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Caltrans®

GOLDEN STATE BRIDGE
ENGINEERS & CONTRACTORS LIC. 851187

AGENDA

- Project Introduction
- Design Features and Visuals
- Unique Project Issue
- Lessons Learned and Takeaways

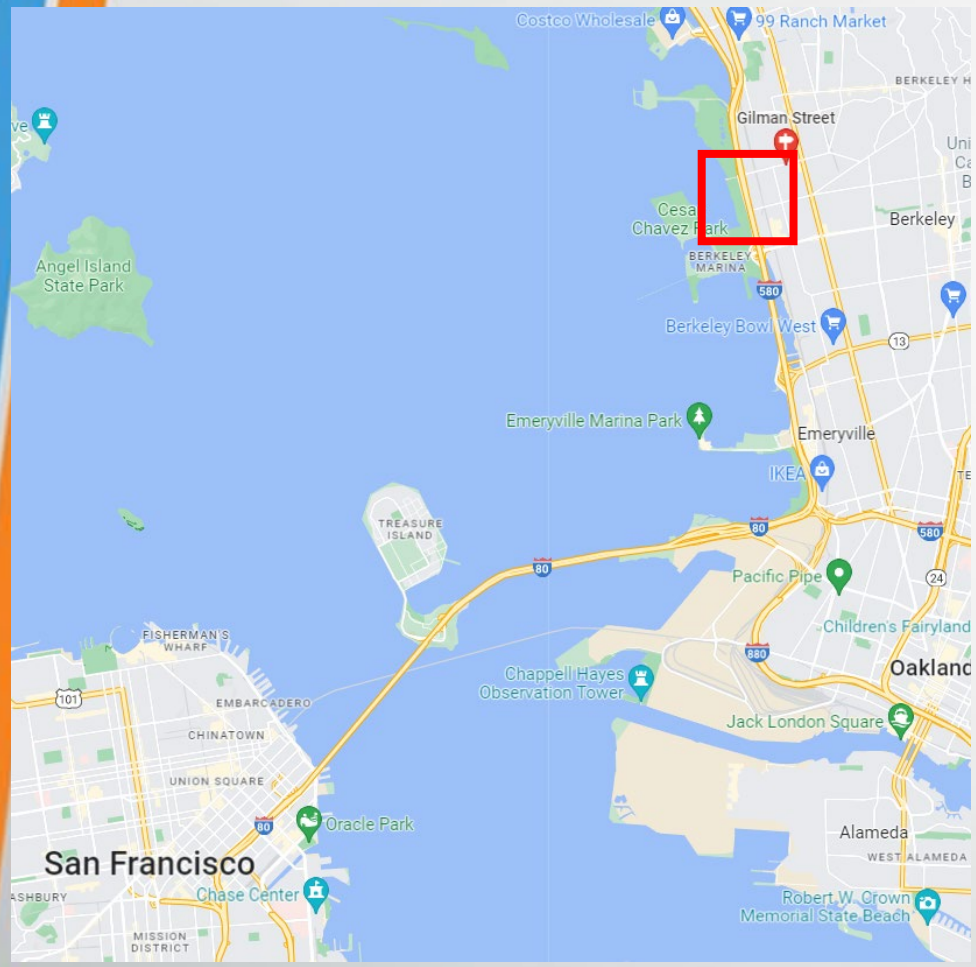
AGENDA

- **Project Introduction**
- Design Features and Visuals
- Unique Project Issue
- Lessons Learned and Takeaways

PRIMARY PROJECT PARTNERS

- California Department of Transportation (Caltrans)
  - Project Administration
- Golden State Bridge, Inc. (GSB)
  - Prime Contractor
- Alameda County Transportation Commission (ACTC)
  - Primary Funding Agency
- Parsons Corporation
  - Consultant Designer

PROJECT LOCATION



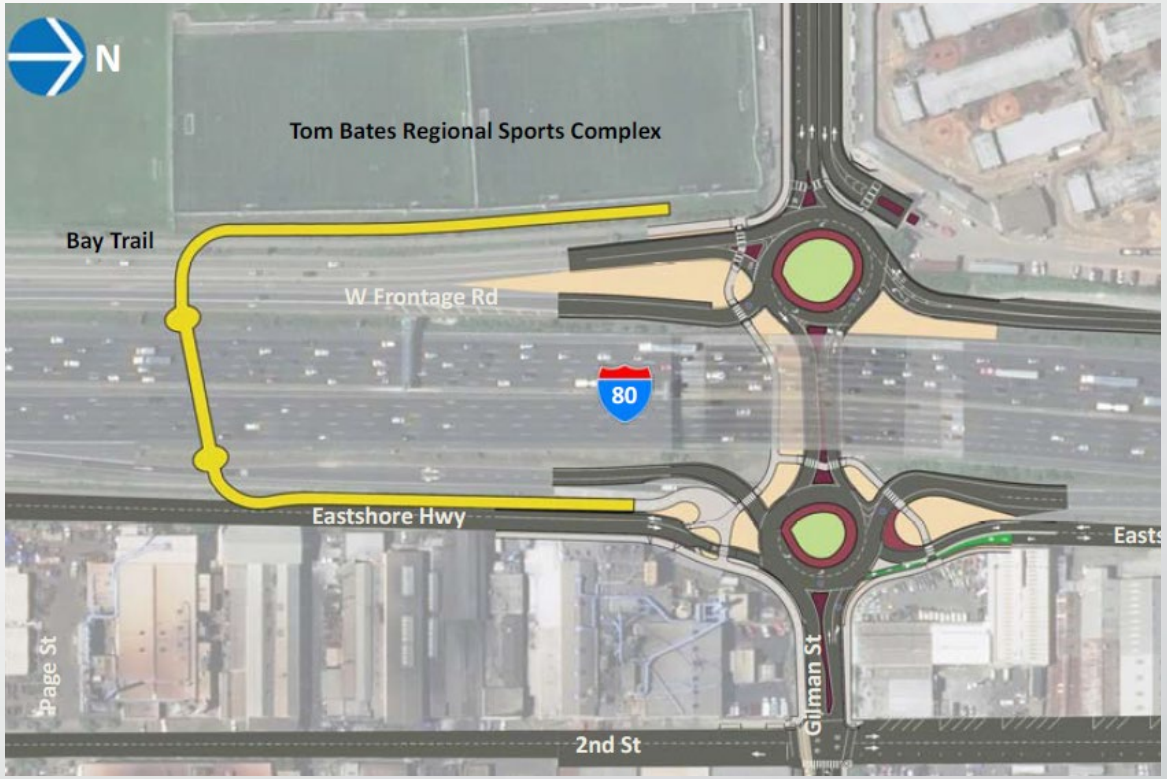
Berkeley, CA

PROJECT PURPOSE AND SCOPE

- First of two projects funded by ACTC to improve vehicular & pedestrian safety and traffic congestion at the I-80/Gilman Street interchange

PROJECT PURPOSE AND SCOPE

- This particular project involves construction of a new pedestrian overcrossing (POC) bridge over I-80 (a separate sister project involves construction of roundabouts to facilitate traffic flow)
- POC will provide a safe, alternate pedestrian path through the interchange



