Foundations

General

A Preliminary Geotechnical Engineering Report dated March, 2008 was prepared by Terracon Consulting Engineers & Scientists (Terracon). Terracon will provide a Final

Geotechnical Report to aid in developing the Stage III design efforts for the bridge on this project. The western bank of Show Low Creek is steep and nearly vertical consisting of basalt. The eastern bank gently slopes upward and also consists of basalt. Based on this preliminary report it is assumed all foundations will be supported on spread footings bearing on rock.

Seismic Considerations

The project location is not considered seismically active and is not located in the vicinity of a seismically active fault. The Map of Horizontal Acceleration at Bedrock for Arizona with 90 Percent Probability of Non-Exceedence in 50 Years by Ignatius Po Lam, Bruce, A. Schell and Kenneth M. Euge, 1992, recommends a horizontal acceleration of 4 percent of gravity. The above probability of occurrence corresponds to a return period of approximately 475 years.

With respect to seismic design, the acceleration level at the project site falls under the Seismic Performance Category (SPC) A. For the new bridge the AASHTO LRFD Bridge Design Specification, 4th Edition, 2007 with 2008 Interim Revisions specifies that the bridge be designed for Seismic Zone 1.

Groundwater

Excavations into the fractured bedrock may encounter shallow groundwater associated with Show Low Creek, when the excavation extends to depths below current creek levels.

1.5 Drainage

Preliminary drainage issues for this project are discussed in the *DCR.*

1.6 Utilities

A detailed discussion of utility issues for this project is included in the *DCR.*

1.7 Right-of-Way

The right-of-way requirements for this project are delineated in the *DCR.* All bridge construction will occur within the acquired right-of-way.

1.8 Construction Phasing and Maintenance of Traffic

A discussion of site specific construction sequencing and traffic control is included in the *IDCR.*

1.9 Structure Aesthetics

The three predominant features that contribute to the aesthetic appeal of a bridge structure are the superstructure type, overall configuration and architectural treatment. The box girder offers uniform simple lines, a comparatively shallow structure depth and an integral pier cap, which are known to be aesthetically pleasing characteristics. Precast prestressed girders offer a more complicated surface and a comparatively deeper structure. The pier cap is typically exposed but the use of dapped end girders leads to a more attractive integral look. When comparing these two structure types aesthetically, the box girder is generally the preferred alternative.

The overall bridge layout and configuration should produce the appearance of openness. Open slopes with stub abutments convey an unrestricted visual range to the viewer. Furthermore, longer span bridges with stub abutments are generally thought to be more attractive than shorter spans with full-height abutments. Therefore, whenever feasible, longer span bridges with stub abutments are preferred.

The proposed bridge will use pier wall supports that vary in width from 6' at the top and 3' at the top of footing.

2.0 SHOW LOW CREEK BRIDGE

2.1 General

The bridge includes two 12 foot lanes, two 8 foot shoulders and an 8 foot sidewalk on the left side of the bridge. The left side of the bridge has a Pedestrian Traffic Bridge Railing (SD 1.04) and the right side has a 32 inch F- Shape Concrete Barrier. The total width of the bridge is 50'-7" out-to-out.

2.2 Alternative 1 Cast-in-Place Post-Tensioned Concrete Box Girder

This alternative consists of 3 spans with lengths 109', 134' and 109'. The superstructure consists of 5 webs and the total depth is 5'-6". This alternative must be built on falsework. The west abutment is a stub abutment and the east abutment is a wall type abutment since there is a large difference in ground line elevation from left and right side of the bridge. Piers are located near the creek edges to minimize scour. The piers consist of one wall pier 17 feet wide and a varying thickness from 6 feet at the top to 3 feet at the bottom. By using a varying thick pier, the pier foundation construction can be economized and the elevation of the bridge has an aesthetic appeal. Note: Falsework in the creek may require a navigation construction window and additional 404 permitting.

2.3 Alternative 1A Cast-in-Place Post-Tensioned Concrete Box Girder

This alternative consists of 2 spans with lengths 176' and 176'. This alternative was studied to more effectively use post-tensioning, eliminate a girder line and reduce substructure cost by using only one pier. The superstructure consists of 4 webs and the total depth is 7'-0". This alternative must be built on falsework. The abutments and pier are like those of Alternative 1. The pier thickness varies from 7 feet at the top to 3 feet at the bottom. Note: Falsework in the creek may require a navigation construction window and additional 404 permitting.

2.4 Alternative 2 Precast/Prestressed Concrete AASHTO Type V Girders

Precast girders were chosen for this alternative to avoid the use of falsework. This alternative also has 3 spans with lengths 115'-10", 117'-4" and 115'-10". The superstructure consists of 6 girder lines with a spacing of 8'-6" and 8 inch cast-in-place concrete deck slab. To economize on girder fabrication, all girders have the same length. The abutments are similar to Alternative 1. The piers vary in thickness like Alternative 1 however a 6 foot deep by 6'-6" pier cap is required on top.

2.5 Alternative 3 Continuous Steel Plate Girders

Steel Plate girders were chosen for this alternative to be more aesthetic than precast girders and offer less weight during erection. This alternative has 2 spans with lengths 176', and 176'. The superstructure consists of 5 lines of girders with a spacing of 10'-1 1/2" and 9 inch cast-in-place concrete deck slab. The depth of the superstructure is 7'-0". The abutments are similar to Alternative 1. The pier is like the one described for Alternative 1A.

2.6 Construction Sequencing & Maintenance of Traffic

There are no specific requirements for construction of this bridge since it is a new bridge on a new alignment.

2.7 Drainage

Deck drains will not be required on this structure. Drainage of the bridge deck will be toward the end of bridge along the sidewalk and outside barrier. The deck runoff will be conveyed into the project on-site storm drain system.

2.8 Right-of-Way

The construction of this bridge will be within the acquired right-of-way.

