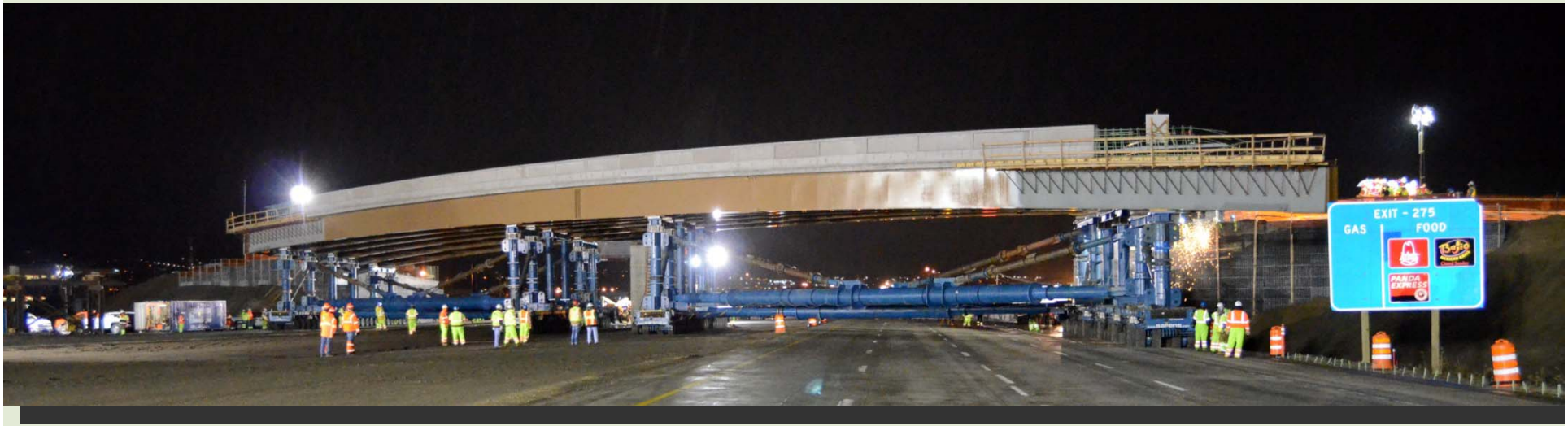
Creating Value …

Sam White Bridge – SPMT Move of 2-Span Continuous Bridge

Richard D. Hansen, P.E., S.E., Michael Baker Jr., Inc,
Bryce Jaynes, Ralph L. Wadsworth Construction

… Delivering Solutions



Baker

Project Team

Provo River Constructors Joint Venture

- Fluor
- Ames Construction, Inc.
- Wadsworth Brother Inc.
- Ralph L. Wadsworth Inc.

Design Team

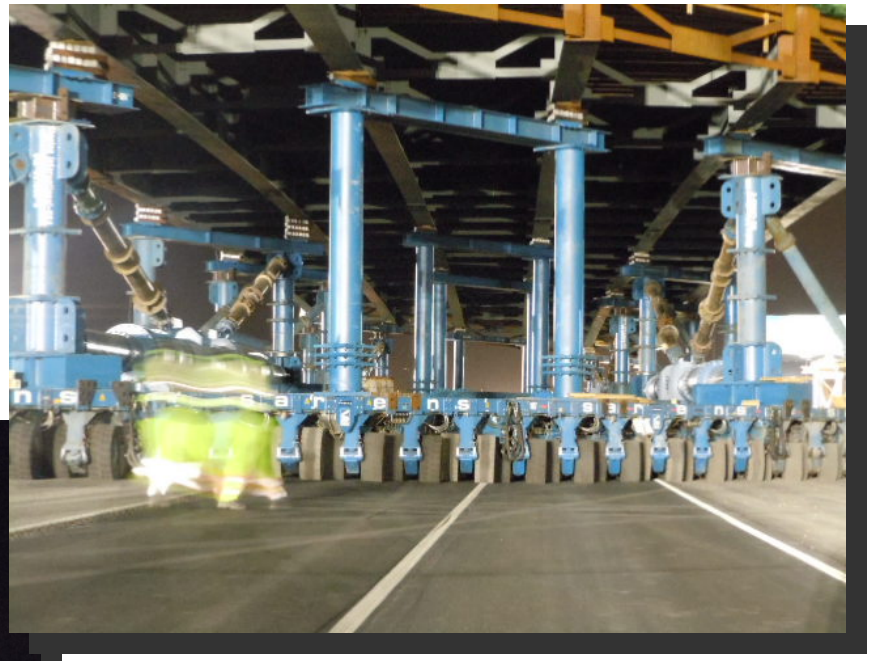
- HDR Inc. (Prime)
- Jacobs
- Michael Baker Jr. Inc
- Kleinfelder

UDOT I-15 CORE Project Scope

- Reconstruct & widen 23 miles of I-15
- New bridges
- Permanent and temporary bridge widenings
- Sign structures and retaining walls
- Drainage structures

Designer Perspective

- You want to move what?
- Why ABC?