Conceptual Layout of POC (yellow)

PROJECT PURPOSE AND SCOPE

- This particular project involves construction of a new pedestrian overcrossing (POC) bridge over I-80 (a separate sister project involves construction of roundabouts to facilitate traffic flow)
- POC will provide a safe, alternate pedestrian path through the interchange

POC Falsework (mid-2022)

AGENDA

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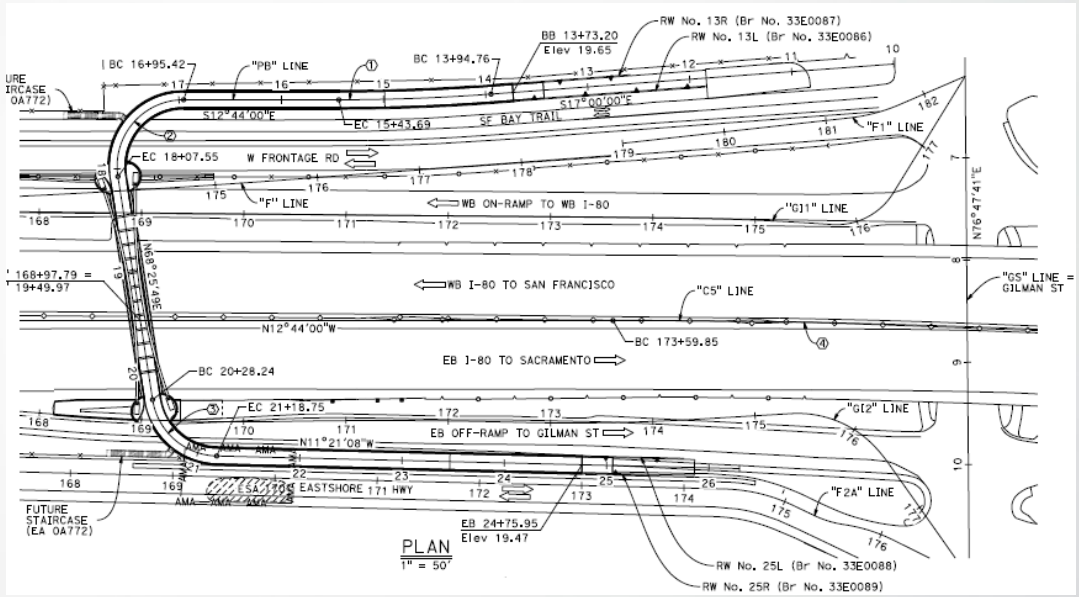
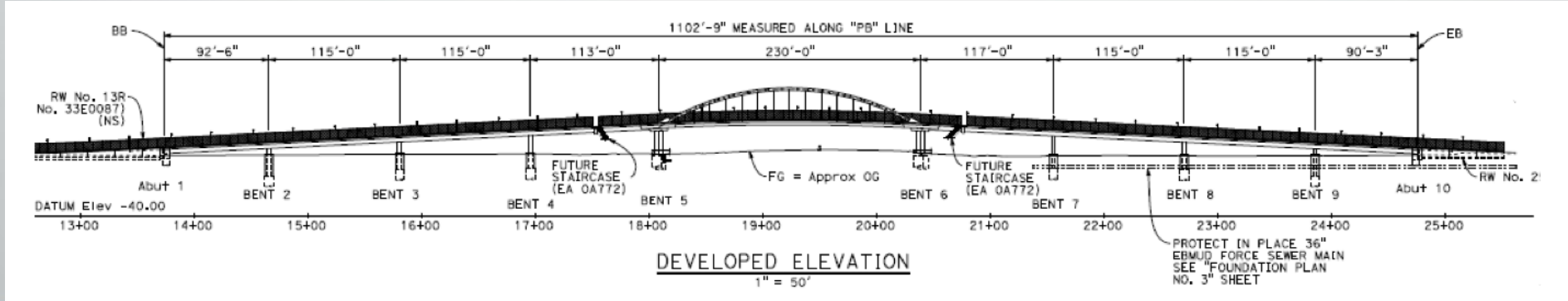
DESIGN FEATURES

- 230 ft long steel arch bridge with CIP post tensioned concrete deck
- 8 approach spans that vary in length from 90 ft to 115 ft with concrete box deck





