Design and Construction of Route 86 over Table Rock Lake

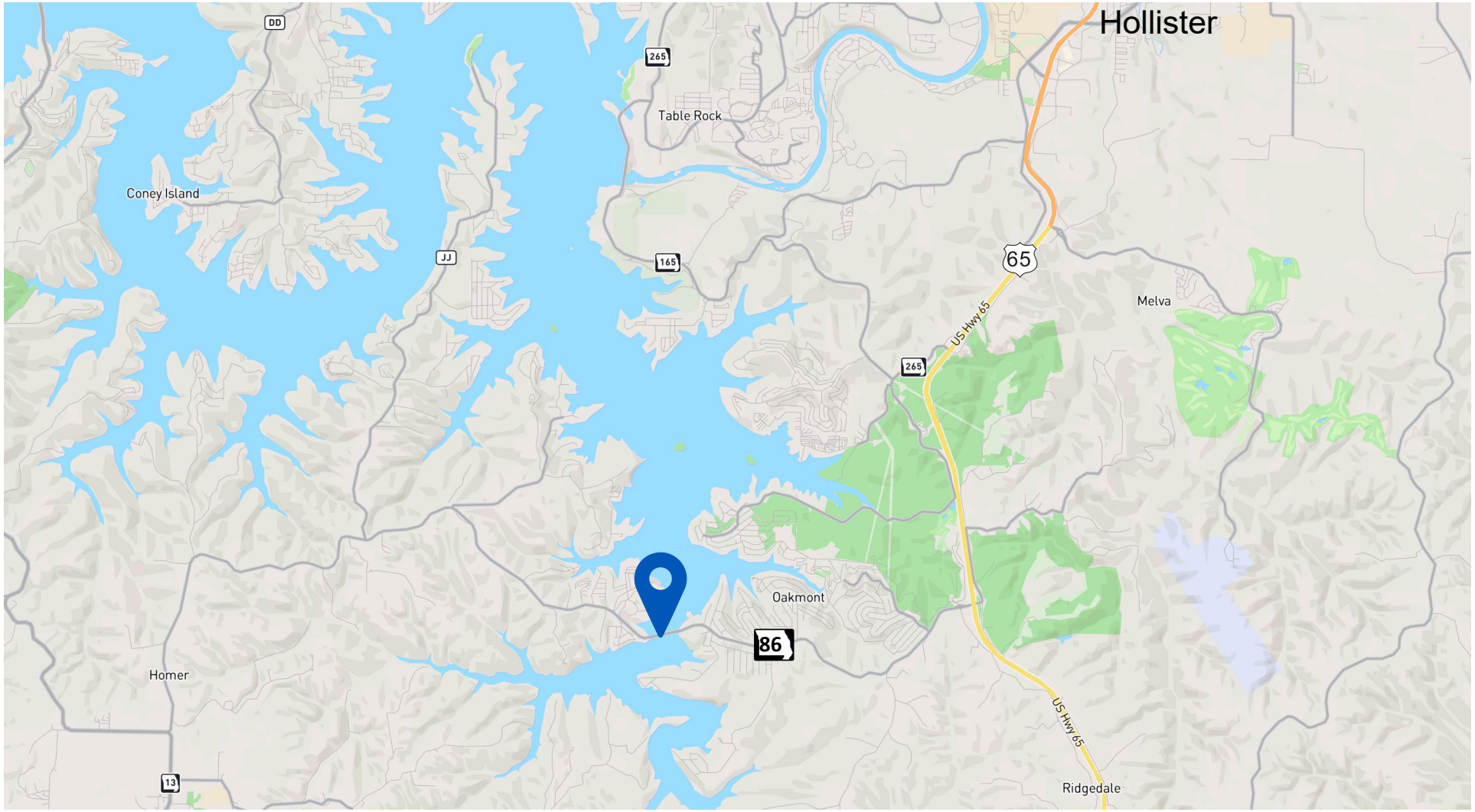
TEAM CONFERENCE

March 14, 2024

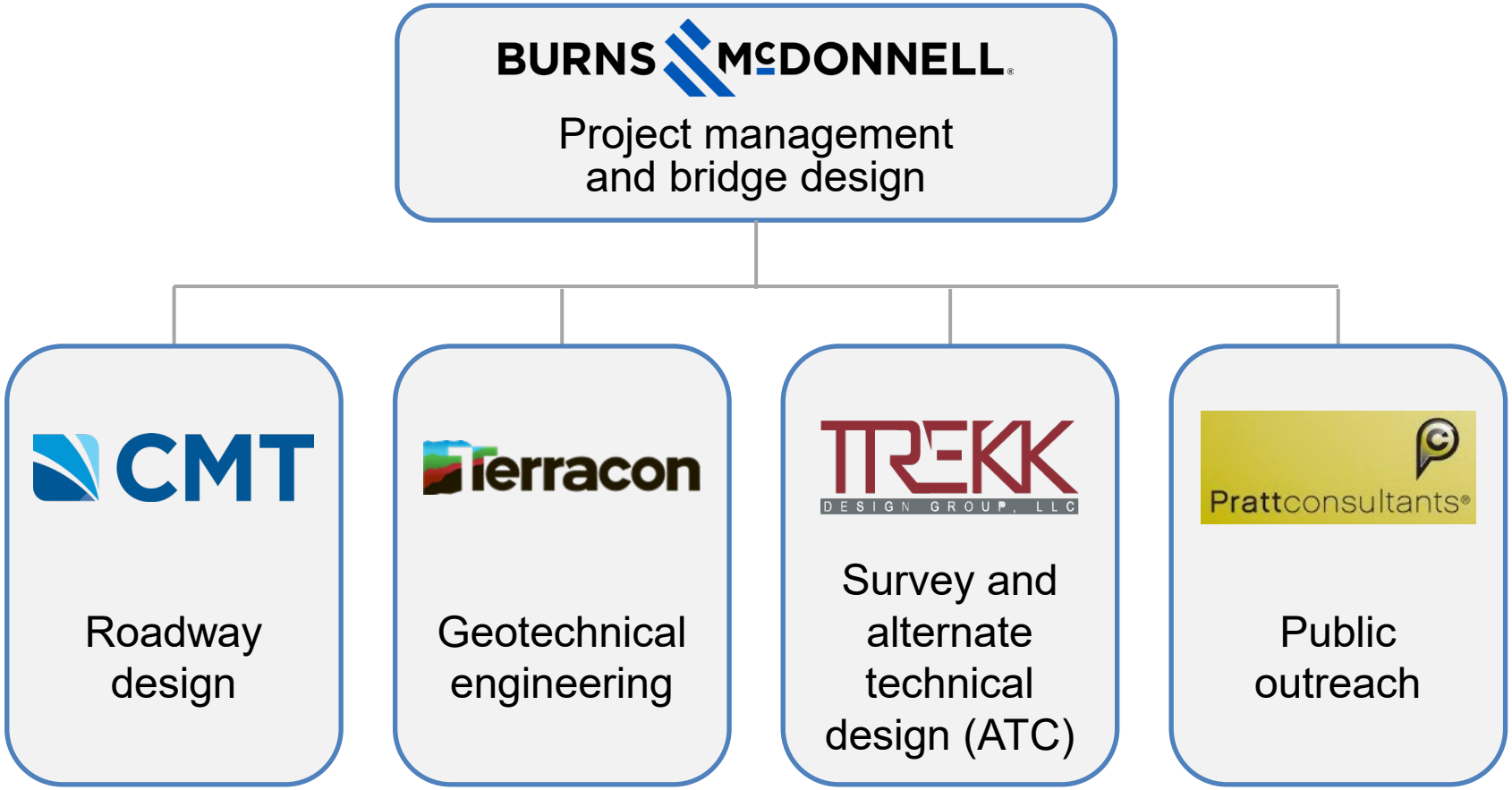
Agenda

- Project location
- Consultant project team
- NEPA constraints
- Alignment alternatives
- Preliminary design
- Final design
- Construction
- Questions