Sam White Bridge

Sam White Bridge	
Out-to-Out Length	354’-0”
Span Lengths	(2) 177’-0” spans
Deck Width	76’-10”
Superstructure Depth	7’-1”
Number of Girders	6 girders
Girder Spacing	13’-6”
Superstructure Weight	4,200,000 lbs

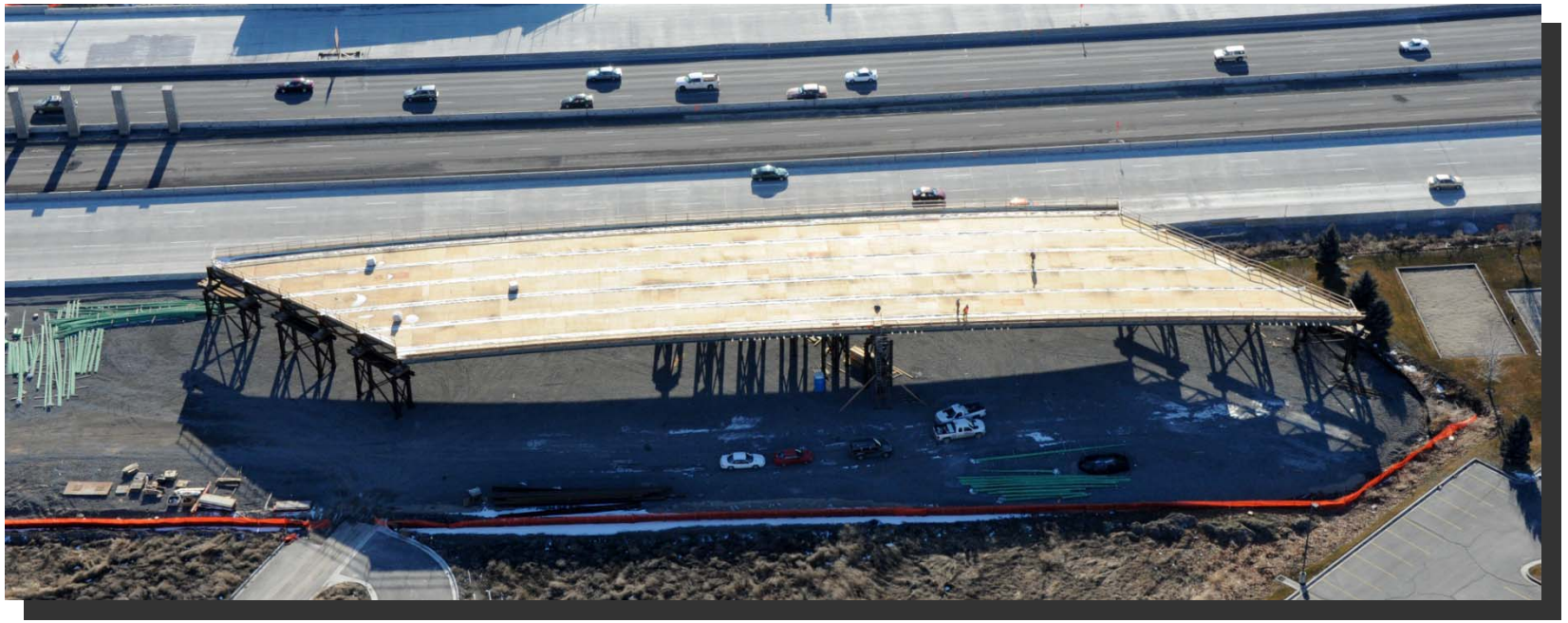
Bridge Move Animation

Design Considerations

- Superstructure
- Substructure (no pier cap)
- Geometry
- Temporary supports
- Structural modeling
- SPMT limits/grading
- Move tolerances and monitoring
- Team coordination