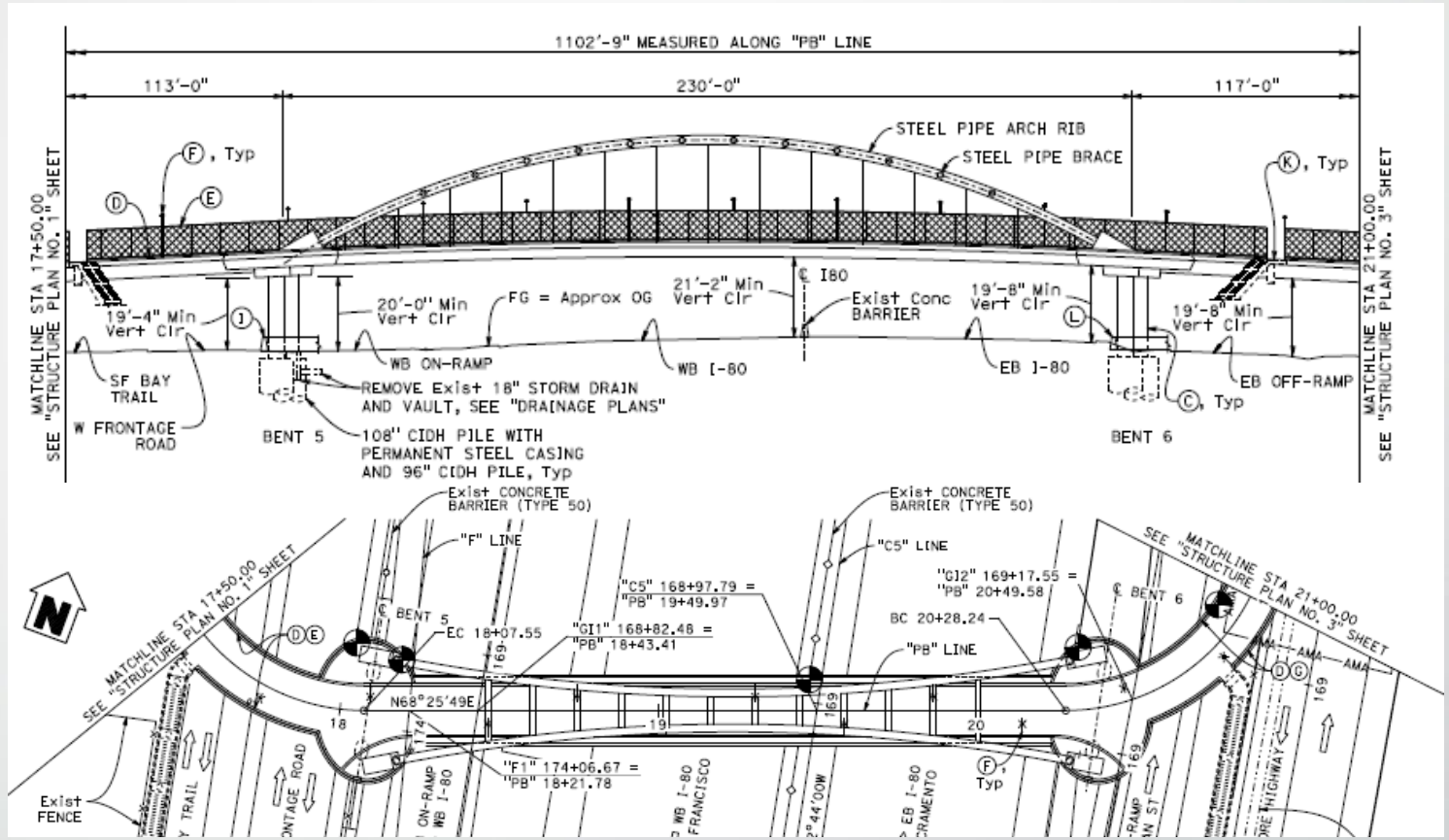
DESIGN FEATURES

- Bridge supported by oblong shaped columns
- Cast-in-drill holed hole (CIDH) concrete pile column foundations
- Permanent steel casings for top 15 to 16 feet of CIDH
- Both sides of the bridge approaches bounded by Type 5 retaining walls on CIDH pile/footing foundations

DESIGN FEATURES

Main Span

- Tied-arch bridge (basket handle) – Two parallel arches inclined towards each other and connected with rib braces
- Deck supported by vertical ties connected to the arch ribs
- Ends of each arch are “tied” together via post-tensioned deck to resist the thrust of the arch



VISUAL SIMULATIONS

I-80 Eastbound looking north

VISUAL SIMULATIONS

I-80 Eastbound Looking South

VISUAL SIMULATIONS

Eastshore Highway southeast of Gilman St

VISUAL SIMULATIONS

Bay Trail southwest of Gilman Street

AGENDA

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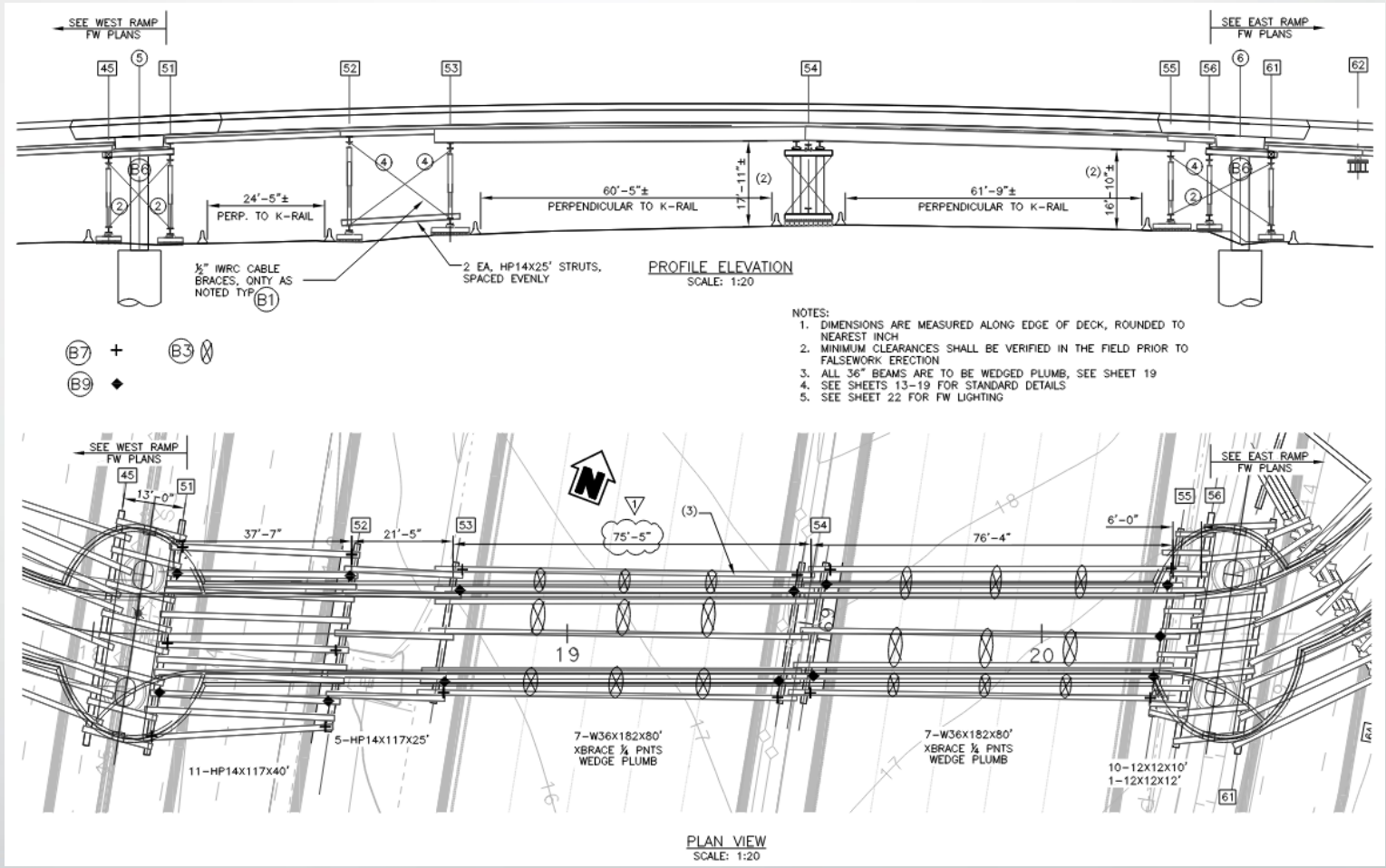
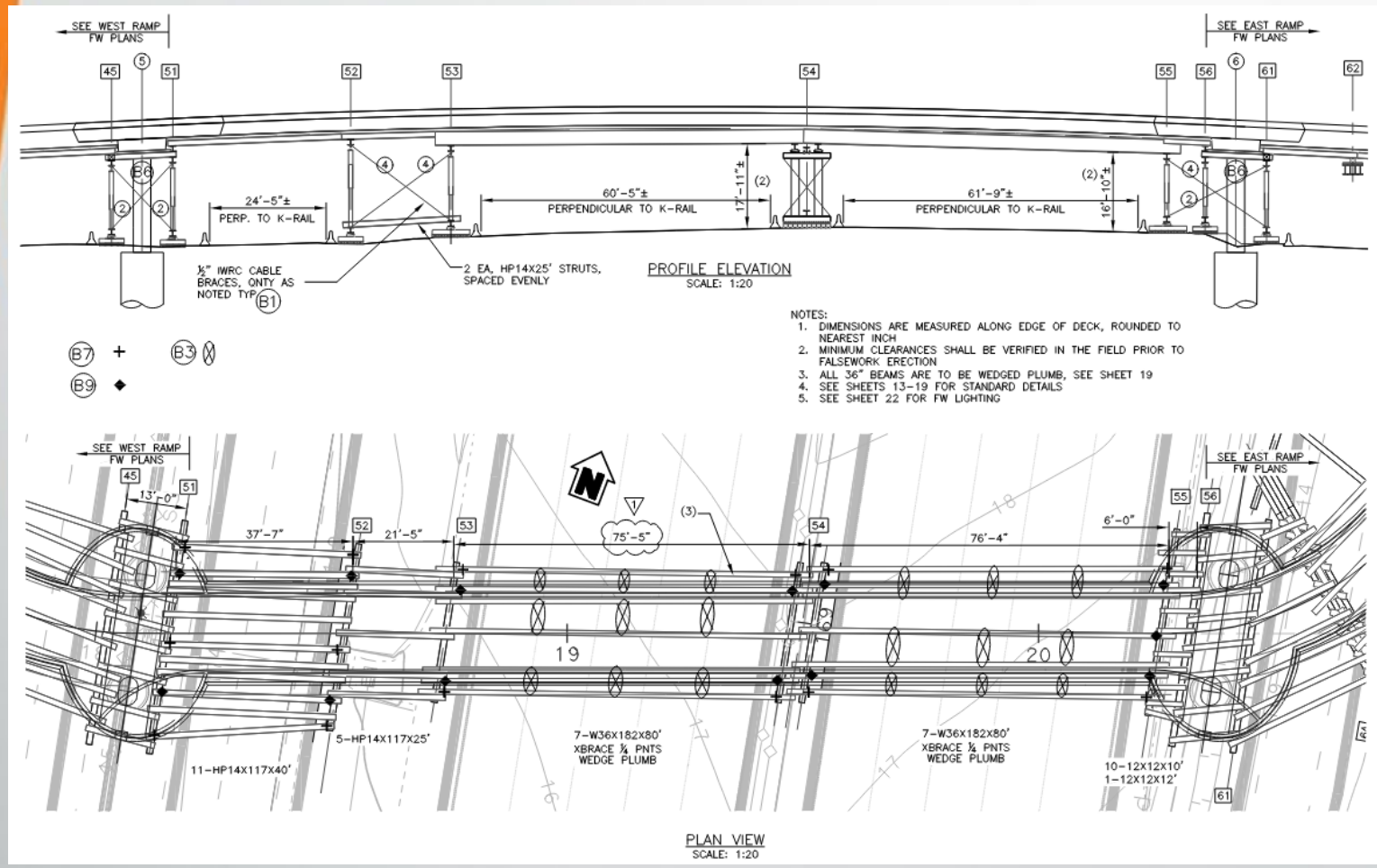
UNIQUE PROJECT ISSUE – MAIN SPAN CAMBER