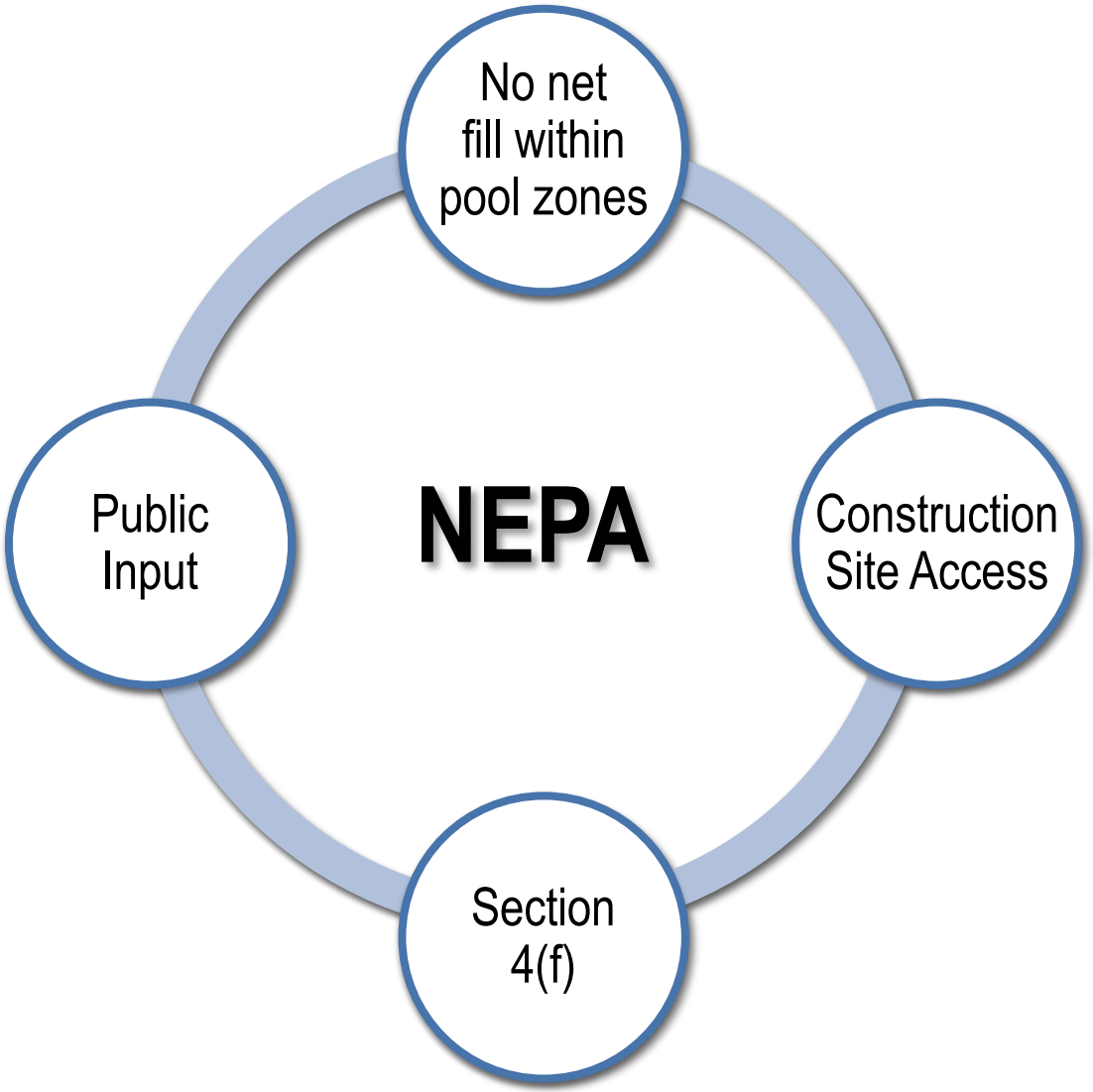
Project location



Consultant project team

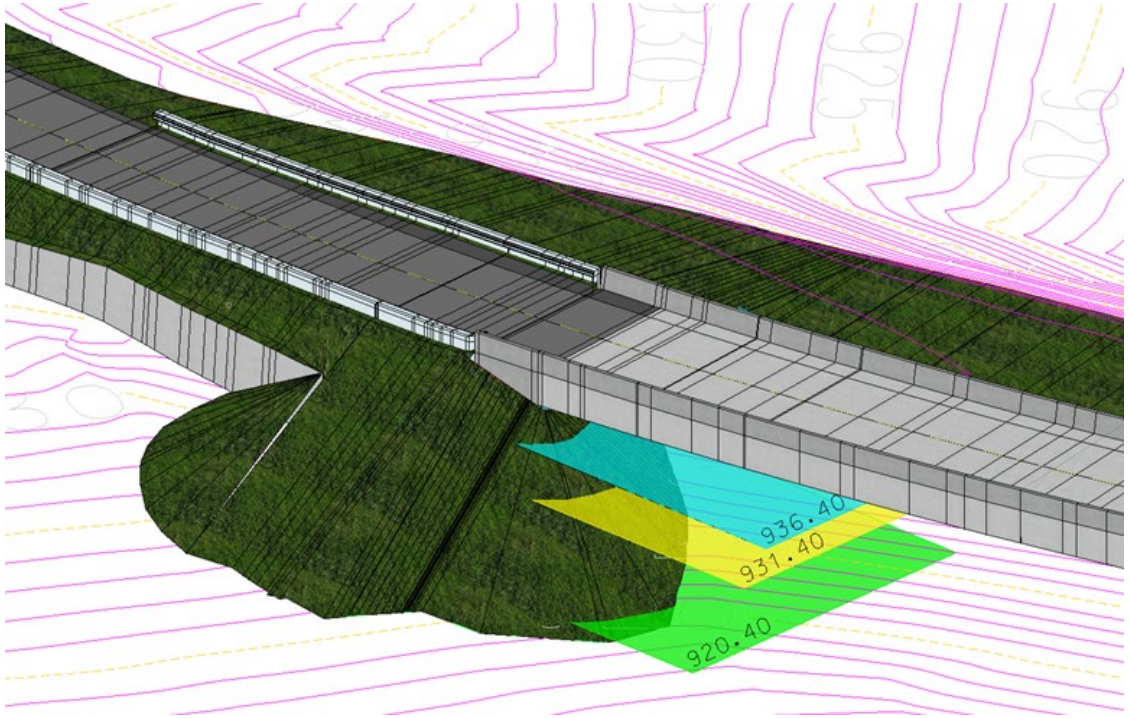


NEPA constraints

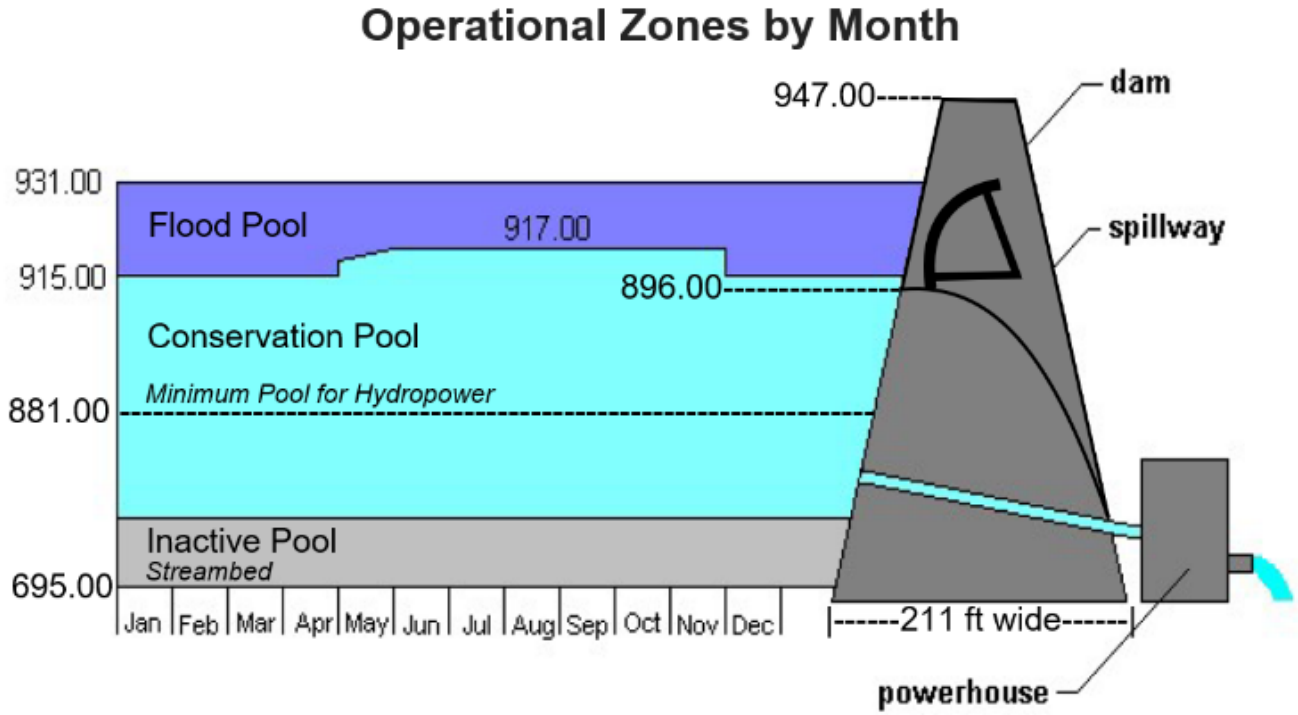


NEPA constraints

No net fill within various pool zones



SW Corner



Pool Zone Elevations (NGVD 29)

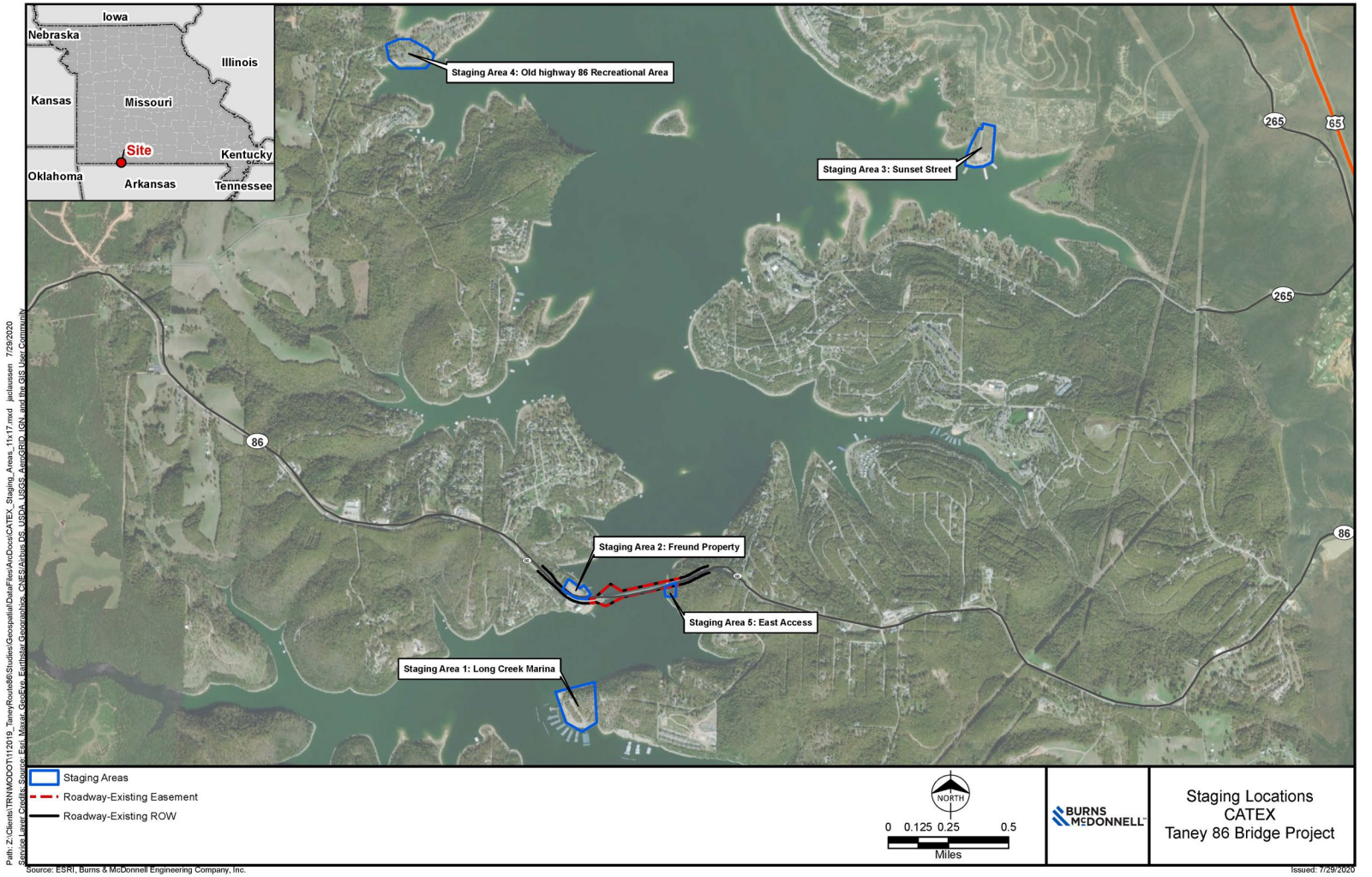
881 – 915

915 – 931

931 – 936

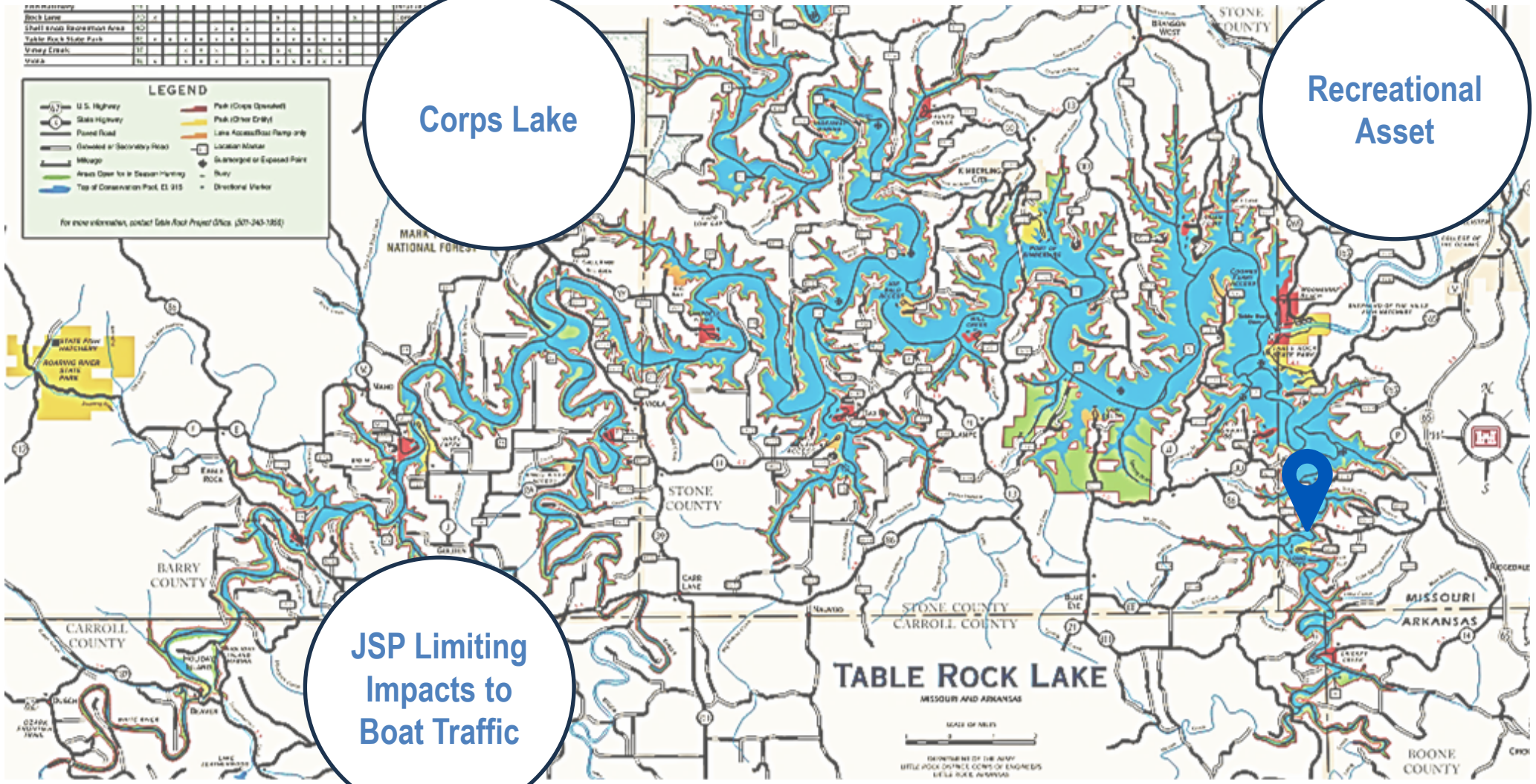
NEPA constraints

Site access for construction



NEPA constraints

Section 4(f)