Superstructure

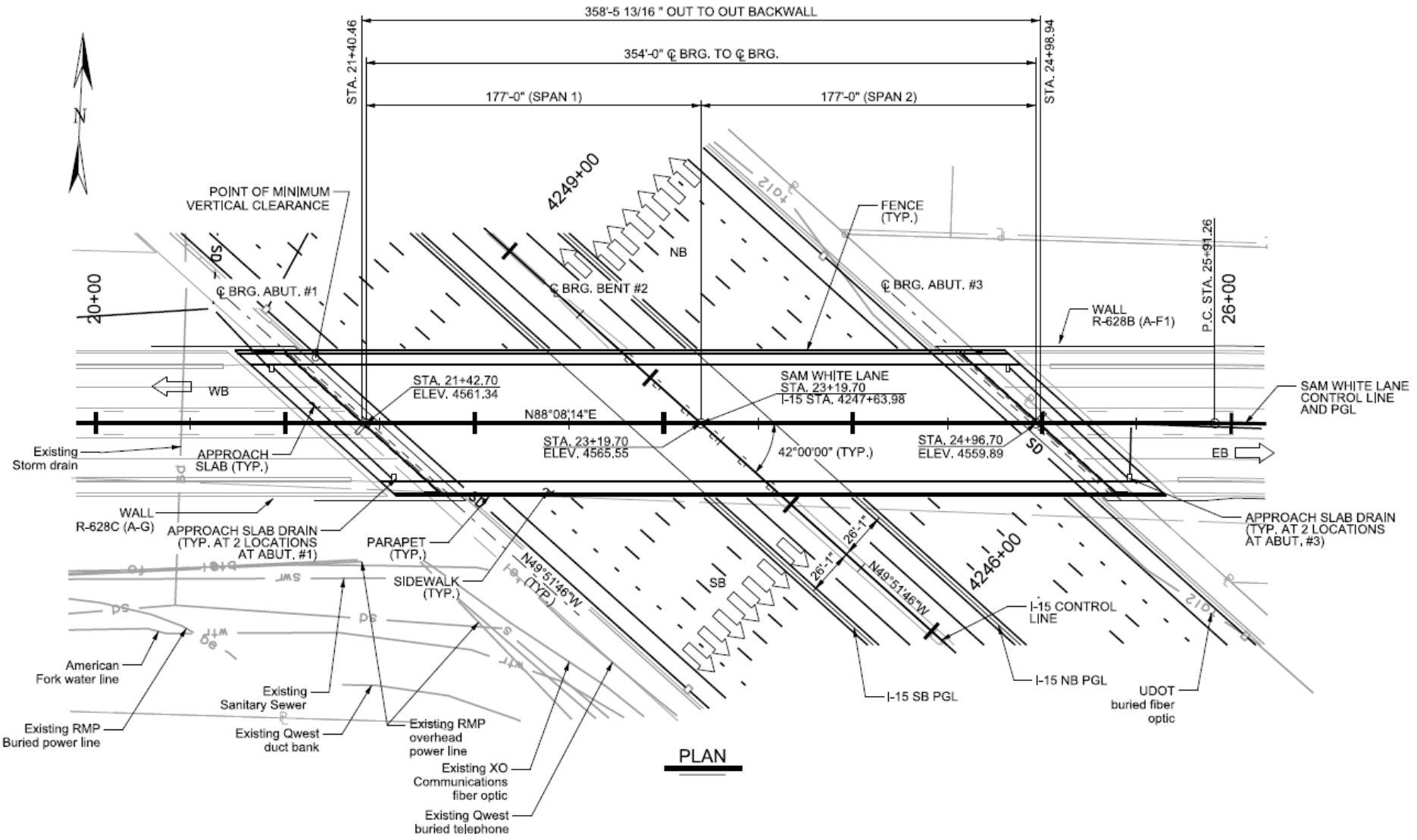
- Steel Girders
- Light-weight concrete (120 pcf)
- Place sidewalk after bridge move
- Minimize seismic forces and displacements
- Minimize number of SPMTs



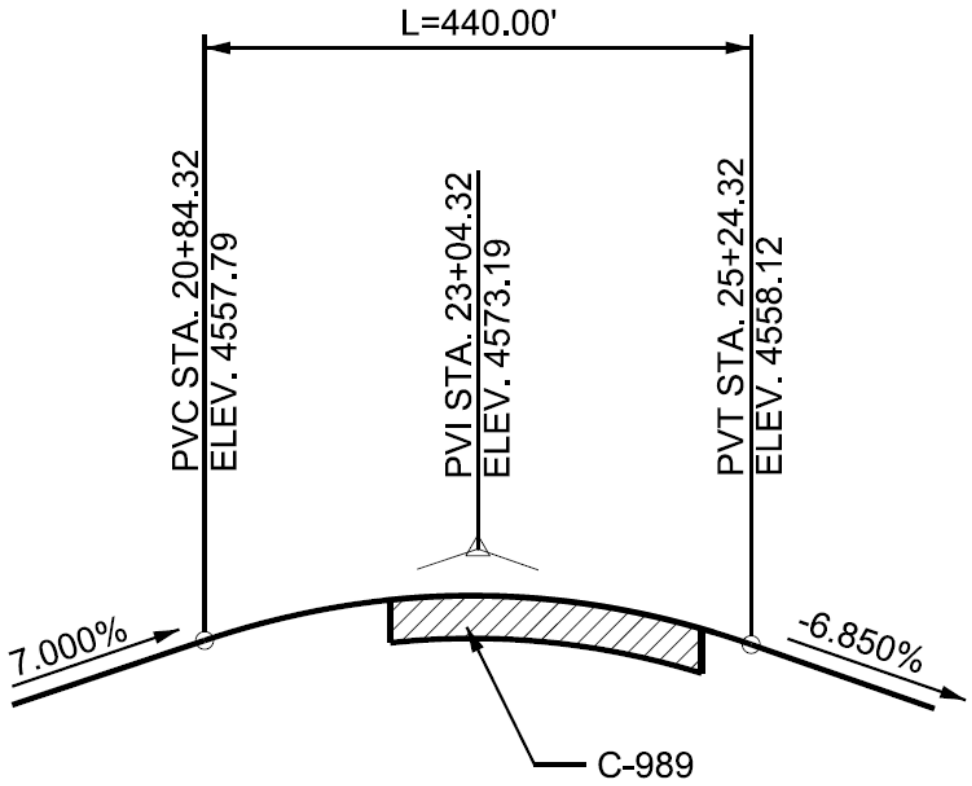
Substructure

- Integral abutments with single rows of pipe piles
- No pier cap
- Pier columns supported on rectangular pile cap