2.9 Utilities

There will be utilities carried across the bridge. The size and amount will be determined during final design.

2.10 Cost Estimate

The unit costs used in estimating the construction cost for these alternatives are based on the most recent ADOT bid history. The estimated cost of these bridge alternatives based on 2009 dollars, including a 15% contingency to compensate for any unidentified construction items, is shown below. Differential roadway items such as embankment are negligible for these alternatives and therefore were not included as part of the cost comparison.

Alternative 1: Three span cast-in-place post-tensioned concrete box girder
Stub abutments on spread footings
Wall Piers on spread footings

Total structure cost: $1,746,968
Unit bridge cost/sf: $96.88

Alternative 1A: Two span cast-in-place post-tensioned concrete box girder
Stub abutments on spread footings
Wall Pier on Spread footing

Total structure cost: $1,773,836
Unit bridge cost/sf: $98.37

Alternative 2: Three span precast prestressed type v girders
Stub abutments on spread footings
Wall piers on spread footings

Total structure cost: $1,667,469
Unit bridge cost/sf: $94.68

Alternative 3: Two span continuous steel plate girders
Stub abutments on spread footings
Wall pier on spread footing

Total structure cost: $2,194,898
Unit bridge cost/sf: $121.72

2.11 Recommended Alternative

Alternative 2, a three-span precast prestressed type v girder bridge with stub abutments supported on spread footings and wall piers supported on spread footings is the recommended bridge type and configuration for this location. Alternative 1 and 1A are more aesthetic than Alternative 2 but did not prove to be as cost effective. Alternative 2 is the most economical, highly constructible by local contractors and typically requires minimal maintenance.

BRIDGE PLANS, ELEVATIONS AND TYPICAL SECTIONS

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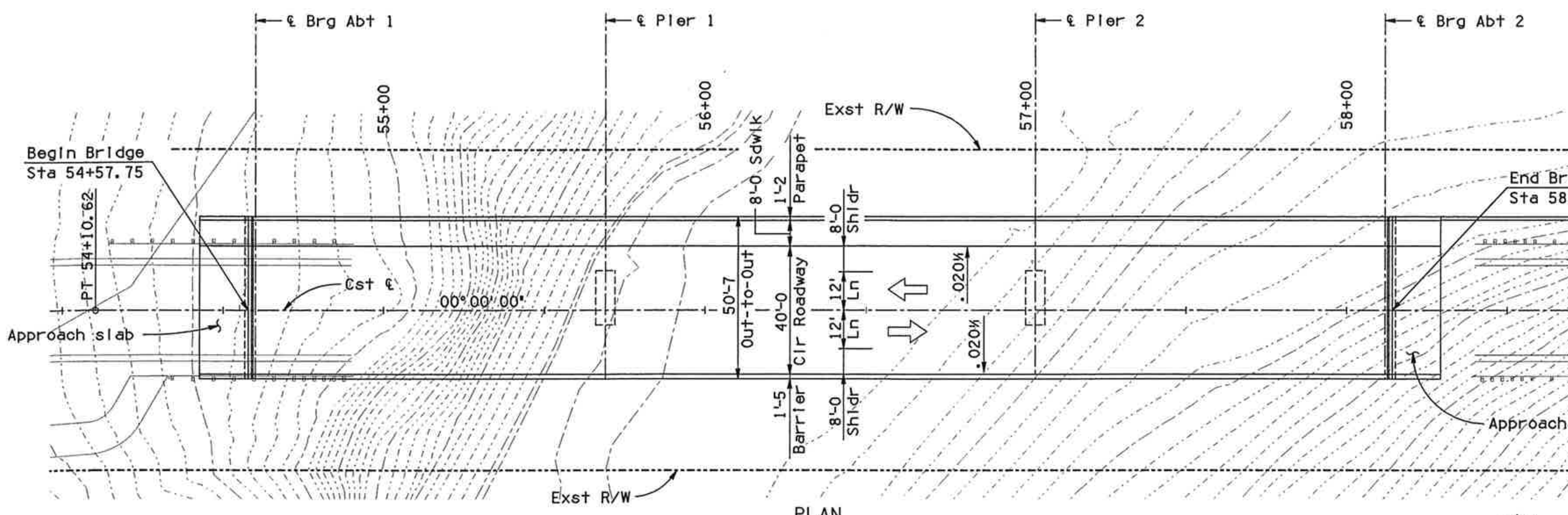

PLAN

New 3 Span Cast-In-Place Post Tensioned Box
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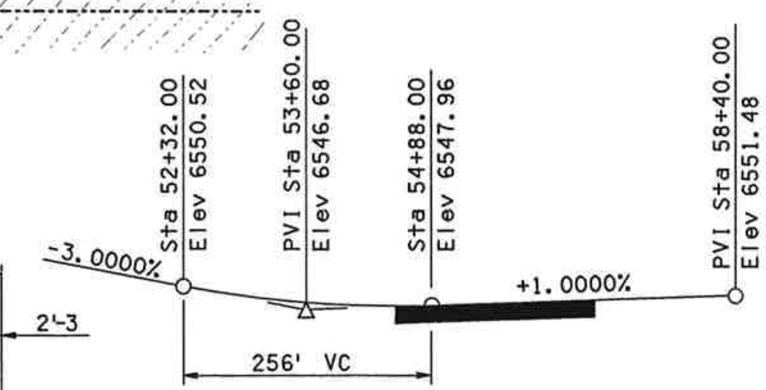