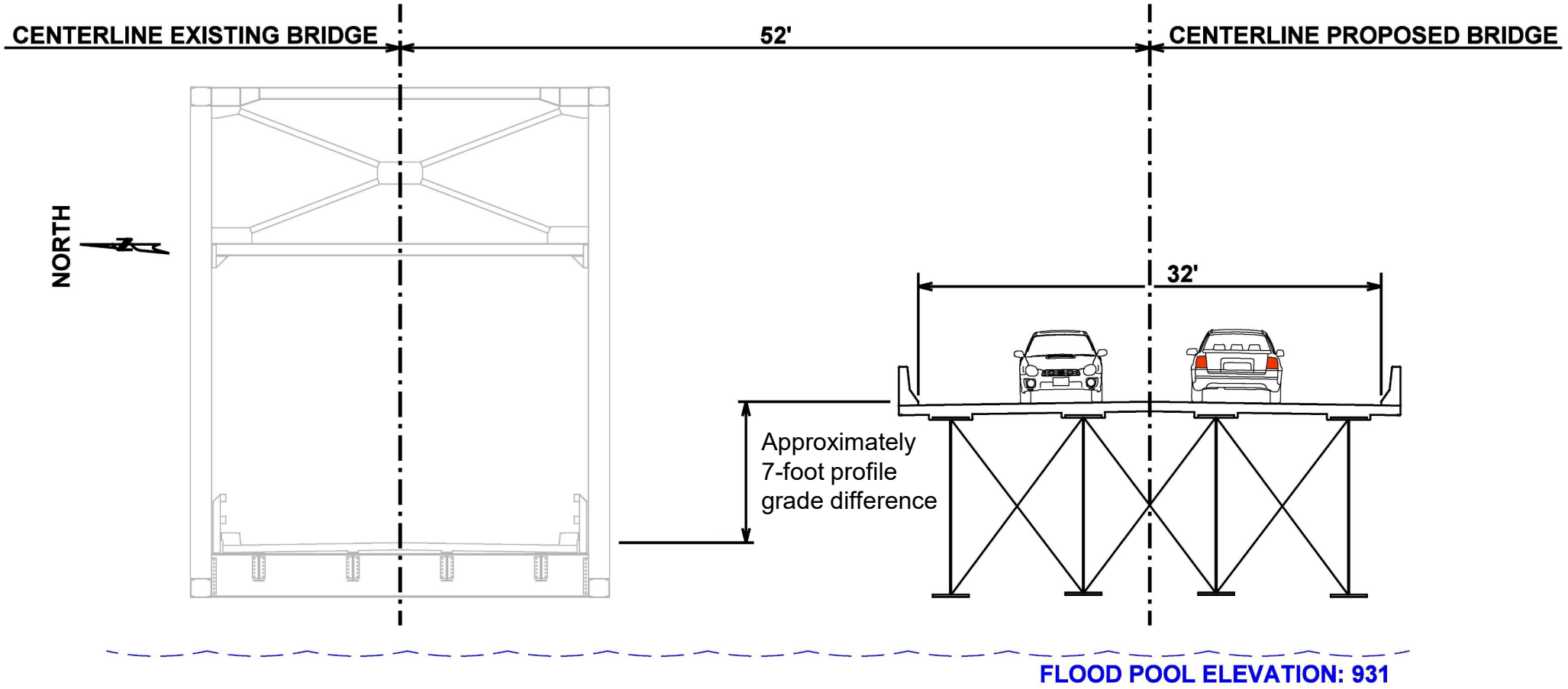
Corps Lake

Recreational Asset

JSP Limiting Impacts to Boat Traffic

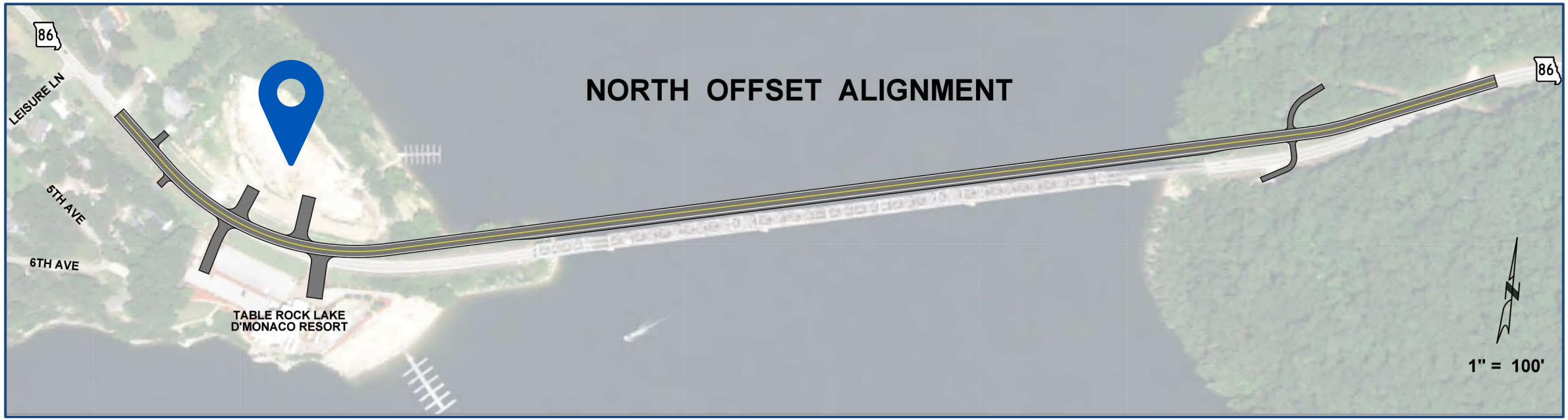
Alignment alternatives

Vertical alignment



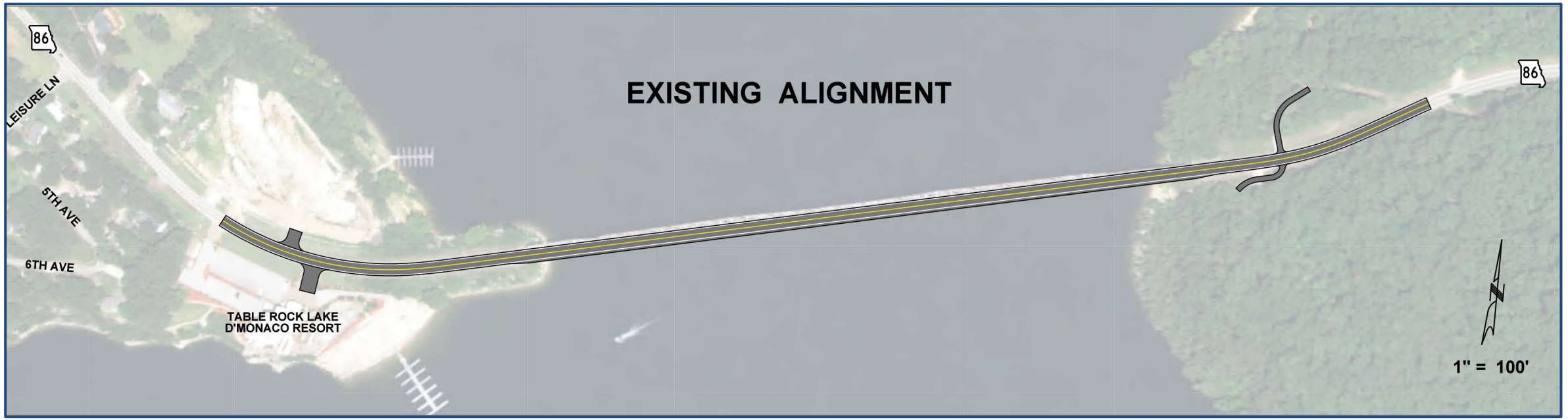
Alignment alternatives

Horizontal alignment alternatives



Alignment alternatives

Horizontal alignment alternatives

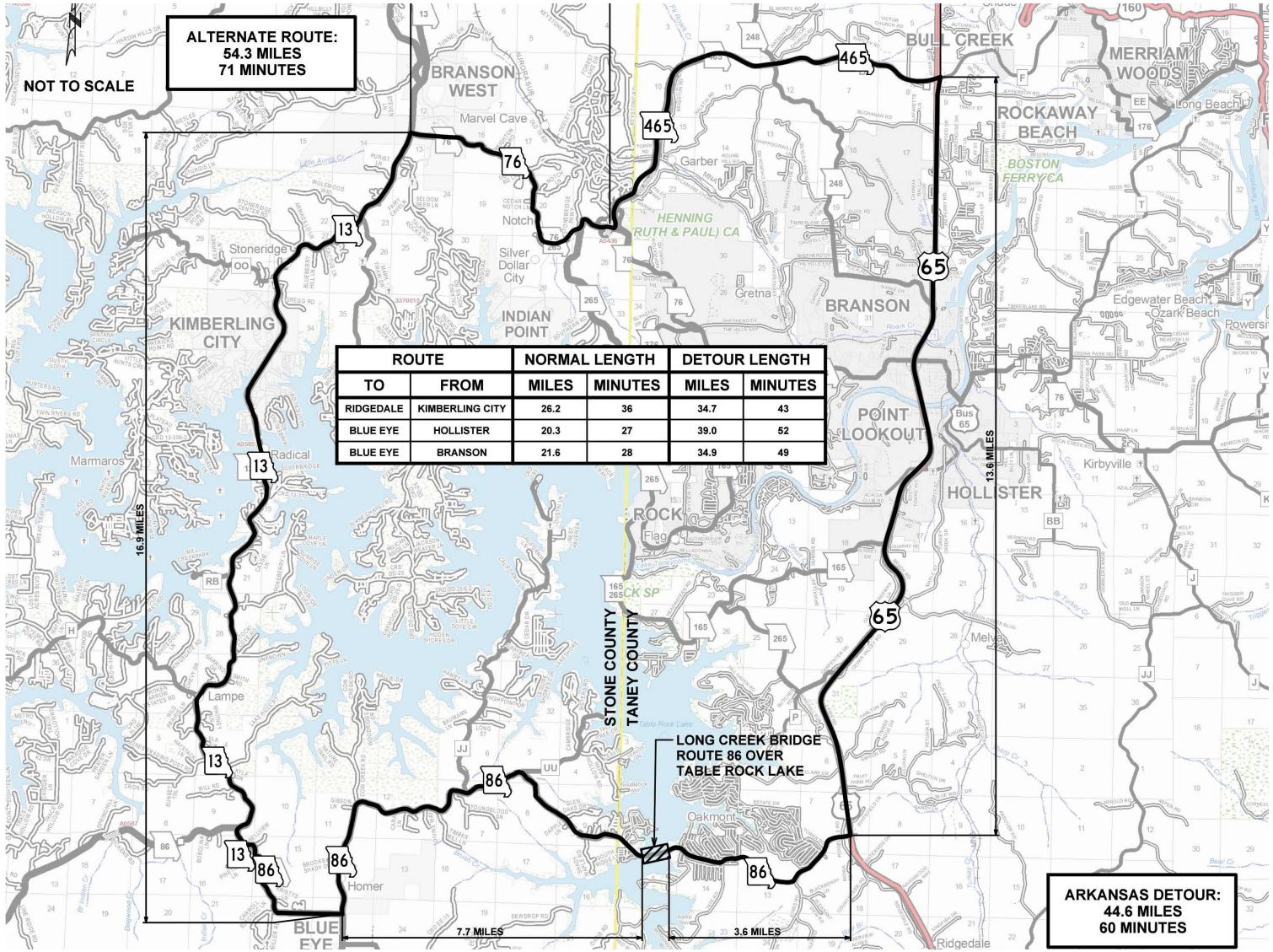


Alignment alternatives

Horizontal alignment alternatives

Daily road user costs

$194,618



ROUTE		NORMAL LENGTH		DETOUR LENGTH	
TO	FROM	MILES	MINUTES	MILES	MINUTES
RIDGEDALE	KIMBERLING CITY	26.2	36	34.7	43
BLUE EYE	HOLLISTER	20.3	27	39.0	52
BLUE EYE	BRANSON	21.6	28	34.9	49