Geometry


358'-5 13/16 " OUT TO OUT BACKWALL
354'-0" ℄ BRG. TO ℄ BRG.
177'-0" (SPAN 1)
177'-0" (SPAN 2)
STA. 21+40.46
STA. 24+98.94
N
POINT OF MINIMUM VERTICAL CLEARANCE
4249+00
NB
FENCE (TYP.)
℄ BRG. ABUT. #1
℄ BRG. BENT #2
℄ BRG. ABUT. #3
P.C. STA. 25+91.26
20+00
26+00
WALL R-628B (A-F1)
WB
STA. 21+42.70
ELEV. 4561.34
N88°08'14"E
SAM WHITE LANE
STA. 23+19.70
I-15 STA. 4247+63.98
SAM WHITE LANE CONTROL LINE AND PGL
Existing Storm drain
APPROACH SLAB (TYP.)
STA. 23+19.70
ELEV. 4565.55
42°00'00" (TYP.)
STA. 24+96.70
ELEV. 4559.89
EB
WALL R-628C (A-G)
APPROACH SLAB DRAIN (TYP. AT 2 LOCATIONS AT ABUT. #1)
PARAPET (TYP.)
APPROACH SLAB DRAIN (TYP. AT 2 LOCATIONS AT ABUT. #3)
SIDEWALK (TYP.)
N49°51'46"W (TYP.)
SB
26'-1"
4246+00
I-15 CONTROL LINE
American Fork water line
Existing Sanitary Sewer
I-15 SB PGL
I-15 NB PGL
UDOT buried fiber optic
Existing RMP Buried power line
Existing Qwest duct bank
Existing RMP overhead power line
Existing XO Communications fiber optic
Existing Qwest buried telephone
PLAN