Main Span Falsework

- The main span falsework system spanned over the WB On-Ramp, WB-80, and EB-80.



CAMBER STRIP VALUES PROVIDED TO GSB



Contract 04-OA7714
Gilman POC
Main Span Falsework
By Tom 4/28/2022

CAMBER STRIP VALUES:
Note camber value per contract plan between bent 5 and bent 6 is 0 (sheet 169 of 221 - girde

BNT 5-1 TO BNT 5-2 - CAMBER STRIP VALUE IN INCH

	DL
1/4 L	0.93
1/2 L	1.4
3/4 L	0.93

BNT 5-2 TO BNT 5-3 - CAMBER STRIP VALUE IN INCH

	DL
1/4 L	0.28
1/2 L	0.41
3/4 L	0.28

BNT 5-3 TO BNT 5-4 - CAMBER STRIP VALUE IN INCH

	DL
1/4 L	2
1/2 L	3
3/4 L	2

BNT 5-4 TO BNT 5-5 - CAMBER STRIP VALUE IN INCH

	DL
1/4 L	2.3
1/2 L	3.45
3/4 L	2.3

SET MAIN SPAN STRINGERS, CAMBER, AND SOFFIT PANELS

Set soffit panels with the values provided and started setting forms

MAIN SPAN HANGER PLATES AND GEOMETRIC CONTROL

- Hanger plates, which connect the main span to the cables, were set to theoretical elevation, independent from the soffit panels
- Once the soffit panels and hanger plates were set, GSB started verifying the locations and elevations of the tie hanger plates to confirm the cable lengths will work

ARCH RIB AND TIE GIRDER HANGER PANEL POINT COORDINATES

PANEL POINT	NORTH RIB			NORTH TIE			SOUTH RIB			SOUTH TIE		
	X (ft)	Y (ft)	Z (ft)	X (ft)	Y (ft)	Z (ft)	X (ft)	Y (ft)	Z (ft)	X (ft)	Y (ft)	Z (ft)
2	17.000	14.214	9.172	17.000	9.500	2.993	17.000	-14.214	9.172	17.000	-9.500	3.263
3	31.000	11.902	15.627	31.000	9.500	3.531	31.000	-11.902	15.627	31.000	-9.500	3.801
4	45.000	9.946	21.088	45.000	9.500	3.985	45.000	-9.946	21.088	45.000	-9.500	4.255
5	59.000	8.346	25.556	59.000	9.500	4.356	59.000	-8.346	25.556	59.000	-9.500	4.626
6	73.000	7.101	29.032	73.000	9.500	4.643	73.000	-7.101	29.032	73.000	-9.500	4.913
7	87.000	6.211	31.514	87.000	9.500	4.847	87.000	-6.211	31.514	87.000	-9.500	5.117
8	101.000	5.678	33.004	101.000	9.500	4.967	101.000	-5.678	33.004	101.000	-9.500	5.237
9	115.000	5.500	33.500	115.000	9.500	5.004	115.000	-5.500	33.500	115.000	-9.500	5.274
10	129.000	5.678	33.004	129.000	9.500	4.957	129.000	-5.678	33.004	129.000	-9.500	5.227
11	143.000	6.211	31.514	143.000	9.500	4.827	143.000	-6.211	31.514	143.000	-9.500	5.097
12	157.000	7.101	29.032	157.000	9.500	4.613	157.000	-7.101	29.032	157.000	-9.500	4.883
13	171.000	8.346	25.556	171.000	9.500	4.316	171.000	-8.346	25.556	171.000	-9.500	4.586
14	185.000	9.946	21.088	185.000	9.500	3.935	185.000	-9.946	21.088	185.000	-9.500	4.205
15	199.000	11.902	15.627	199.000	9.500	3.471	199.000	-11.902	15.627	199.000	-9.500	3.741
16	213.000	14.214	9.172	213.000	9.500	2.923	213.000	-14.214	9.172	213.000	-9.500	3.193