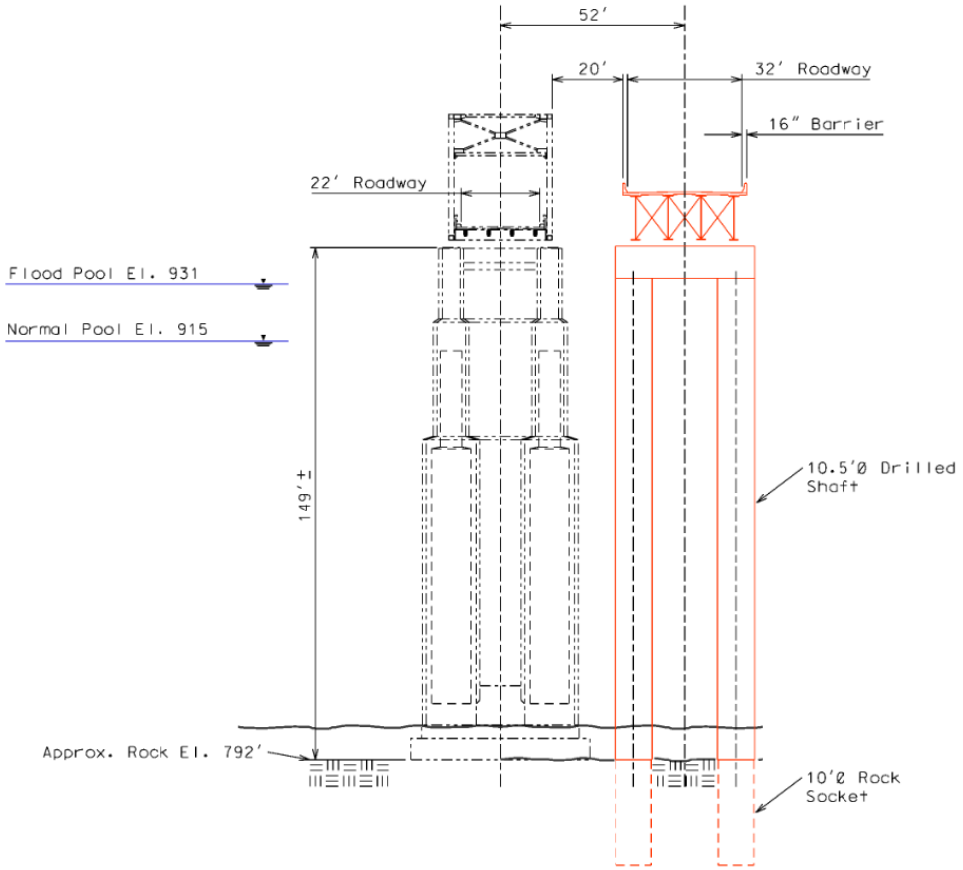
Alignment alternatives

Horizontal alignment alternatives

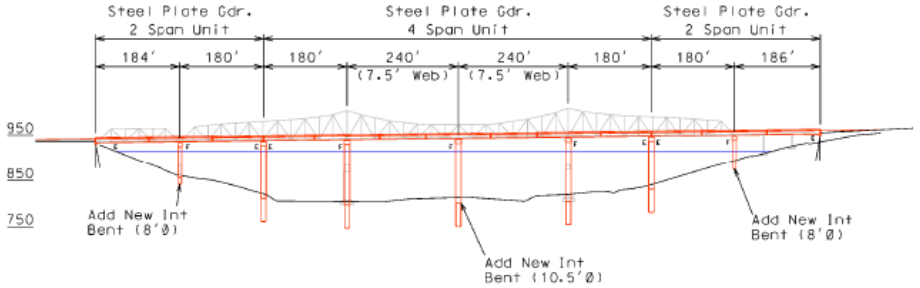
1. Avoid impacts to property in northwest corner of bridge site
2. Less desirable for access on east side of the bridge