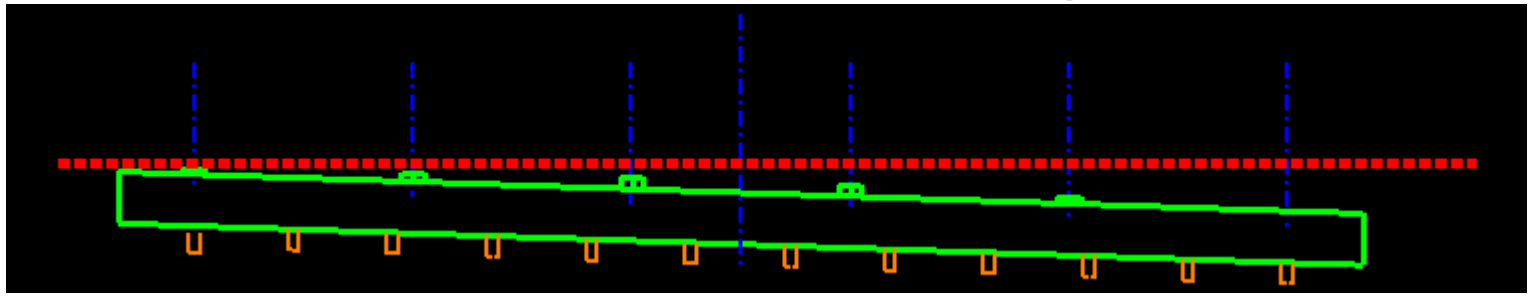
Geometry



SAM WHITE LANE PROFILE

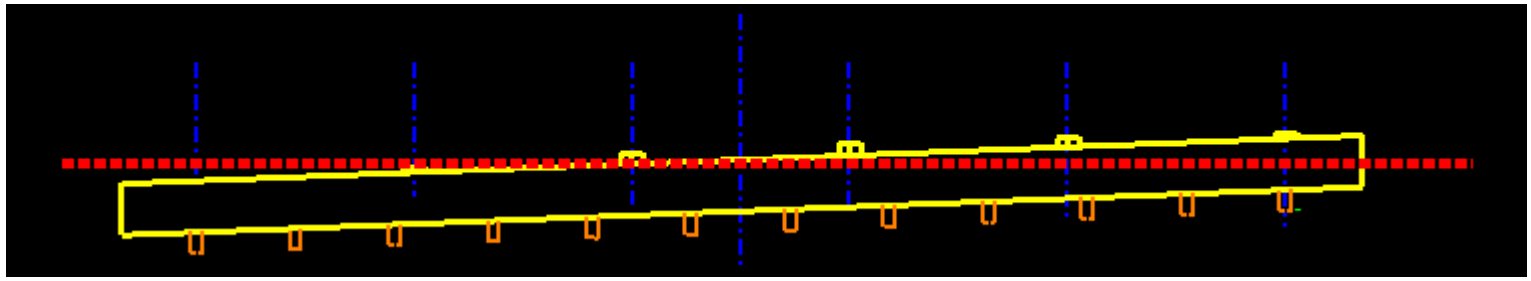
Geometry

Abutment 1 (West Abutment) – Looking West



SPMT Travel Direction

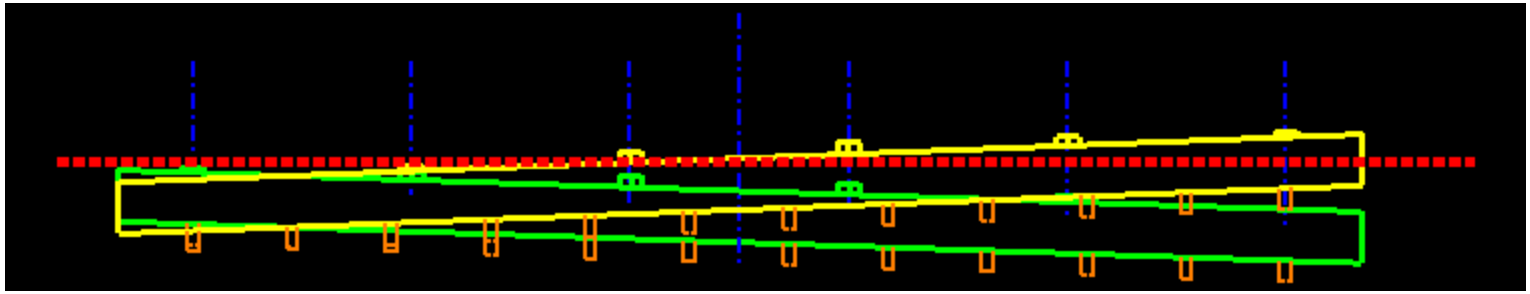
Abutment 3 (East Abutment) – Looking West



SPMT Travel Direction

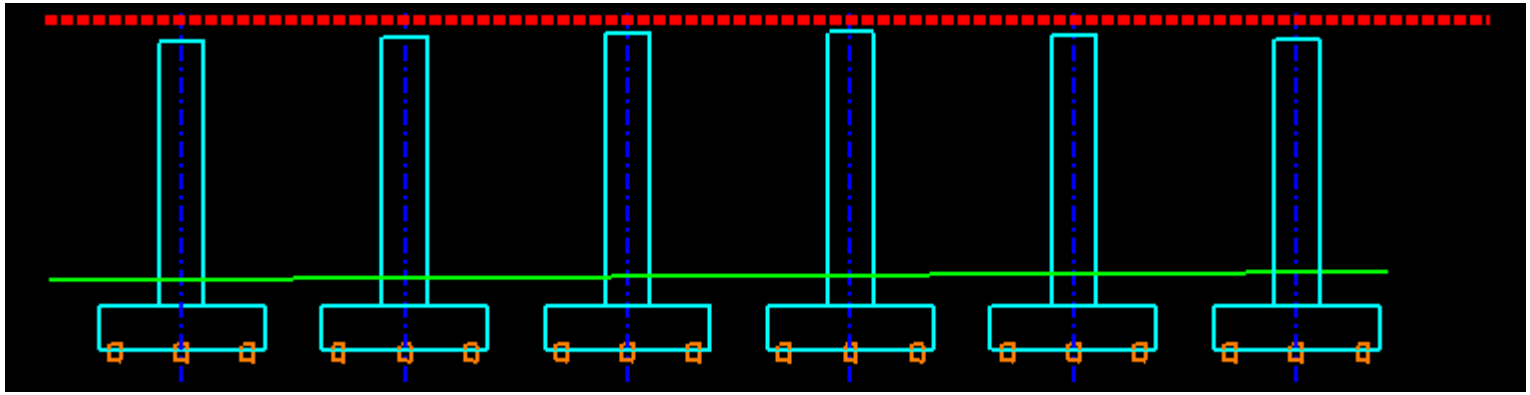
Geometry

Superimposed Abutments – Looking West



SPMT Travel Direction

Bent – Looking West



SPMT Travel Direction

Temporary Supports

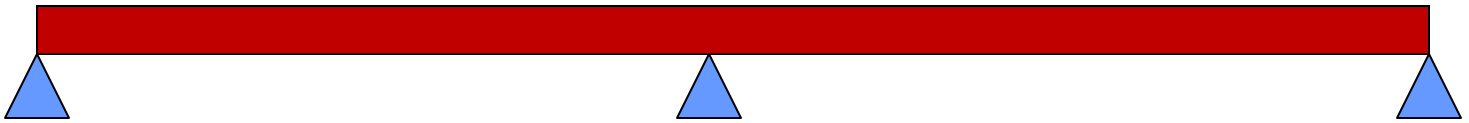
- Coordination needed
- Temporary support design considerations (piles vs. spread footings)
- Settlement
- Vibrations

Structural Modeling

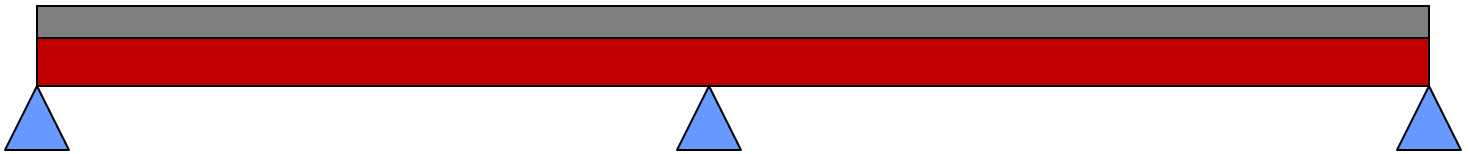
- Stroke required to lift
- Deck and parapet stress
- Allowable twist/displacements
- Placement tolerances