ARCH RIB SPLICE POINT COORDINATES

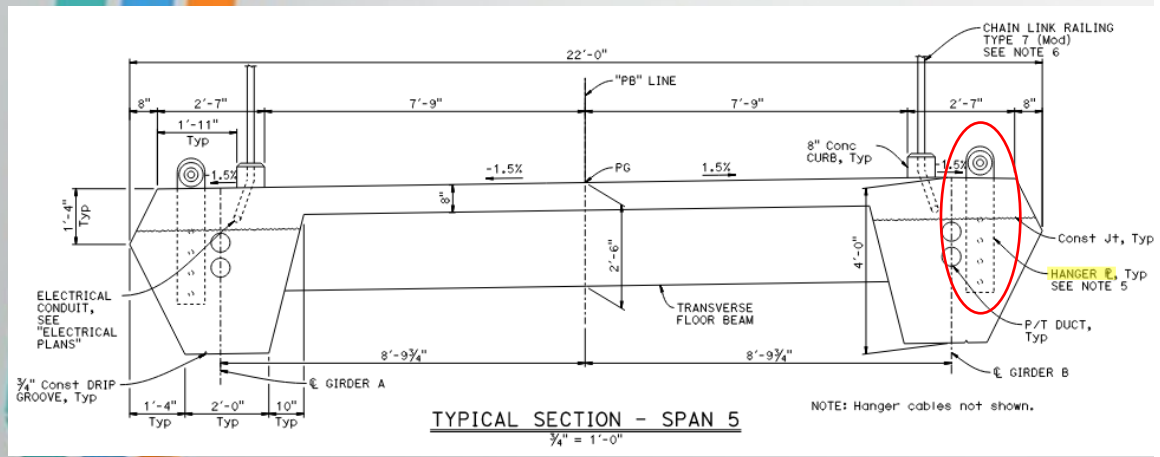
SPLICE	NORTH RIB			SOUTH RIB		
	X (ft)	Y (ft)	Z (ft)	X (ft)	Y (ft)	Z (ft)
1	32.500	11.676	16.259	32.500	-11.676	16.259
2	60.500	8.195	25.976	60.500	-8.195	25.976
3	88.500	6.137	31.721	88.500	-6.137	31.721
4	116.500	5.502	33.494	116.500	-5.502	33.494
5	141.500	6.137	31.721	141.500	-6.137	31.721
6	169.500	8.195	25.976	169.500	-8.195	25.976
7	197.500	11.676	16.259	197.500	-11.676	16.259

ARCH RIB STRUT POINT COORDINATES

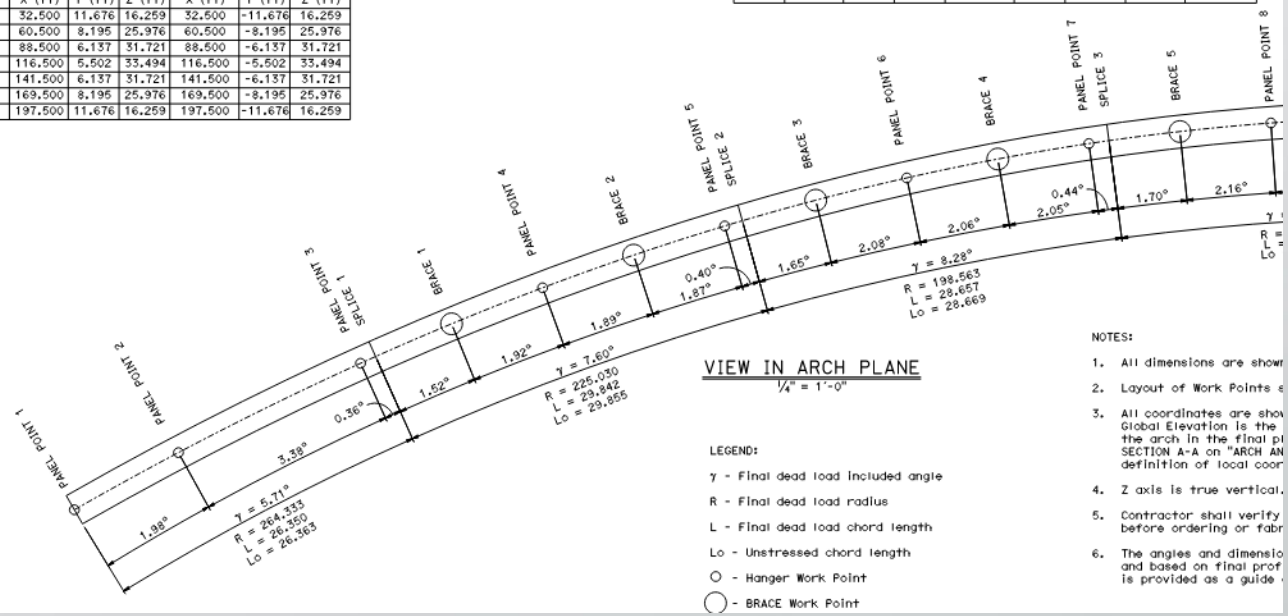
STRUT	NORTH RIB			SOUTH RIB		
	X (ft)	Y (ft)	Z (ft)	X (ft)	Y (ft)	Z (ft)
1	38.000	10.880	18.481	38.000	-10.880	18.481
2	52.000	9.101	23.446	52.000	-9.101	23.446
3	66.000	7.679	27.418	66.000	-7.679	27.418
4	80.000	6.612	30.397	80.000	-6.612	30.397
5	94.000	5.900	32.383	94.000	-5.900	32.383
6	108.000	5.544	33.376	108.000	-5.544	33.376
7	122.000	5.544	33.376	122.000	-5.544	33.376
8	136.000	5.900	32.383	136.000	-5.900	32.383
9	150.000	6.612	30.397	150.000	-6.612	30.397
10	164.000	7.679	27.418	164.000	-7.679	27.418
11	178.000	9.101	23.446	178.000	-9.101	23.446
12	192.000	10.880	18.481	192.000	-10.880	18.481

ARCH PRIMARY CONTROL POINT COORDINATES

POINT	NORTH RIB				SOUTH RIB			
	X (ft)	Y (ft)	Z (ft)	GLOBAL ELEVATION	X (ft)	Y (ft)	Z (ft)	GLOBAL ELEVATION
0	0.000	17.500	0.000	38.695	0.000	-17.500	0.000	38.695
18	230.000	17.500	0.000	38.695	230.000	-17.500	0.000	38.695



TYPICAL SECTION – SPAN 5
¾" = 1'-0"