Preliminary design

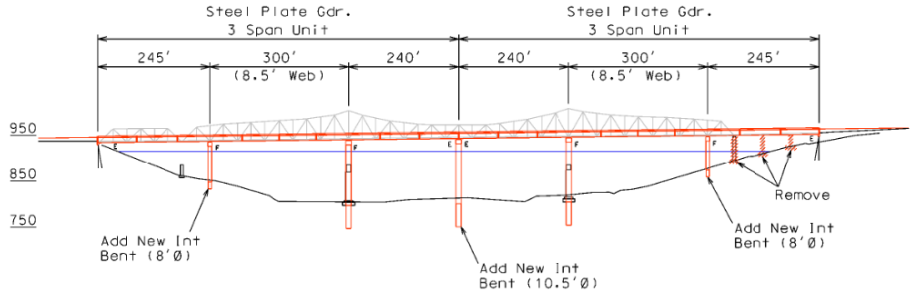
Conceptual span layouts



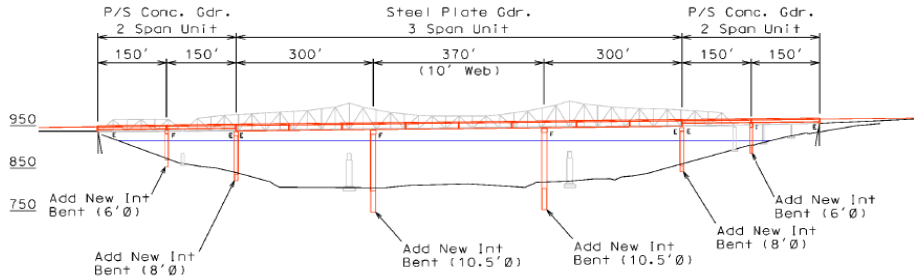
New Lake Pier – Off Alignment



240' Max. Span – Off Alignment



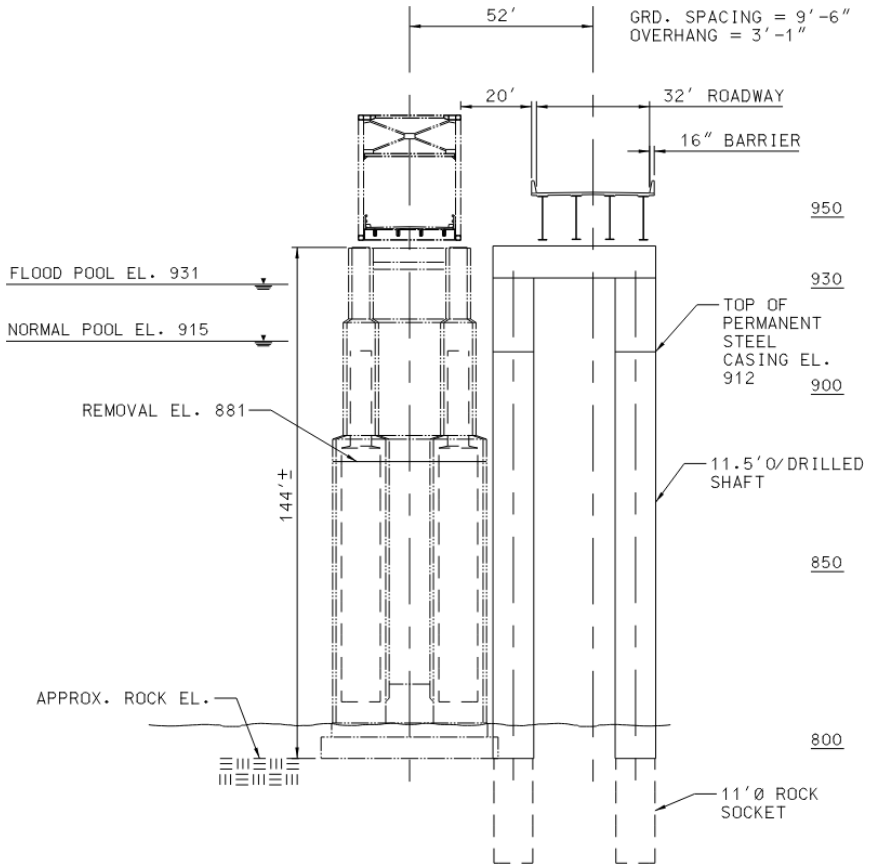
300' Max. Span – Off Alignment



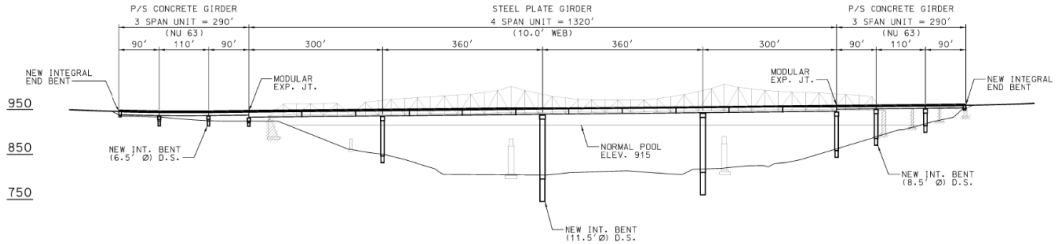
370' Max. Span – Off Alignment

Preliminary design

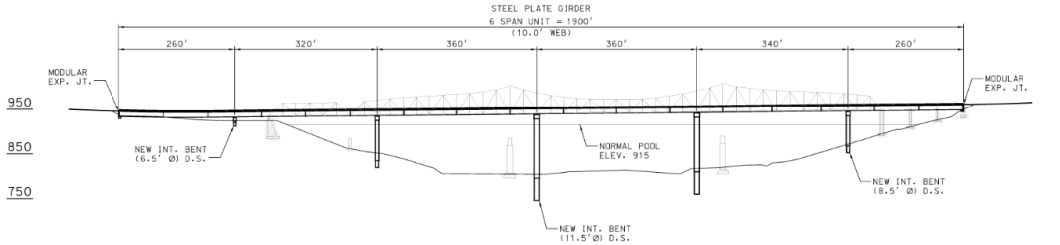
Preliminary span layouts



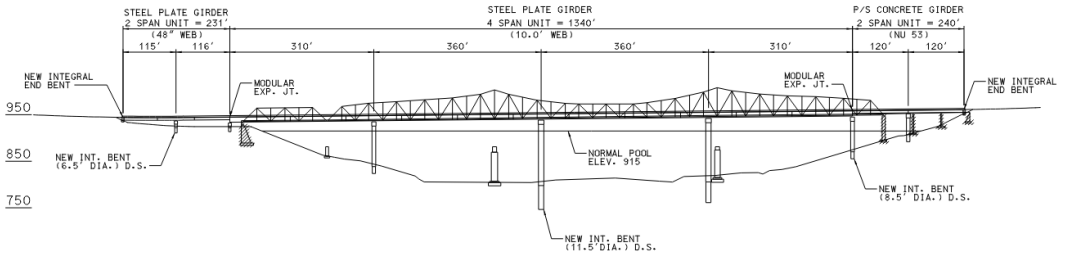
LAKE PIER ON ADJACENT ALIGNMENT



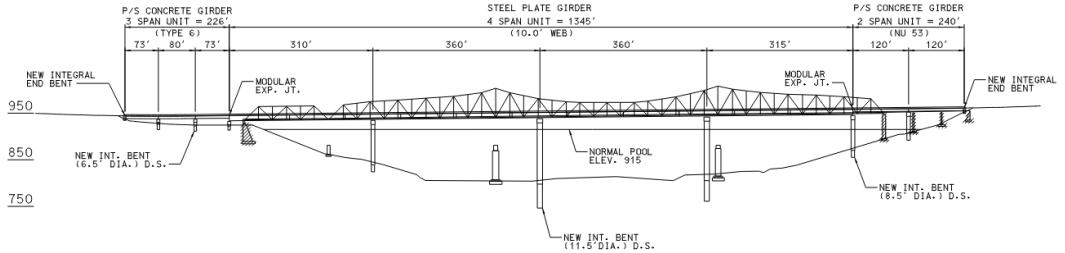
360′ MAX. SPAN – SOUTH ALIGNMENT



360′ Max. Span (1 Unit) – South Alignment



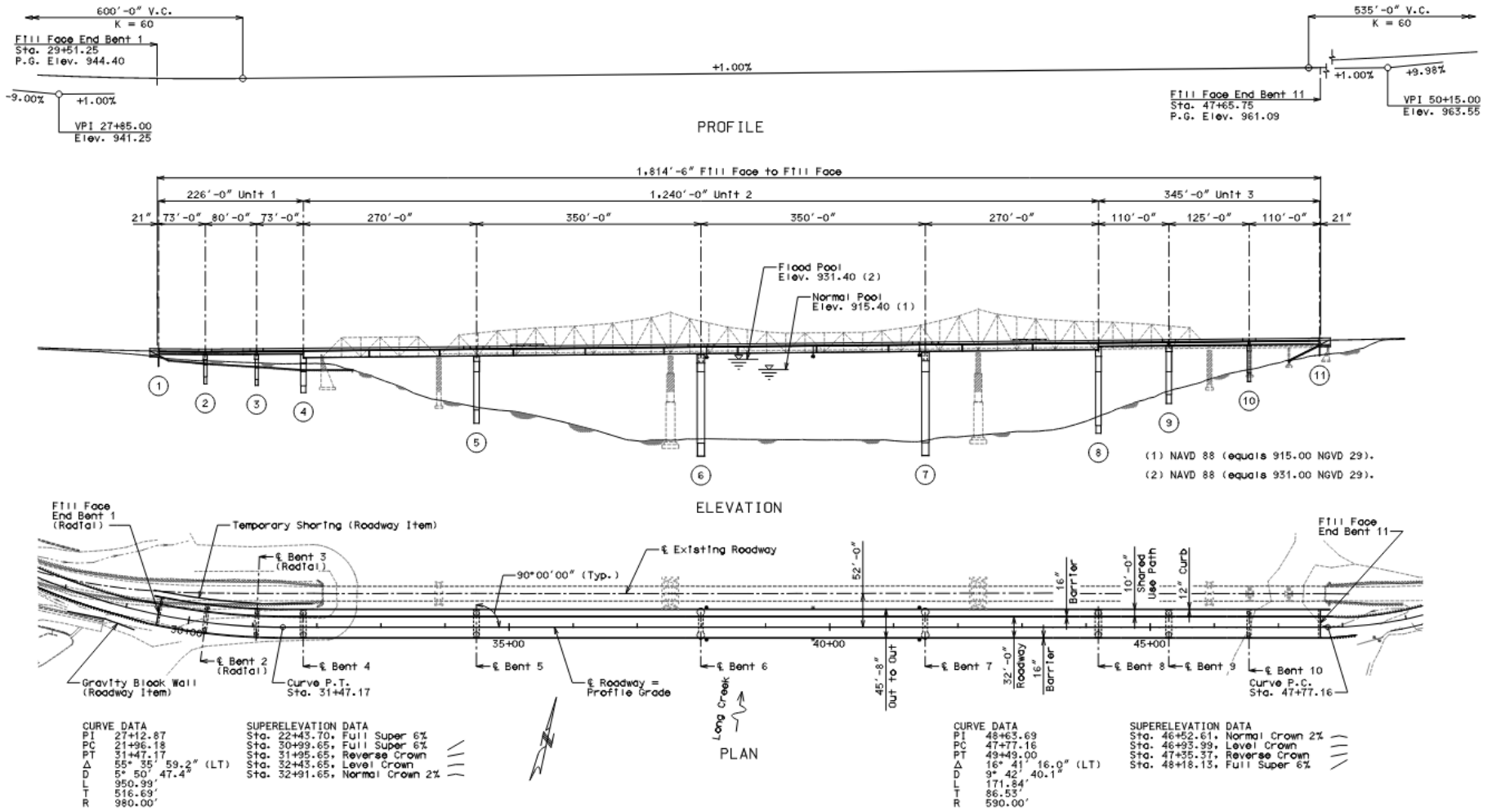
SOUTH ALIGNMENT



SOUTH ALIGNMENT

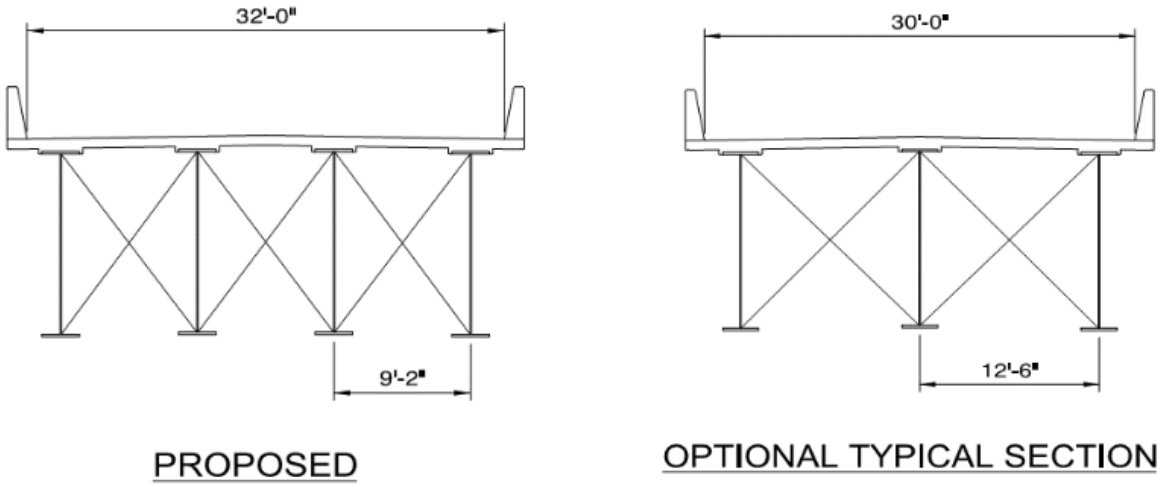
Preliminary design

Final span layout

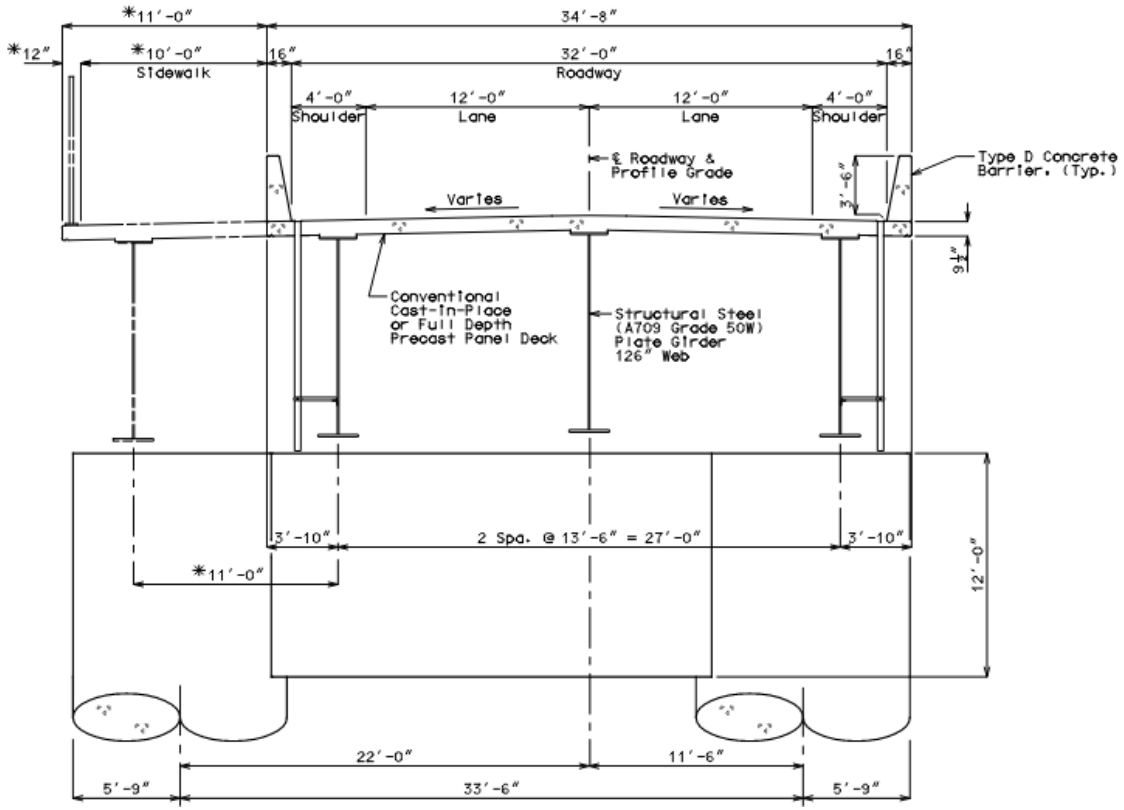


Preliminary design

- Preliminary typical section with future sidewalk



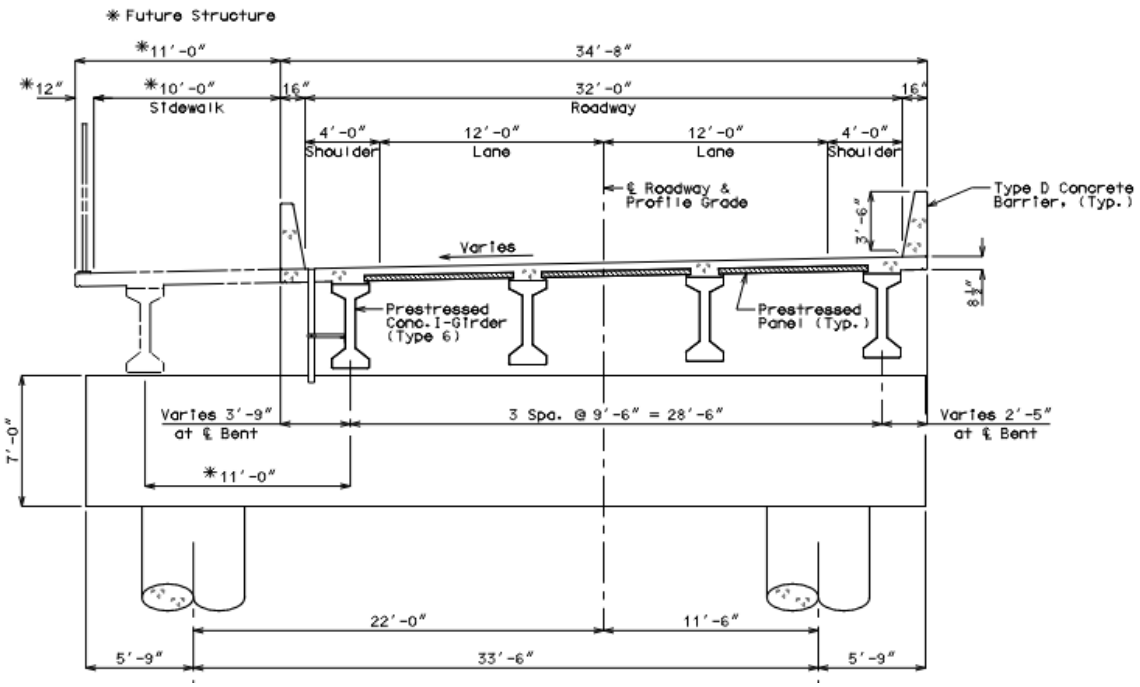
Value engineering performed during preliminary phase.