Structural Modeling

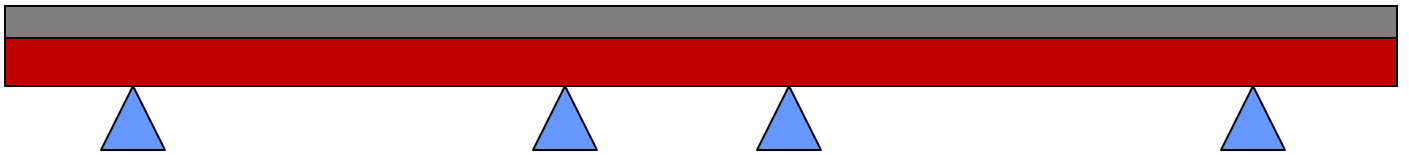
Non-composite Beam



Composite Beam



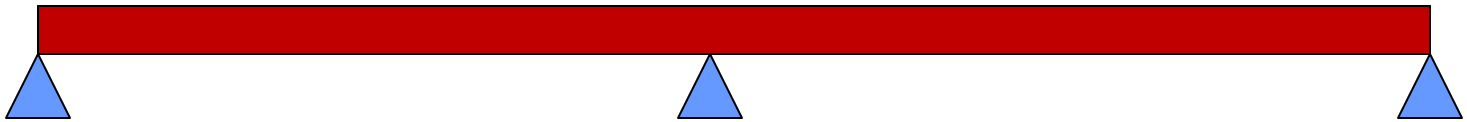
Move Support Displacements (SPMT Lift)



SPMT Limits/Grading

- Bridge weight
- SPMT Limits
  - 11 k/wheel
  - 22 k/axle
  - 44 k/axle line
- Stroke limits (20 inches)
- Grading
  - Use of SPMTs (feasibility)
  - Match relative elevations

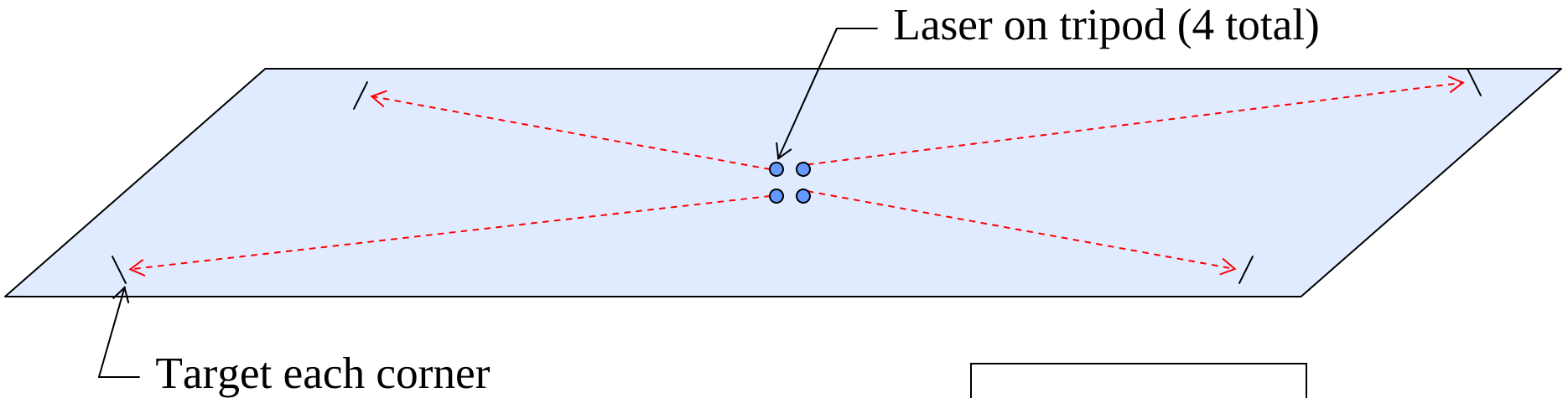
SPMT Limits/Grading



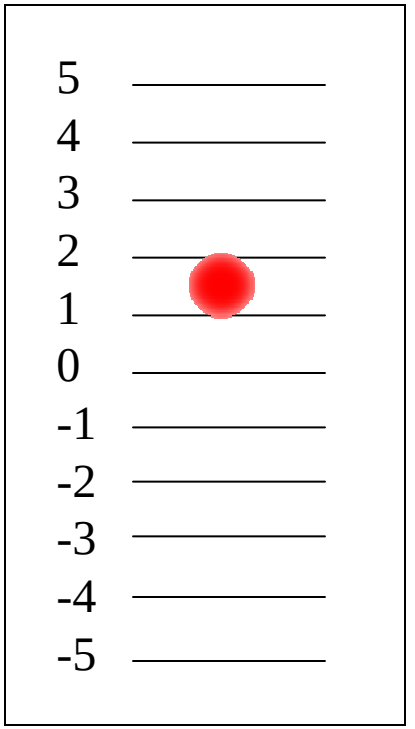
0.1875wl 0.625wl 0.1875wl

The reaction at the center support is 3.3 times greater than at the abutments.