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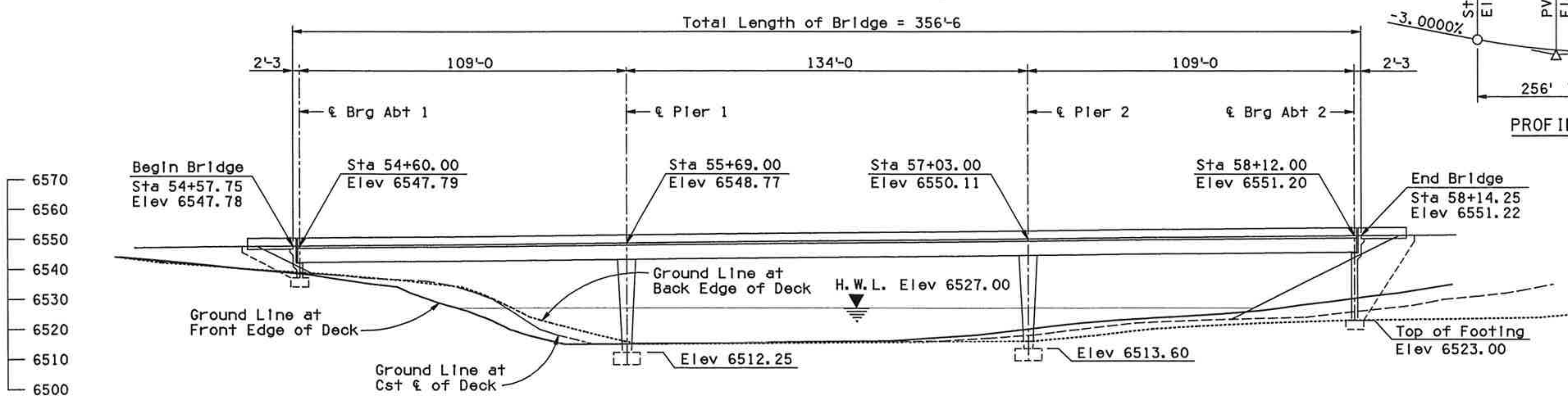

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LOCATION SCOTT RANCH ROAD

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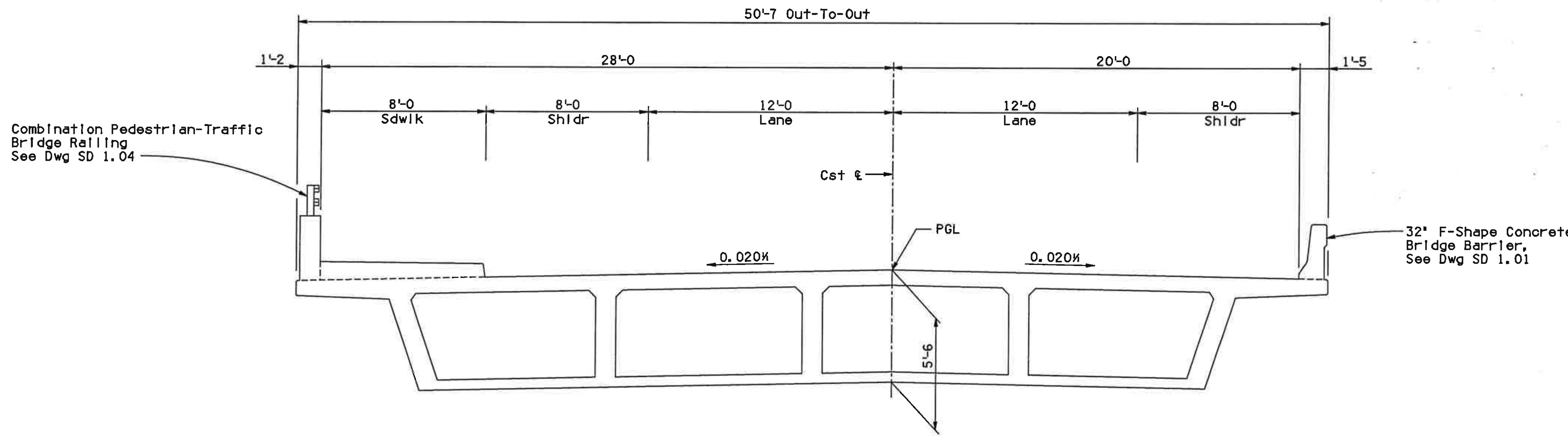

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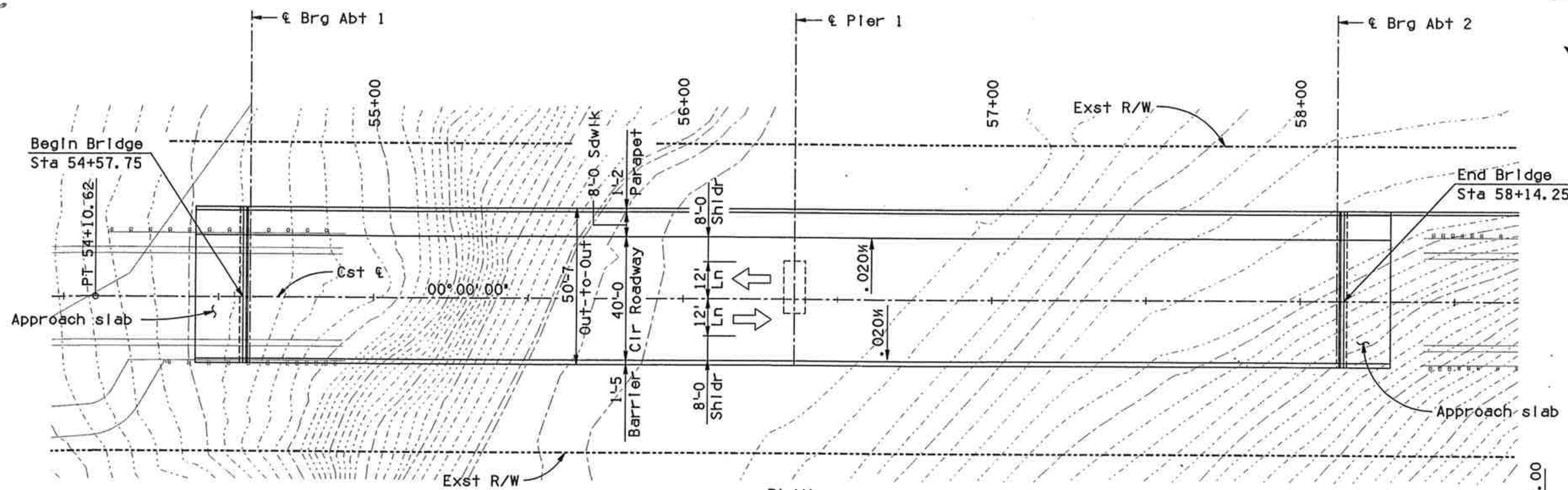