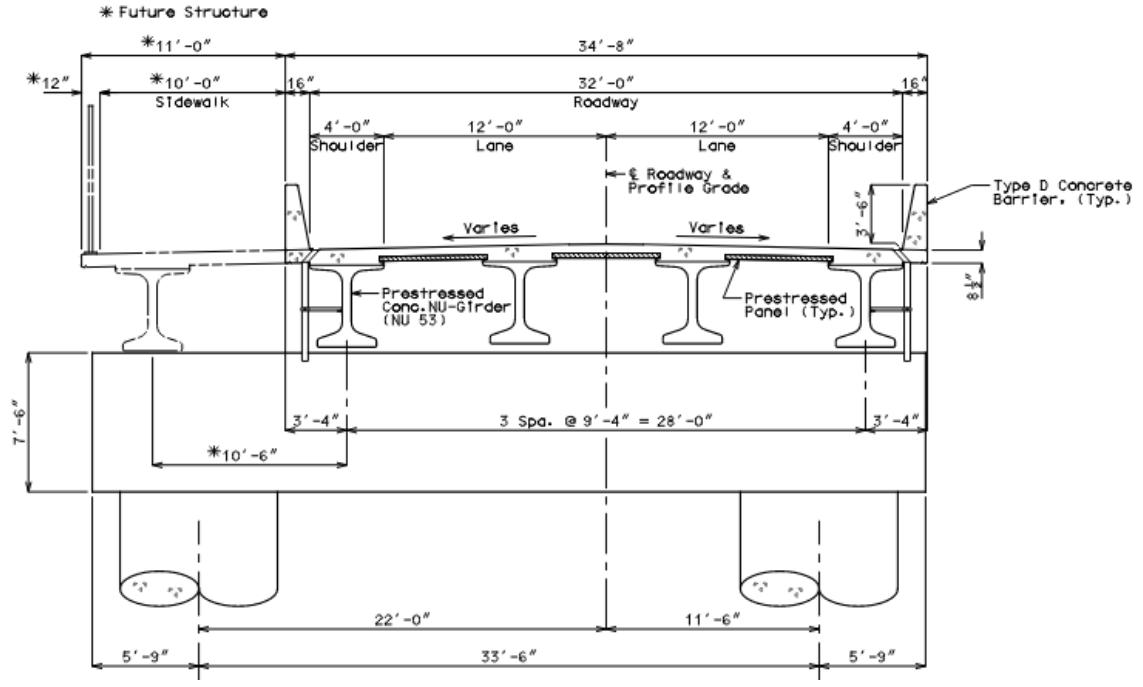
Unit 2

Preliminary design

- Preliminary typical section with future sidewalk



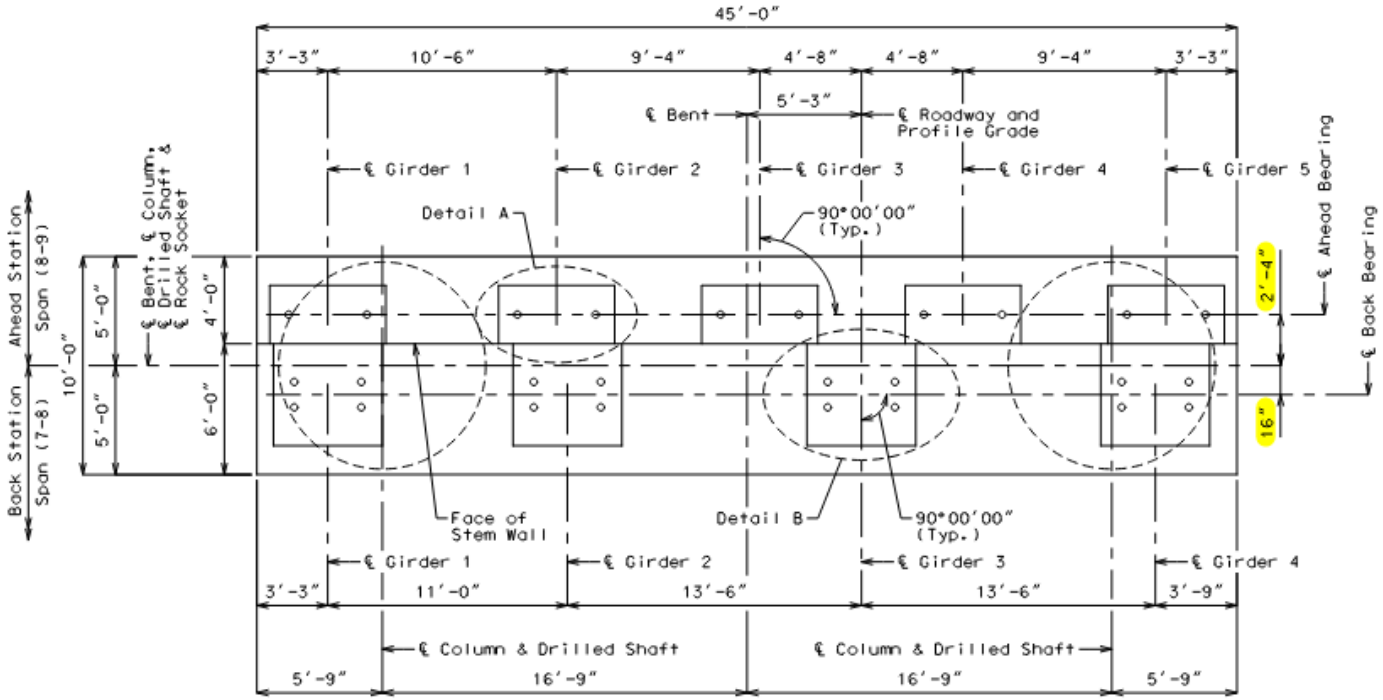
Unit 1



Unit 3

Preliminary design

- Bearings were offset on the expansion bents so a large dead load moment was not induced into the drilled shafts from the corresponding vertical load from each of the adjacent units.



Bent 8 Cap Plan

Preliminary design

- One value engineering item discussed was to post-tension the superstructure to the substructure at the top of the tall intermediate bents which changes the fixity condition.
- If utilized, the end condition of the tall bents would shift from a flagpole condition (e) toward some degree of framed fixity between (e) and (d).
- Final design followed LRFD 5.6.4.1: KL/r <100 and designed by the approximate procedure for evaluation of slenderness

Flagpole Condition

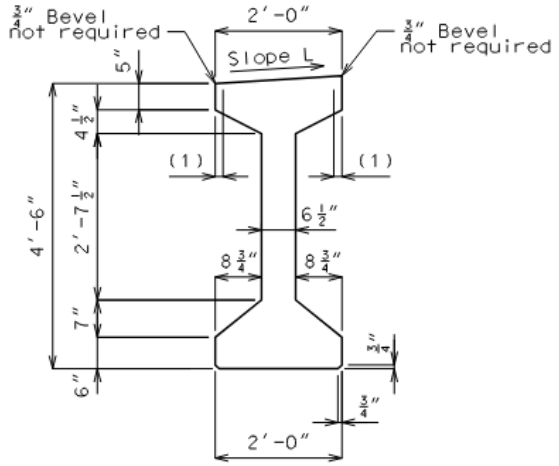
Partial Fixity Condition
(Overlain on Flagpole Condition)

Buckled shape of column is shown by dashed line	(a)	(b)	(c)	(d)	(e)	(f)
Theoretical *K* value	0.5	0.7	1.0	1.0	2.0	2.0
Design value of *K* when ideal conditions are approximated	0.65	0.80	1.0	1.2	2.1	2.0
End condition code		Rotation fixed Translation fixed Rotation free Translation fixed Rotation fixed Translation free Rotation free Translation free				

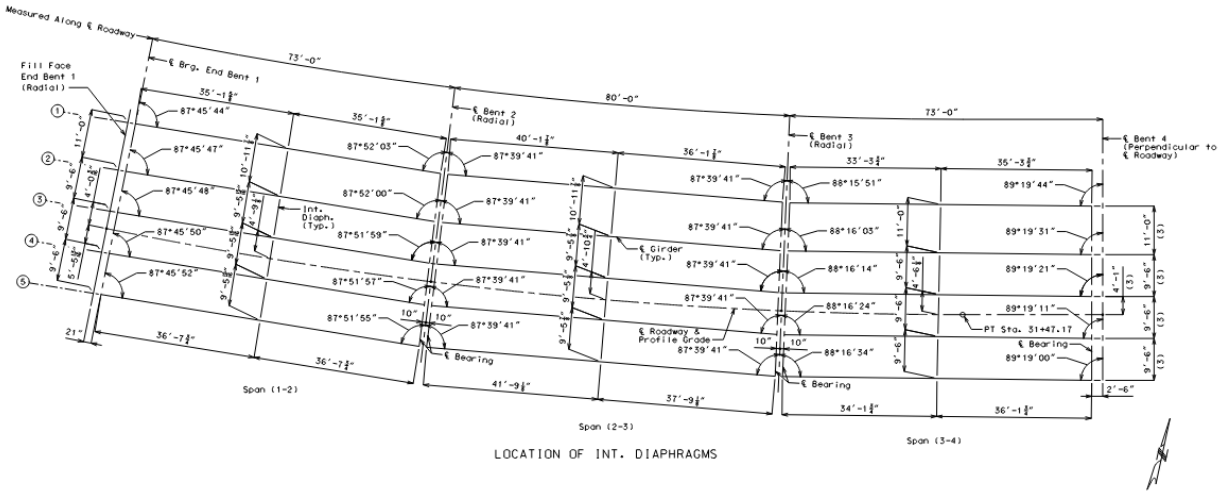
LRFD Table C4.6.2.5-1: Effective Length Factors, K

Final design

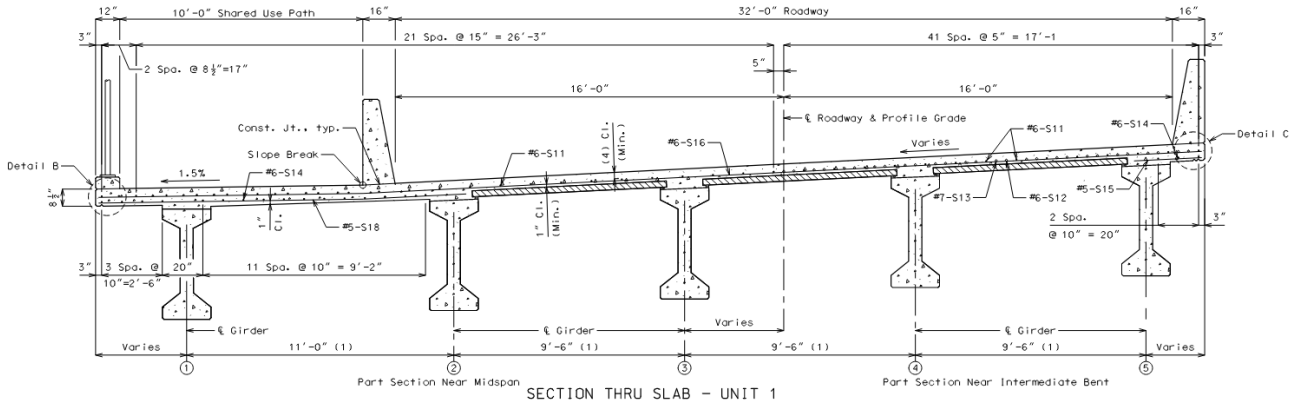
- Horizontal and vertical curvature in conjunction with the superelevation in Unit 1 required stepped and sloped top flanges in the Type 6 girders.