Move Tolerances and Monitoring



- Accuracy
- Error
- Weather



Team Coordination

- Bridge farm
- Temp abutments
- Traffic phasing
- Site prep and SPMT travel path
- Schedule

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Construction

- Grading and layout
- Temporary abutment construction
- Demolition
- Conventional style superstructure
- Conventional style substructure
- Deck pour and screed elevation
- Final grading
- Underground utilities in travel path mitigation
- Travel path construction
- One-night transport, placement, and alignment

Grading & Layout

Design delta is established; the initial grading and alignment is determined for construction of the temporary abutments. Geotechnical engineer evaluates soils and ground pressure to determine material requirements for bridge farm.

Temporary Abutments

Type of temporary abutments are established.

Temporary Abutments

H-pile temporary abutments driven over 90 feet then constructed of 14 x 89 H-piles with cross frames and headers for beam seats.

Superstructure Construction

Girders are erected in a similar fashion as conventional construction with three notable differences.

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Unlike conventional construction, structures erected offline (off-corridor) do not require lane restrictions or detours.

Contractor accessibility and safety is improved by erecting girders offline during the day in a secure and flat location. This saves time and money while improving ingress and egress.

The substructure and superstructure can be built simultaneously allowing the contractor to accelerate the schedule.

Superstructure Construction

Substructure Construction

Pile caps, abutments, and columns are constructed in the same manner as conventional.

Substructure Construction

Substructure Construction

Deck Construction

DECK POUR AND SCREEDS As the bridge is built in a different location with differing elevations, the screed elevations are modified to match the called-out screeds once the bridge is placed.