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New 2 Span Cast-In-Place Post Tensioned Box
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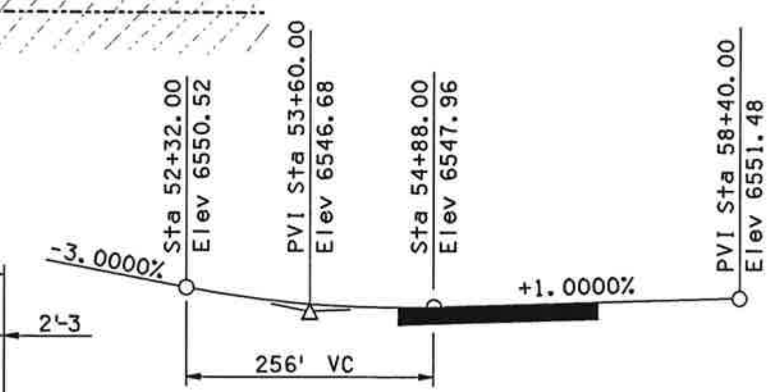

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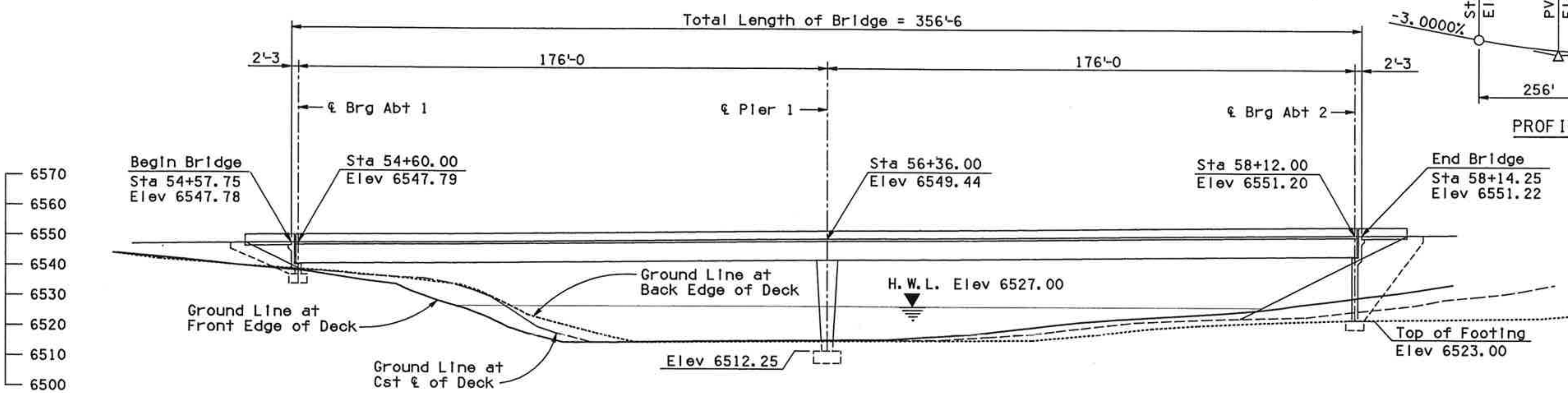

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GENERAL PLAN ALT 1A

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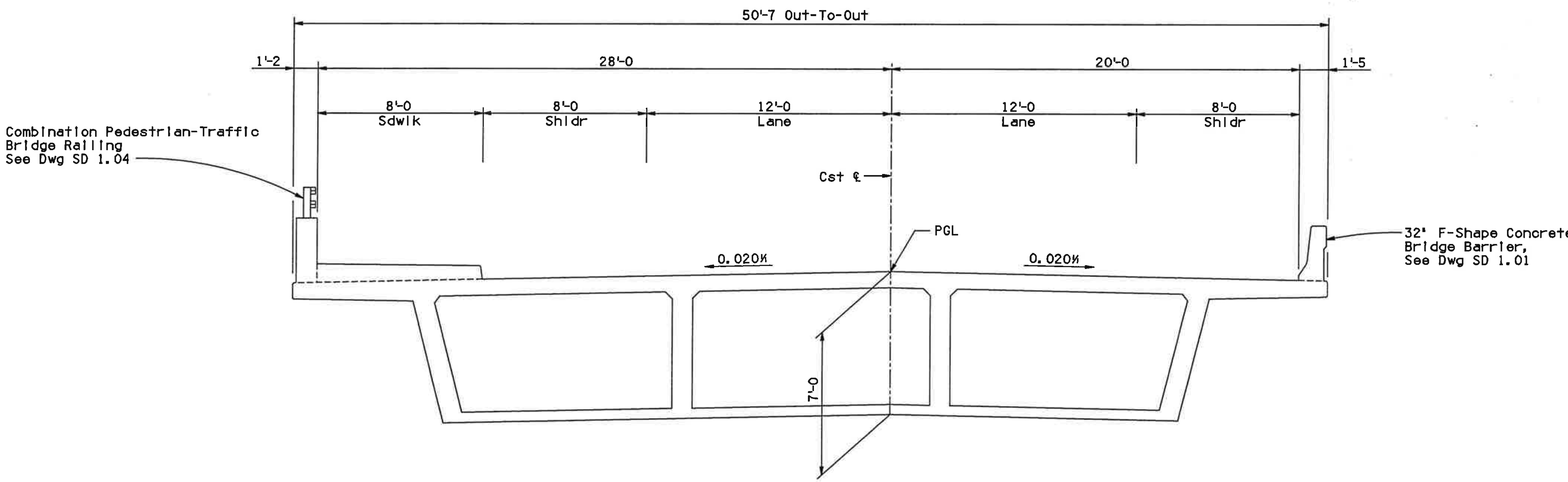