GIRDER DIMENSIONS AT MID SPAN



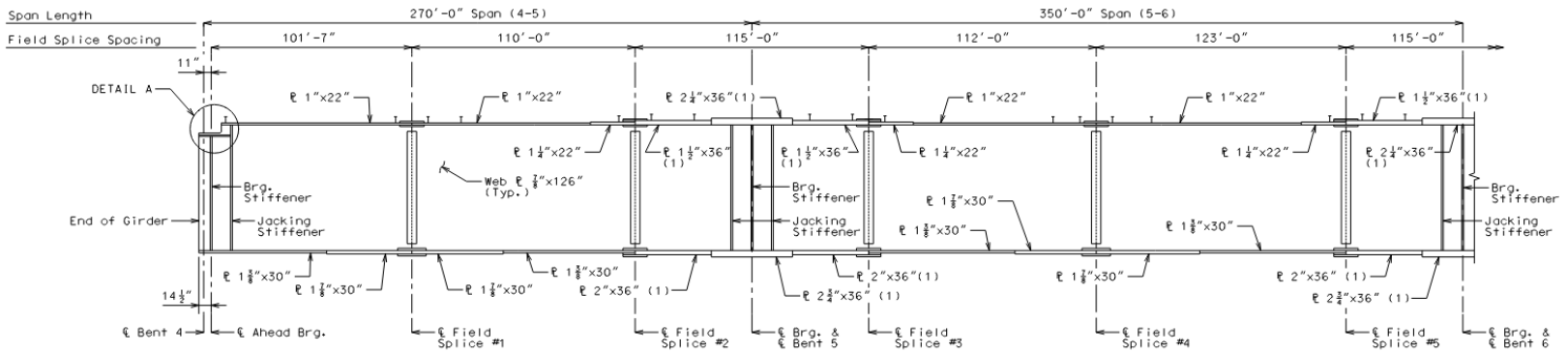
LOCATION OF INT. DIAPHRAGMS



SECTION THRU SLAB – UNIT 1

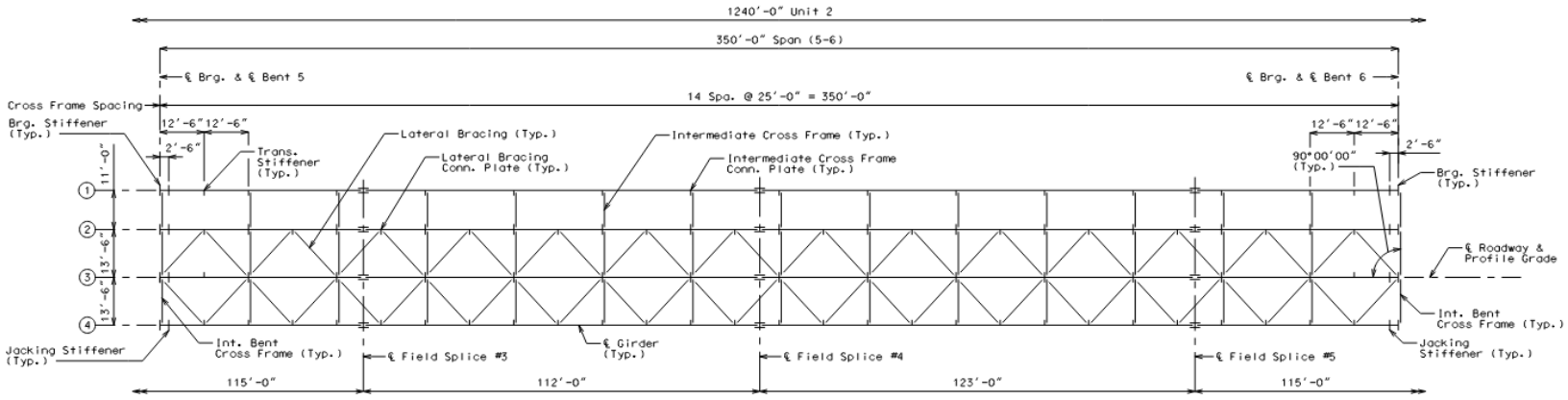
Final design

- Unit 2 girder webs 10’-6” deep
- Grade HPS 70W flanges over the piers



GIRDER ELEVATION – SPAN (4-5) AND SPAN (5-6)

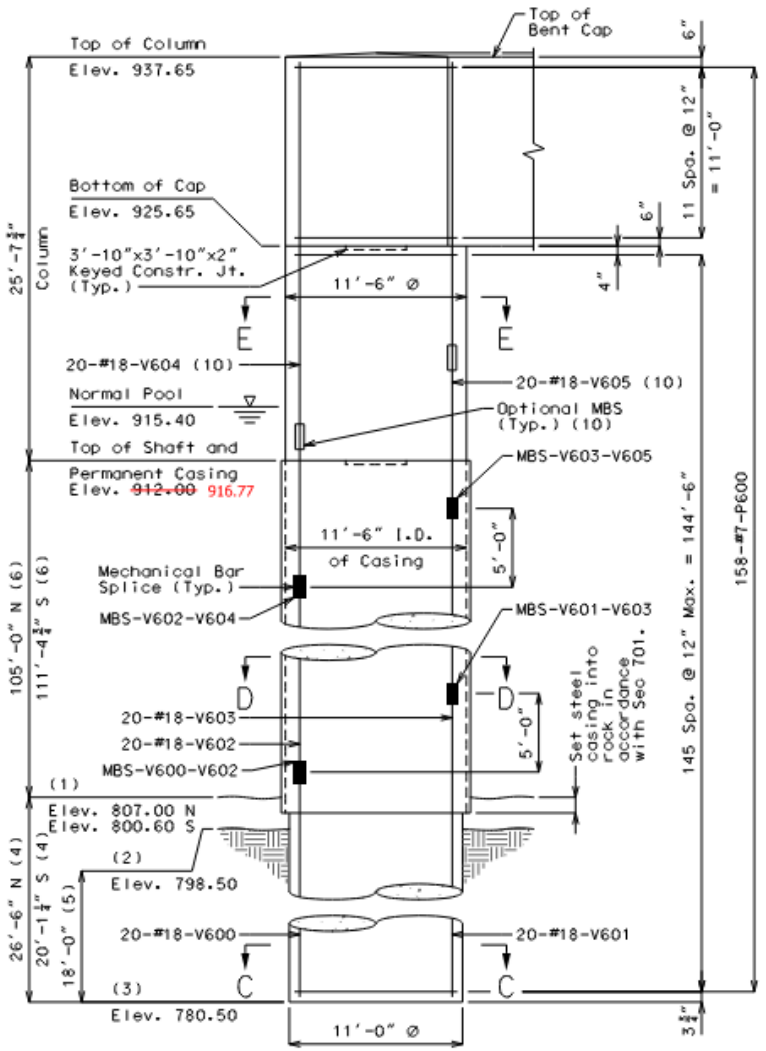
(1) ASTM A709 Grade HPS 70W flange plates

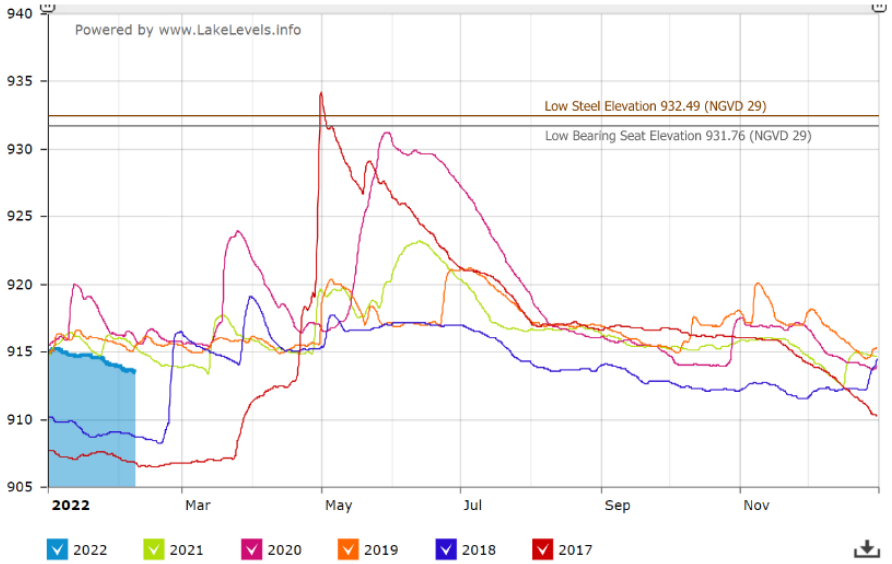


FRAMING PLAN – SPAN (5-6)

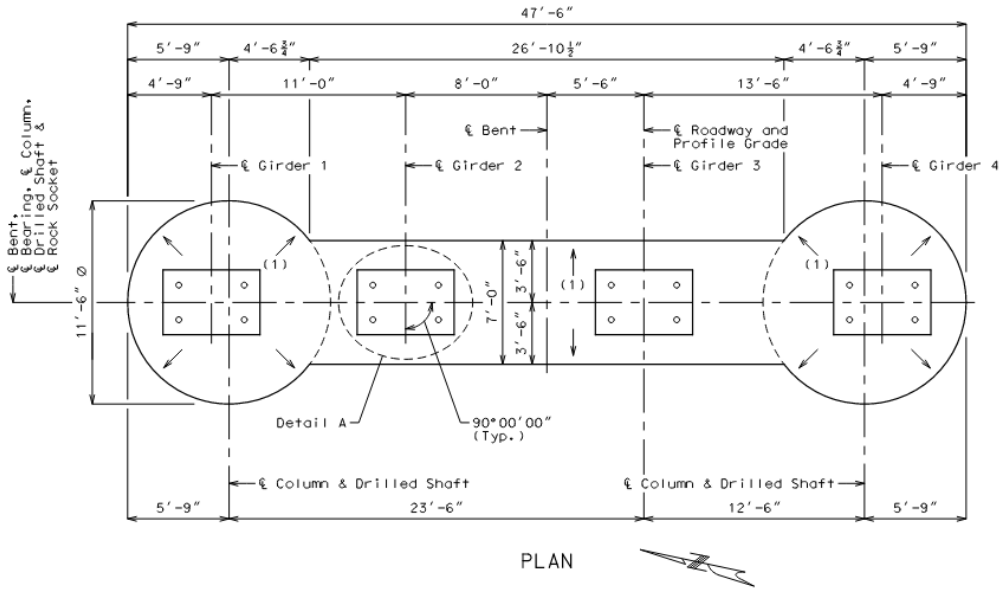
Final design

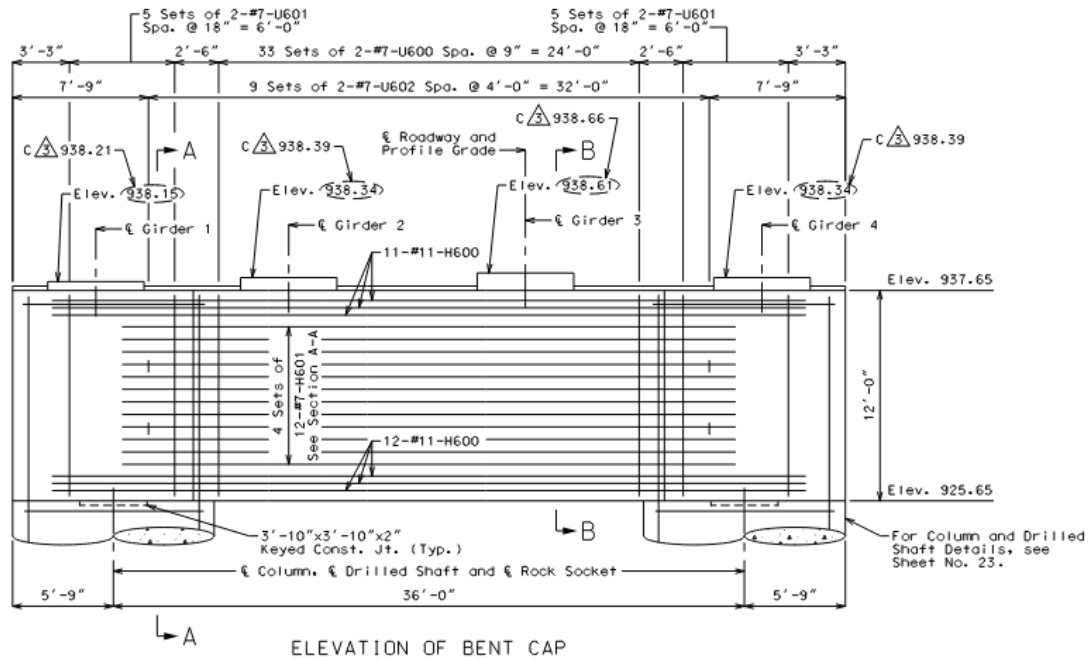
- Bent 6 drilled shaft
- Bottom of cap 925.25 (NGVD 29)
- Frequent lake levels near ~ 920 hindered the option of a lower strut.