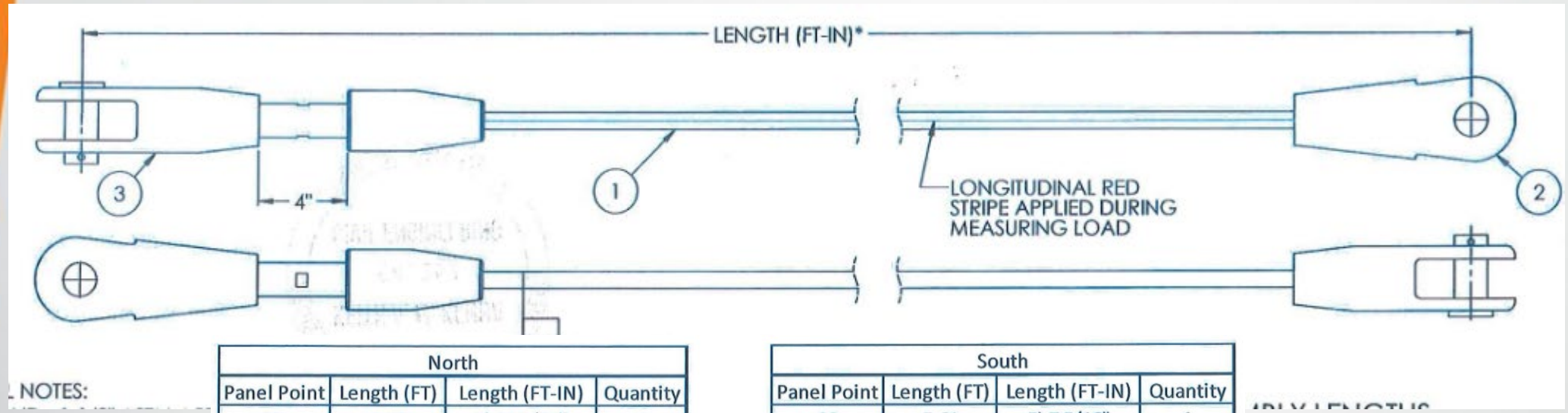


VIEW IN ARCH PLANE
¼" = 1'-0"

LEGEND:
γ - Final dead load included angle
R - Final dead load radius
L - Final dead load chord length
Lo - Unstressed chord length
○ - Hanger Work Point
◯ - BRACE Work Point

NOTES:
1. All dimensions are shown
2. Layout of Work Points s
3. All coordinates are sho Global Elevation is the the arch in the final p SECTION A-A on "ARCH AN definition of local coor
4. Z axis is true vertical.
5. Contractor shall verify before ordering or fabr
6. The angles and dimensio and based on final prof is provided as a guide

HANGER CABLES



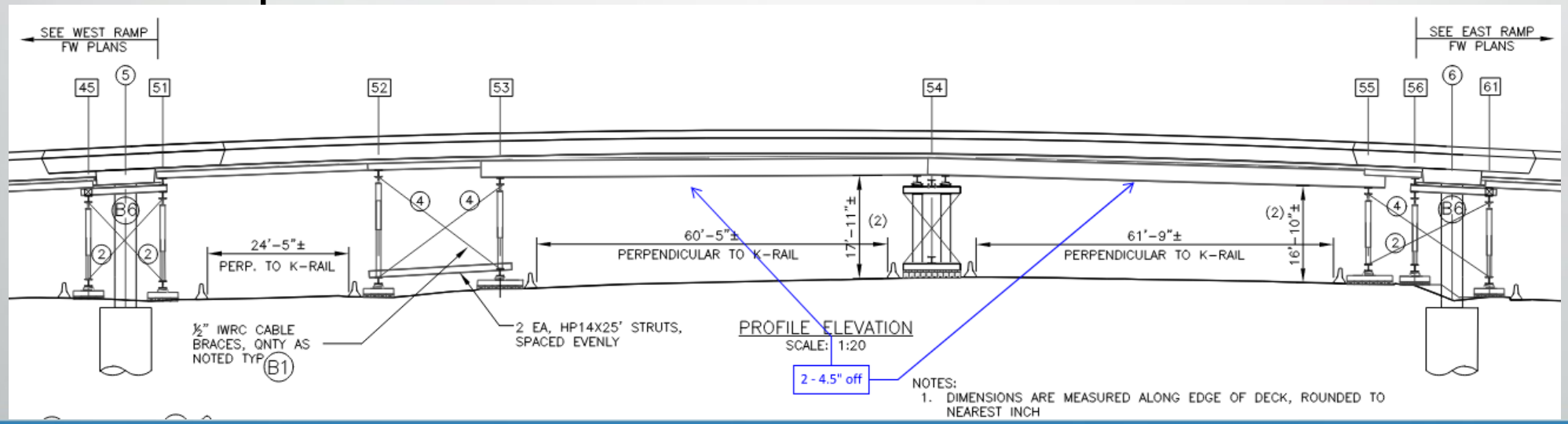
NOTES:

North			
Panel Point	Length (FT)	Length (FT-IN)	Quantity
2N	5.93	5'-11 3/16"	1
3N	10.37	10'-4 7/16"	1
4N	15.14	15'-1 11/16"	1
5N	19.27	19'-3 1/4 "	1
6N	22.6	22'-7 3/16"	1
7N	24.94	24'-11 1/4 "	1
8N	26.37	26'-4 7/16"	1
9N	26.85	26'-10 3/16"	1
10N	26.36	26'-4 5/16"	1
11N	24.92	24'-11 1/16"	1
12N	22.53	22'-6 3/8 "	1
13N	19.23	19'-2 3/4 "	1
14N	15.09	15'-1 1/16"	1
15N	10.31	10'-3 3/4 "	1
16N	5.87	5'-10 7/16"	1

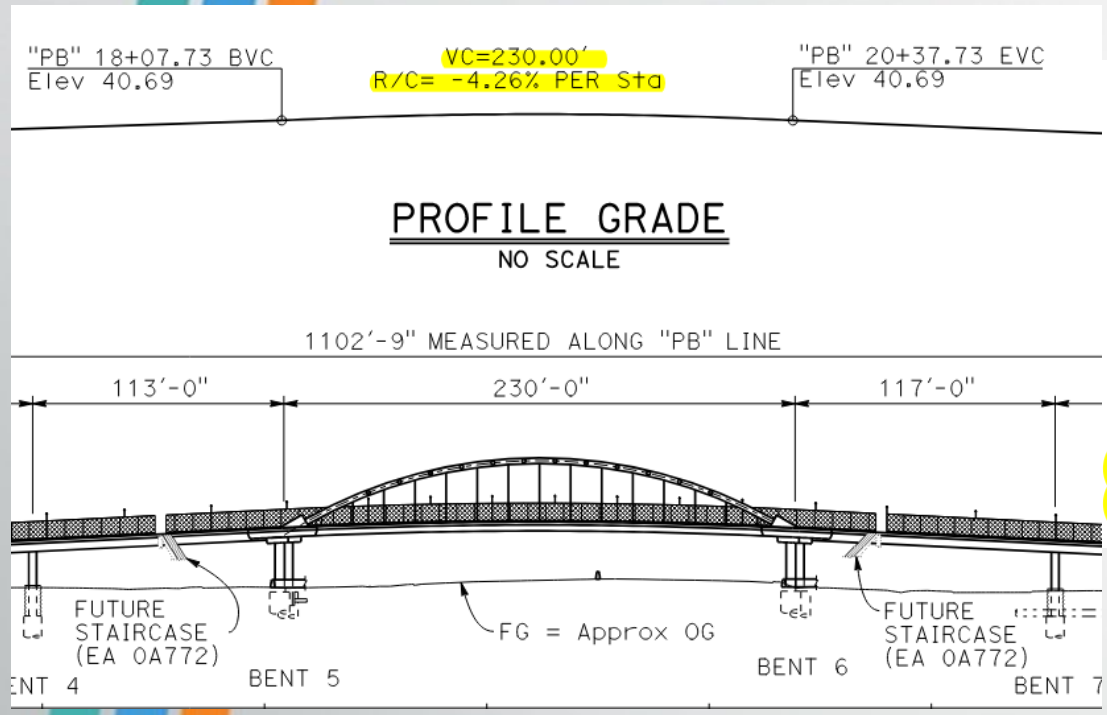
South			
Panel Point	Length (FT)	Length (FT-IN)	Quantity
2S	5.61	5'-7 5/16"	1
3S	10.1	10'-1 3/16"	1
4S	14.900	14'-10 13/16"	1
5S	19.05	19'-5/8 "	1
6S	22.36	22'-4 5/16"	1
7S	24.74	24'-8 7/8 "	1
8S	26.17	26'-2 1/16"	1
9S	26.65	26'-7 13/16"	1
10S	26.16	26'-1 15/16"	1
11S	24.72	24'-8 5/8 "	1
12S	22.33	22'-3 15/16"	1
13S	19.01	19'-1/8 "	1
14S	14.850	14'-10 3/16"	1
15S	10.03	10'-3/8 "	1
16S	5.55	5'-6 5/8 "	1