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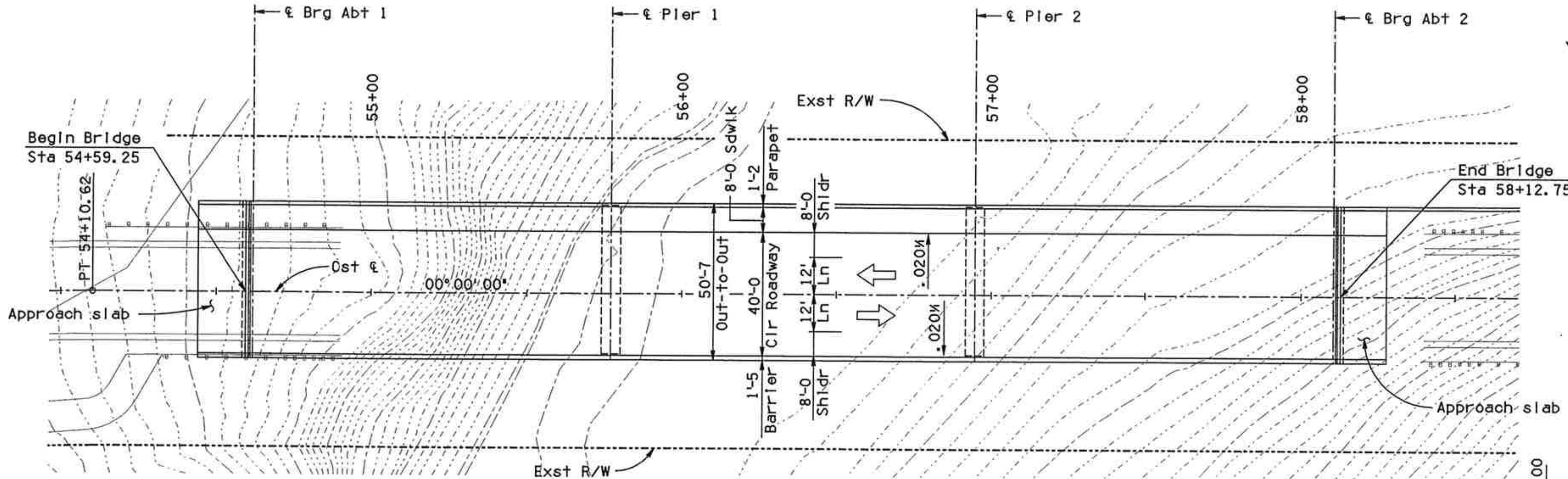

PLAN

New 3 Span Precast Prestressed Concrete AASHTO Type V Girder Bridge
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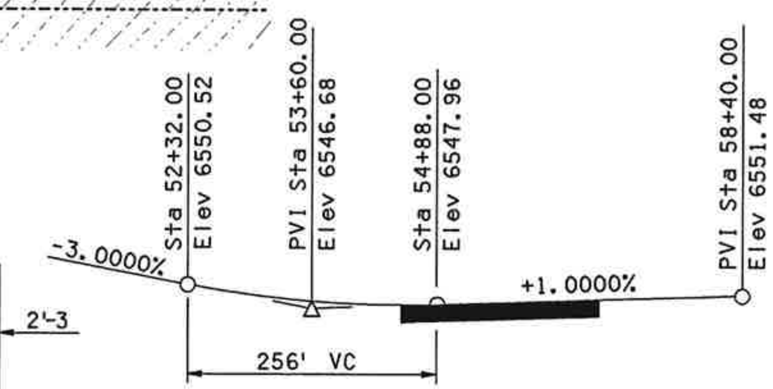

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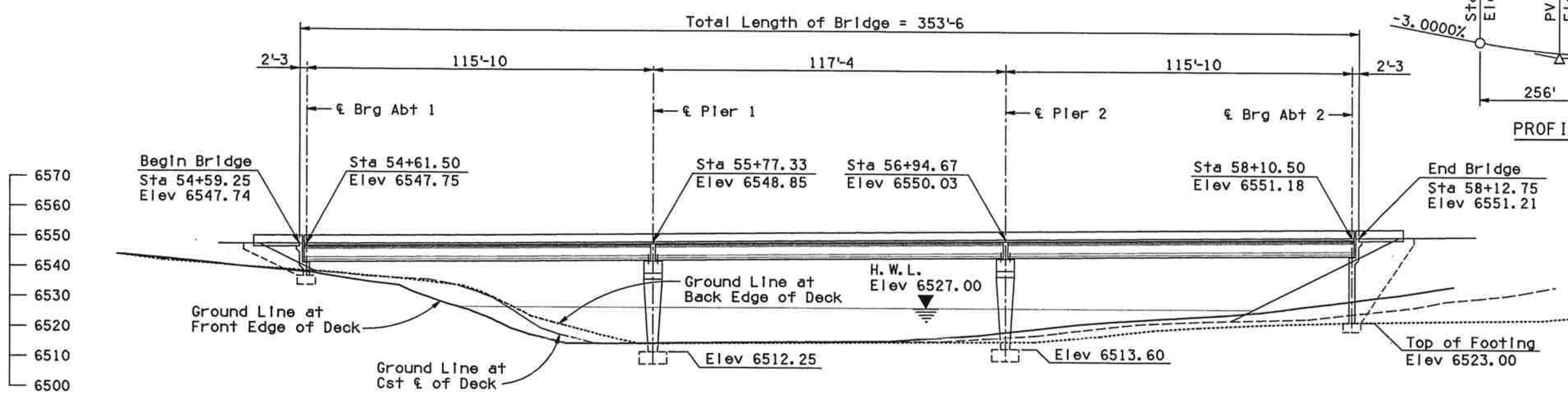