Final design

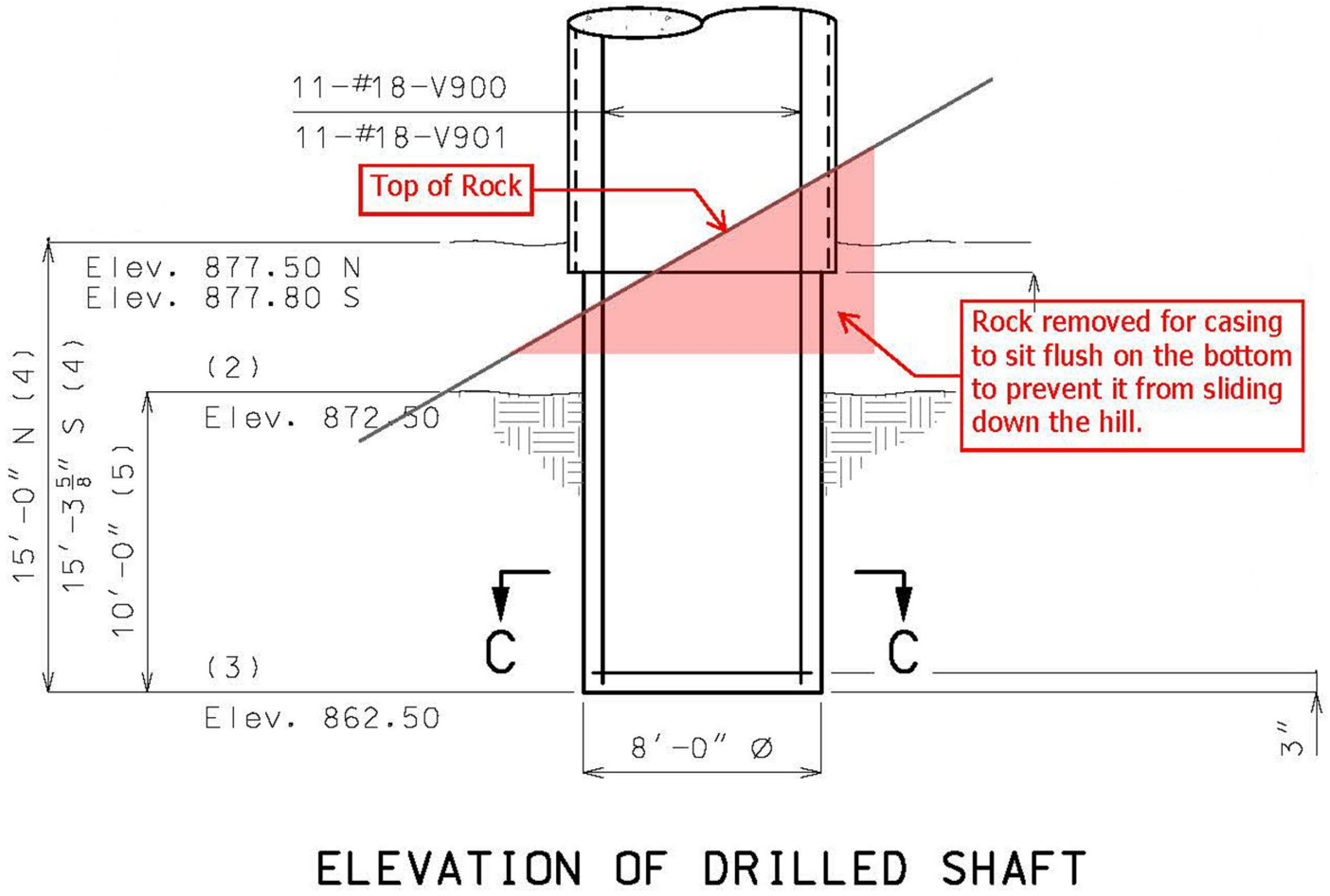




- Cap over columns would have resulted in an excessively wide cap
- Pedestals allowed for bearing height adjustments and construction tolerances

Construction

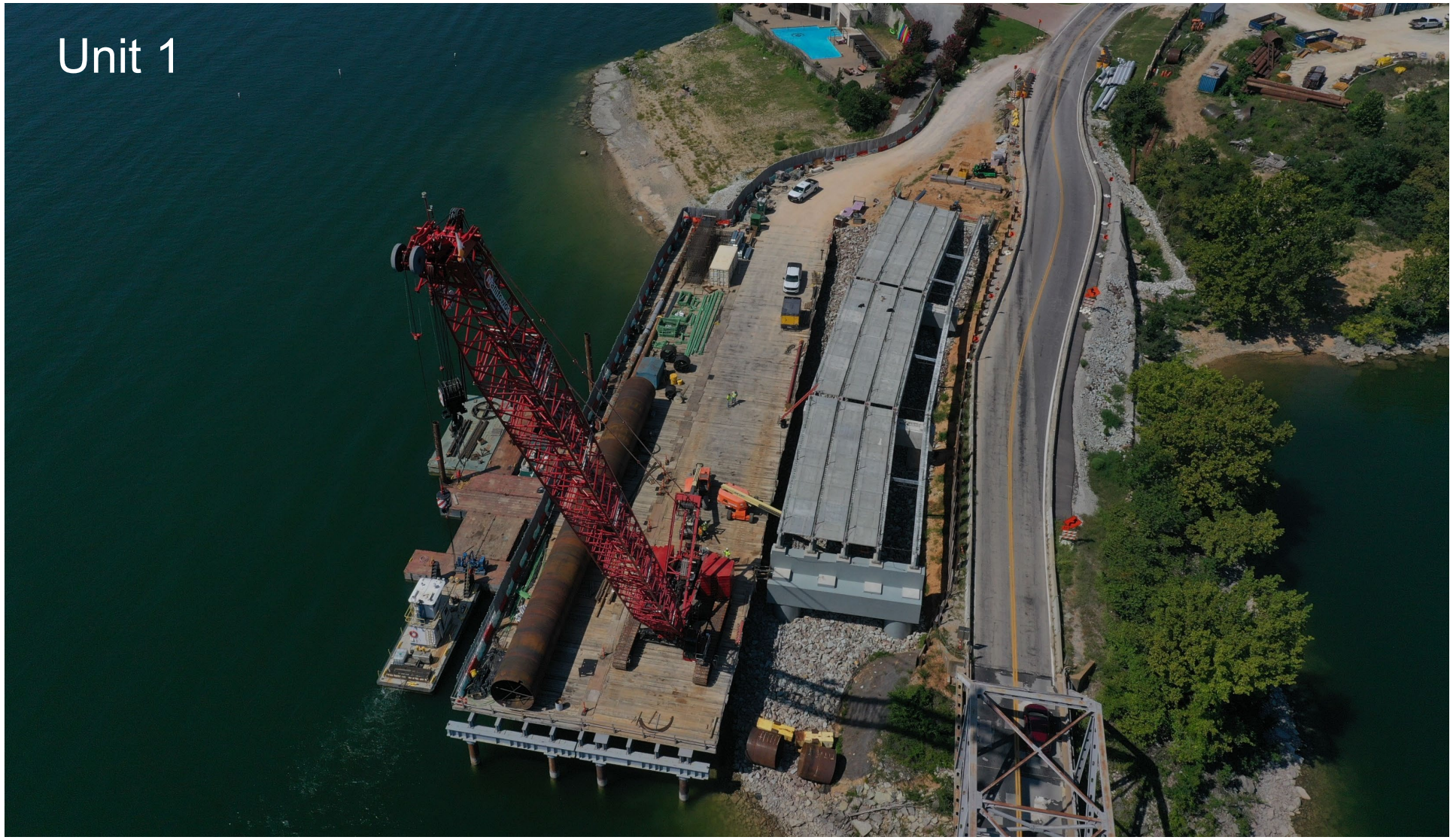
- Rock slope with minimal overburden
  - Rock must be benched to prevent casing from sliding down the hill.
- Minimal overburden
  - Permanent casing may be seated 3 – 5 feet into rock for bottom stability.



ELEVATION OF DRILLED SHAFT

Construction

Construction



Construction

- Picking 11.5’ diameter casing 134.5’ in length
- Rough template with spuds
- Fine template

Construction

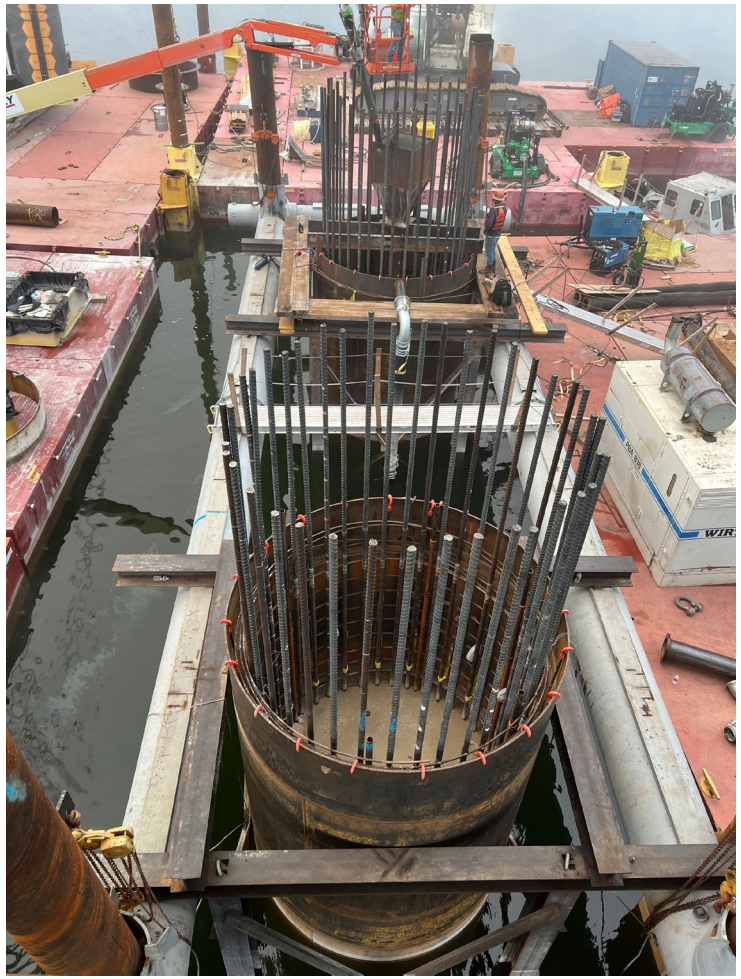
- Buoyancy tube used to reduce weight of casing which reduces load on the drill as it seats the casing

Construction

- Airlift performed to get debris out of the bottom of the rock socket prior to video inspection of the rock socket
- Rebar cage installed using the chandelier/ wind chime method

Construction

- Drilled shaft concrete placement operation
- As the water rises inside the casing it discharges through the pipe and exits ~20’ below the water surface elevation



Questions