ISSUE PRESENTS ITSELF

- When verifying the soffit and elevation of the hanger plates, the theoretical “fill” values were not correct.
- There was a pattern where the values were generally OK above and near the falsework bents but far out of tolerance at the long falsework spans.



CAMBER VALUES DID NOT ACCOUNT FOR VERTICAL ALIGNMENT



SECTION 48 **TEMPORARY STRUCTURES**

48-2.03C Erection

Construct falsework to support the loads imposed without settlement or take-up beyond that shown on the falsework drawings.

Install the final bracing system before placing falsework members above stringers.

If falsework is over or adjacent to roadways or railroads, all details of the falsework system that contribute to horizontal stability and resistance to impact, except for bolts in bracing, must (1) be installed when each element of the falsework is erected and (2) remain in place until the falsework is removed.

If ordered, use camber strips to compensate for falsework deflection, vertical alignment, and anticipated structure deflection. The Engineer furnishes the amount of camber to be used in constructing falsework.

The Contract Plans do not state additional anticipated structure deflection.

It was determined that the provided values only accounted for falsework deflection.

Compensation for the vertical alignment was missed.

ADDITIONAL CONSIDERATIONS

- GSB submitted a RFI to Caltrans. The immediate direction was to continue with form, rebar, and PT duct installation.
- Caltrans held internal discussions to finalize how to proceed.
- By the time the final direction was provided, GSB was nearly ready to cast the main span girders.
- Also, the hanger cables were in fabrication to the theoretical lengths. It was too late to change hanger lengths without impacting the project schedule.

OWNER INTERNAL DISCUSSION

- Multiple stakeholders are involved in project; due to urgency and technical nature of issue, all needed to be included in collaboration on how to approach issue
  - Caltrans
    - Structure Construction
    - District 4 Construction
    - Bridge Design (Oversight)
    - District 4 Management
  - ACTC
  - Parsons Corporation (Consultant Design) – Designer of Record

MULTIPLE APPROACHES DISCUSSED

Option #1	Pros	Cons

• Leave bottom of girders at as-constructed soffit form elevations
• Construct deck to planned contours
• Bridge depth would vary (increased at mid-falsework spans)
	• Leave forms and falsework as is, eliminating need to rework installed soffit forms and falsework
	• Tie hanger plates installed at planned elevation and minimum embedment
		• Varying depth would require adjustment of rebar and exterior forms, and additional material
		• Increased bridge depth would increase falsework load
		• New configuration would require design analysis (post tension design, etc.) by consultant and oversight design
		  • Unknown delay due to review time
		  • Risk of new configuration not being acceptable
		• Aesthetics may be negatively impacted (bottom of bridge not smooth)

MULTIPLE APPROACHES DISCUSSED

Option #2	Pros	Cons

• Leave bottom of girders at as-constructed soffit form elevations
• Revise deck contours to provide a “best fit” profile
• Minimize variance in bridge depth
	• Leave forms and falsework as is, eliminating need to rework installed soffit forms and falsework
	• Compared to previous option, reduces amount of rebar and exterior form adjustment, as well as additional material
		• New configuration would require design analysis (post tension design, etc.) by consultant and oversight design
		  • Unknown delay due to review time
		  • Risk of new configuration not being acceptable
		• Because hanger plates need to be installed at planned elevation due to fixed cable lengths, hanger plates may not be installed at planned minimum embedment
		• Aesthetics may be negatively impacted (bottom of bridge not smooth)
		• ADA compliance of deck is not guaranteed

MULTIPLE APPROACHES DISCUSSED

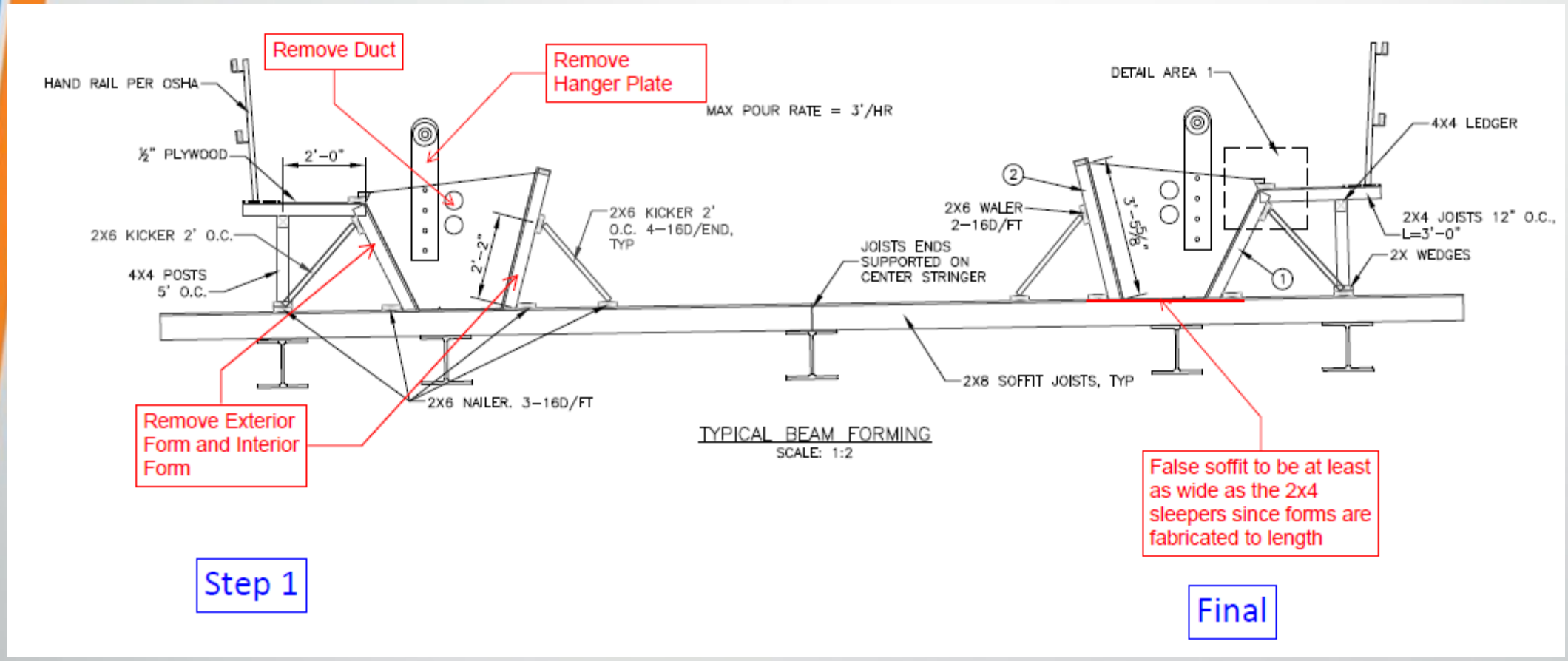
Option #3	Pros	Cons
• Build per plan	• Eliminates negative risks of previous options (cons)	• Require rework of forms and/or falsework