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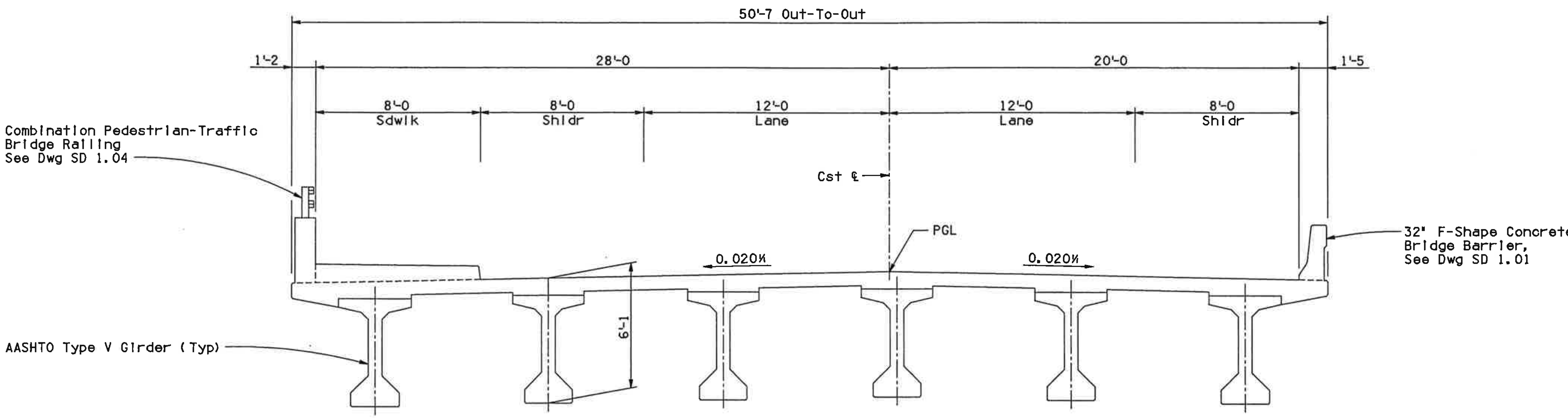

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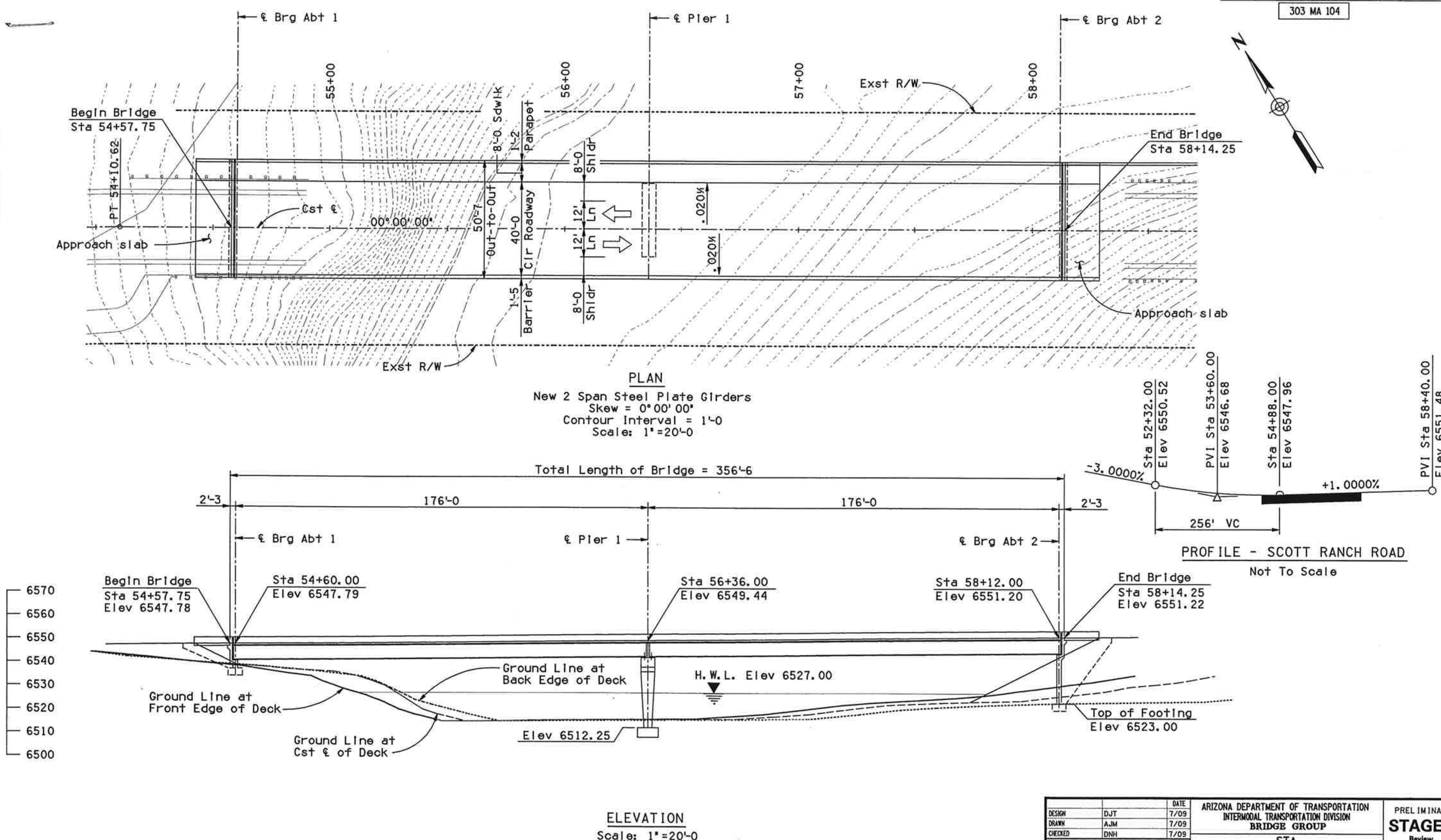

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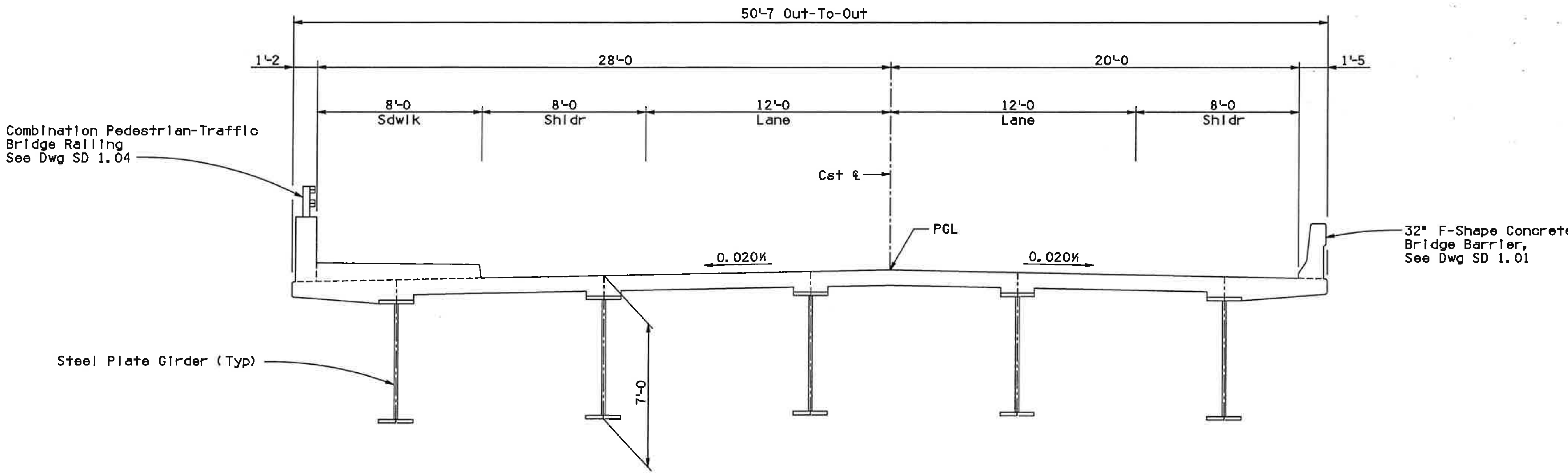

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SURVEY NO. | FINISHED PLANS- | REVISIONS- | LOCATION- | DATE- | SURVEY NO. | FINISHED PLANS- | REVISIONS- | LOCATION- | DATE-

Filename: O:\221656.00 Scott Ranch Road\CADD\Bridge\15%\Alt 3\Scott_Typ Sec_Alt 3.dgn

Date: 7/15/2009 Time: 5:18:00 PM

APPENDIX B

CONSTRUCTION COST ESTIMATE

SCOTT RANCH ROAD BRIDGE - ALT 1 - CIP/PT CONCRETE BOX GIRDER
PRELIMINARY COST ESTIMATE

ITEM NO.	DESCRIPTION	Quantity	Unit	Unit Price	Total Item Price
2030501	Structural Excavation	395	CY	$ 65.00	$ 25,675.00
2030506	Structure Backfill	230	CY	$ 30.00	$ 6,900.00
6010003	Structural Concrete (Class S) (F'c = 3500)	462	CY	$ 500.00	$ 231,000.00
6010006	Structural Concrete (Class S) (F'c = 5000)	1,148	CY	$ 600.00	$ 688,800.00
6011130	32" F- Shape Concrete Barrier	388	LF	$ 60.00	$ 23,280.00
6011132	Pedestrian Traffic Bridge Railing (SD 1.04)	388	LF	$ 165.00	$ 64,020.00
6011347	Deck Joint Assembly (3x3 Compression Seal)	49	LF	$ 200.00	$ 9,800.00
6011371	Approach Slab (SD 2.01)	1,440	SF	$ 20.00	$ 28,800.00
6050002	Reinforcing Steel	232,810	Lbs	$ 0.80	$ 186,248.00
6050012	Reinforcing Steel (Epoxy Coated)	115,110	Lbs	$ 1.00	$ 115,110.00
	Post-Tensioning Steel	46,490	Lbs	$ 3.00	$ 139,470.00
	Sub Total				$ 1,519,103.00
	15% Contingencies	1	Lump Sum		$ 227,865.45
	10% Mobilization	1	Lump Sum		$ 151,910.30
	Total Cost in numbers				$ 1,746,968.45
	Estimator: Dennis Trefren, P.E., S.E. T.Y.Lin Intl.				