- It was decided to approach the issue with Option #3 to GSB, as the negative risks of the other two options were not acceptable

"BUILD PER PLAN" OPTIONS PROPOSED BY GSB

- Replace Camber Strips
  - Remove previously placed camber strips, install with correctly calculated strips that include vertical alignment.
  - To provide access to installed camber strips, crane would be required to lift soffit forms. Full closure of freeway would be needed.
  - Potential safety risk to crews working beneath the suspended soffit.
- False Soffit
  - Added formwork placed on top of existing soffit forms.
  - Additional camber strips would be installed underneath new forms to compensate for vertical alignment that wasn't included previously.
  - Closures not required.
  - Agreed option.

FALSE SOFFIT



- Sketch of proposed False Soffit fix provided by GSB

FALSE SOFFIT

CCO 12 - Fix Camber Strips			
Date	Description	Cost	Subcontractor Markup
GSB Labor and Equipment			
Varies	GSB estimates (5) weeks of 50 hour weeks to disassemble forms, raise the rebar as needed, slide in a false soffit, reset hanger embeds, reset and rekick forms. Below is a crew of 13 personnel	$ 573,069.23	$ -
Varies	GSB estimates 2 weeks of work for CMC Rebar to assist GSB as needed and retie any rebar as needed.	$ 80,554.38	$ 8,055.44
Varies	GSB estimates 1 weeks of work for Schwager Davis to reset their tubes.	$ 22,902.65	$ 2,290.27
	Total =	$ 676,526.26	$ 10,345.70
	Grand Total	$ 686,871.96	

Rough Estimate of Direct Cost and Time

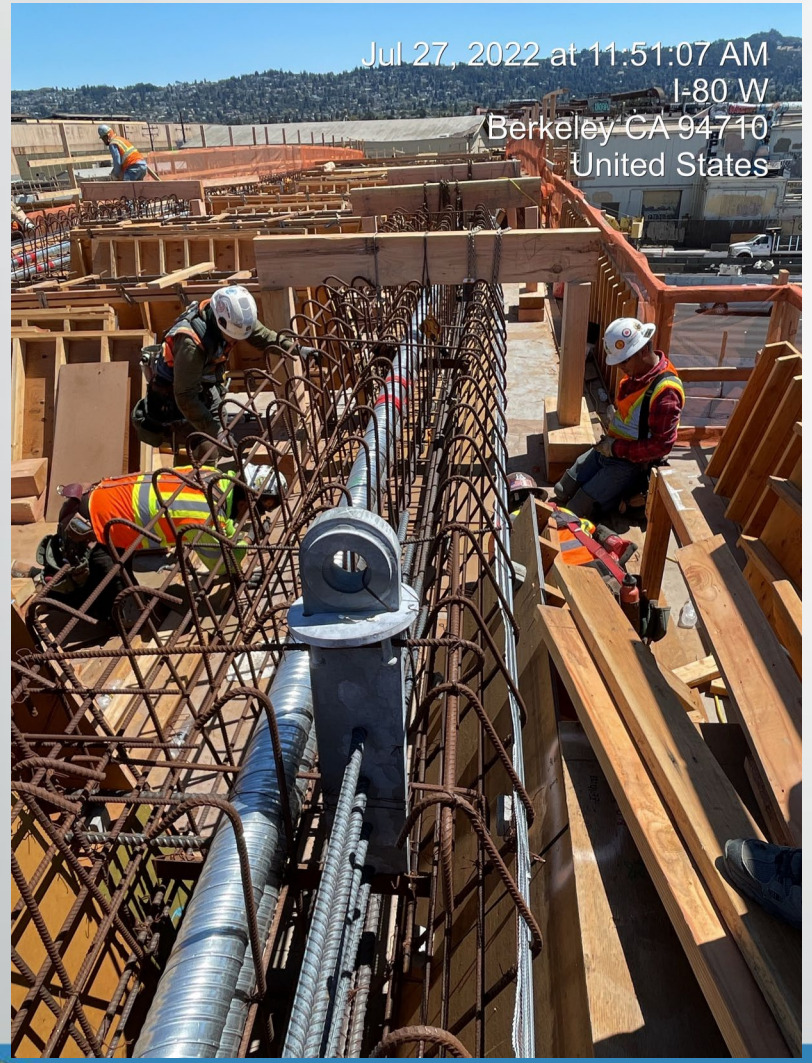
- Direct Cost: approximately $700,000
- Time: 8 total weeks

FALSE SOFFIT

- Stem panels were removed, but rebar was not removed. Contrary to what was anticipated, PT Ducts also did not have to be removed.
- The rebar cages were raised with come alongs and a temporary “U-Horse” made of 6x12s used as support.
- Caltrans provided additional “fill” values, accounting for vertical curve, for the added camber strips.
- The added camber strips and soffit were slid underneath the cage creating two soffits. Dobies and forms were reset.

FALSE SOFFIT

- False soffit was installed in 2 weeks. Hangers were set to the correct elevation.



FALSE SOFFIT

- GSB performed work expeditiously, improving on estimated direct costs and time and reducing the anticipated project impact.

	Estimated	Actual
Direct Costs	$ 690,000	$ 318,945.41
Time	8 Weeks	5 Weeks (25 Days)

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- Unique Project Issue
- **Lessons Learned and Takeaways**

LESSONS LEARNED – ISSUE SPECIFIC

- The camber strips provided by the Engineer should account for vertical alignment.
- Suggest showing the camber calculation to the Contractor. While the Contractor may not check the values nor is it their responsibility, the more eyes on it the better.
- Continue to be proactive and verify critical dimensions (cable lengths) throughout construction. While this issue was unfortunate, it could have been much worse if caught after the main span was cast.

ADDITIONAL TAKEAWAYS

- Taking ownership and accountability of issues leads to quicker resolution.
- Involving all stakeholders can uncover insights that may not have been apparent when only a select number of stakeholders are involved. This will also lead to buy-in of chosen solutions.
- Collaborative problem solving can result in more innovative and effective solutions that may not have been considered otherwise.

AERIAL PICS

AERIAL PICS

AERIAL PICS

AERIAL PICS


Questions?