	Bridge Length (ft) =	356.5			
	Bridge Width (ft) =	50.583			
	Cost/Sq Ft =	**$96.88**			
	Greg Harasha of Meadow Valley quoted all prices on 7/15/2009				

SCOTT RANCH ROAD BRIDGE - ALT 1A - 2 SPAN CIP/PT BOX GIRDER
PRELIMINARY COST ESTIMATE

ITEM NO.	DESCRIPTION	Quantity	Unit	Unit Price	Total Item Price
2030501	Structural Excavation	335	CY	$ 65.00	$ 21,775.00
2030506	Structure Backfill	190	CY	$ 30.00	$ 5,700.00
6010003	Structural Concrete (Class S) (F'c = 3500)	348	CY	$ 500.00	$ 174,000.00
6010006	Structural Concrete (Class S) (F'c = 5000)	1,154	CY	$ 600.00	$ 692,400.00
6011130	32" F- Shape Concrete Barrier	388	LF	$ 60.00	$ 23,280.00
6011132	Pedestrian Traffic Bridge Railing (SD 1.04)	388	LF	$ 165.00	$ 64,020.00
6011347	Deck Joint Assembly (3x3 Compression Seal)	49	LF	$ 200.00	$ 9,800.00
6011371	Approach Slab (SD 2.01)	1,440	SF	$ 20.00	$ 28,800.00
6050002	Reinforcing Steel	197,445	Lbs	$ 0.80	$ 157,956.00
6050012	Reinforcing Steel (Epoxy Coated)	117,970	Lbs	$ 1.00	$ 117,970.00
	Post-Tensioning Steel	82,255	Lbs	$ 3.00	$ 246,765.00
	Sub Total				$ 1,542,466.00
	15% Contingencies	1	Lump Sum		$ 231,369.90
	10% Mobilization	1	Lump Sum		$ 154,246.60
	Total Cost in numbers				$ 1,773,835.90
	Estimator: Dennis Trefren, P.E., S.E. T.Y.Lin Intl.				

	Bridge Length (ft) =	356.5			
	Bridge Width (ft) =	50.583			
	Cost/Sq Ft =	**$98.37**			
	Greg Harasha of Meadow Valley quoted all prices on 7/15/2009				

SCOTT RANCH ROAD BRIDGE - ALT 2 - TYPE V PRECAST GIRDER
PRELIMINARY COST ESTIMATE

ITEM NO.	DESCRIPTION	Quantity	Unit	Unit Price	Total Item Price
2030501	Structural Excavation	455	CY	$ 65.00	$ 29,575.00
2030506	Structure Backfill	260	CY	$ 30.00	$ 7,800.00
6010003	Structural Concrete (Class S) (F'c = 3500)	636	CY	$ 500.00	$ 318,000.00
6010005	Structural Concrete (Class S) (F'c = 4500)	527	CY	$ 500.00	$ 263,500.00
6011130	32" F- Shape Concrete Barrier	385	LF	$ 60.00	$ 23,100.00
6011132	Pedestrian Traffic Bridge Railing (SD 1.04)	385	LF	$ 165.00	$ 63,525.00
6011347	Deck Joint Assembly (3x3 Compression Seal)	49	LF	$ 200.00	$ 9,800.00
6011371	Approach Slab	1,440	SF	$ 20.00	$ 28,800.00
6014953	Prestressed Precast Members (Type V)	2,058	LF	$ 235.00	$ 483,630.00
6050002	Reinforcing Steel	151,210	Lbs	$ 0.80	$ 120,968.00
6050012	Reinforcing Steel (Epoxy Coated)	101,275	Lbs	$ 1.00	$ 101,275.00
	Sub Total				$ 1,449,973.00
	15% Contingencies	1	Lump Sum		$ 217,495.95
	10 % Mobilization	1	Lump Sum		$ 144,997.30
	Total Cost in numbers:				$ 1,667,468.95
	Estimator: Dennis Trefren, P.E., S.E. T.Y.Lin Intl.				

Bridge Length (ft) =	353.5
Bridge Width (ft) =	50.583
Cost/Sq Ft =	**$93.25**

Craig Douwstra of TPAC quoted price for girders on 7/7/2009

Greg Harasha of Meadow Valley quoted all other prices on 7/15/2009

SCOTT RANCH ROAD BRIDGE - ALT 3 - 2 SPAN STEEL PLATE GIRDER
PRELIMINARY COST ESTIMATE

ITEM NO.	DESCRIPTION	Quantity	Unit	Unit Price	Total Item Price
2030501	Structural Excavation	335	CY	$ 65.00	$ 21,775.00
2030506	Structure Backfill	190	CY	$ 30.00	$ 5,700.00
6010003	Structural Concrete (Class S) (F'c = 3500)	636	CY	$ 500.00	$ 318,000.00
6010005	Structural Concrete (Class S) (F'c = 4500)	510	CY	$ 500.00	$ 255,000.00
6011130	32" F - Shape Concrete Barrier	388	LF	$ 60.00	$ 23,280.00
6011132	Pedestrian Traffic Bridge Railing (SD 1.04)	388	LF	$ 165.00	$ 64,020.00
6011347	Deck Joint Assembly (3x3 Compression Seal)	49	LF	$ 200.00	$ 9,800.00
6011371	Approach Slab (SD 2.01)	1,440	SF	$ 20.00	$ 28,800.00
6040002	Structural Steel (A709 Grade 50W)	643,720	Lbs	$ 1.55	$ 997,766.00
6050002	Reinforcing Steel	87,145	Lbs	$ 0.80	$ 69,716.00
6050012	Reinforcing Steel (Epoxy Coated)	114,750	Lbs	$ 1.00	$ 114,750.00
	Sub Total				$ 1,908,607.00
	15% Contingencies	1	Lump Sum		$ 286,291.05
	10% Mobilization	1	Lump Sum		$ 190,860.70
	Total Cost in numbers				$ 2,194,898.05
	Estimator: Dennis Trefren, P.E., S.E. T.Y.Lin Intl.				

	Bridge Length (ft) =	356.5			
	Bridge Width (ft) =	50.583			
	Cost/Sq Ft =	**$121.72**			
	Jay Ochs of Stinger Welding quoted steel price on 7/8/2009				
	Greg Harasha of Meadow Valley quoted all other prices on 7/15/2009				