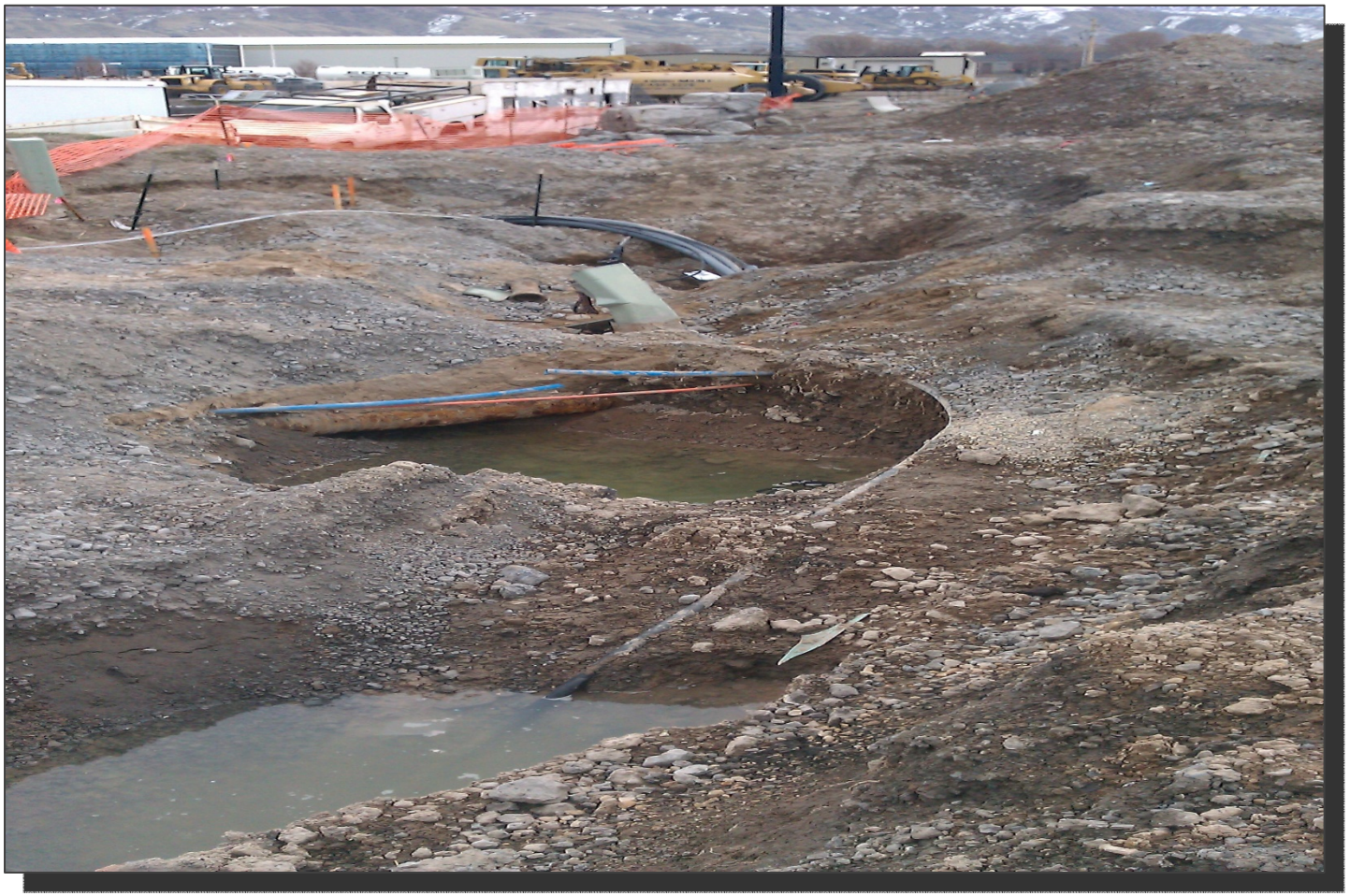
Deck Construction

Due to the bridge being built offline, the deck can be fully tented, heated and easily accessible even in the winter. Because of the access, the deck was also poured with two Bidwell machines reducing the pour duration in half.

Final Grading

Performed prior to SMPT arrival and set up.

Underground Utilities



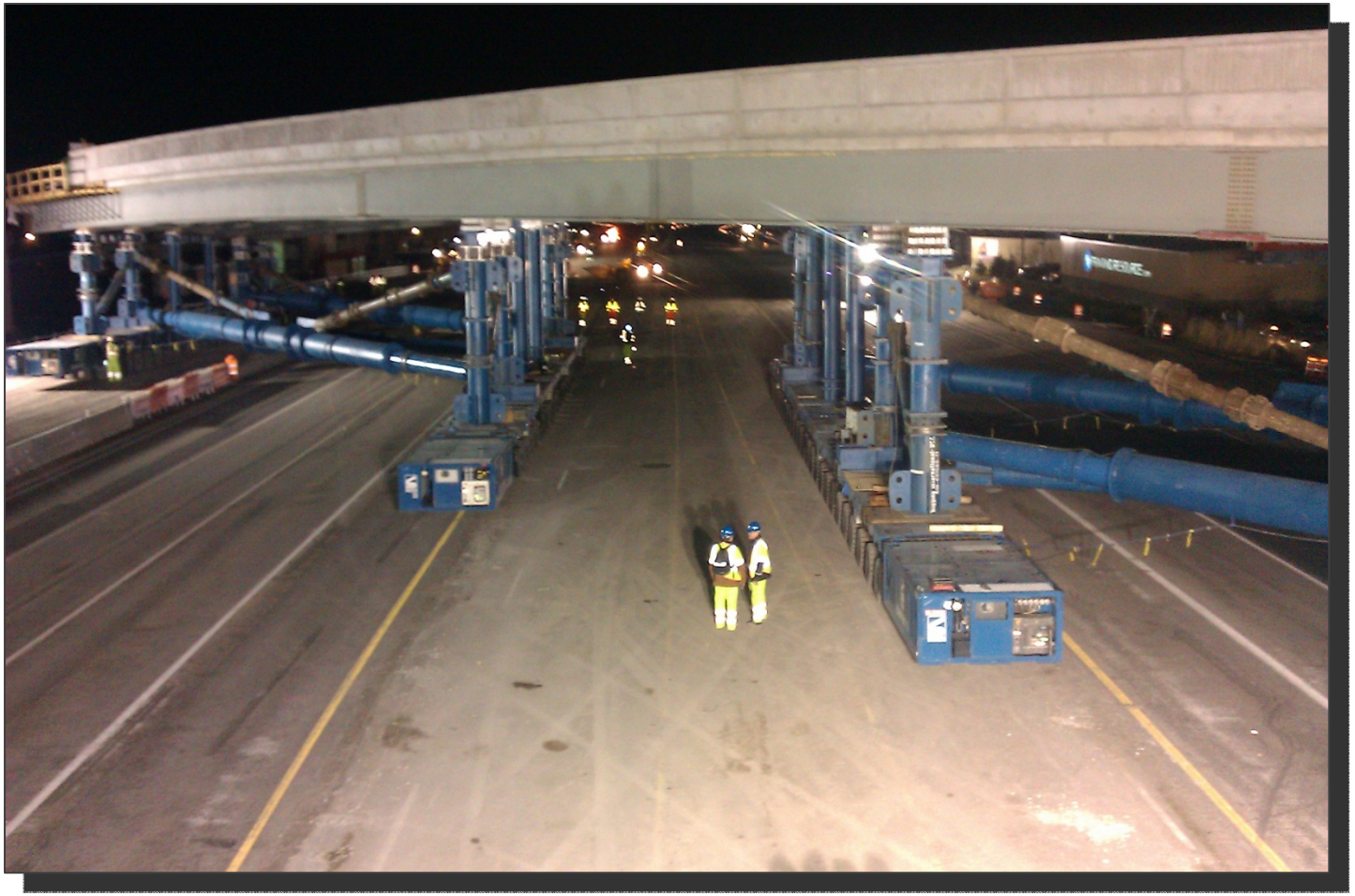
Depending on type, depth, and location of the utilities, additional plates, fills, and route adjustments are established to protect the third party utilities.

Overhead Utilities

Once the location is determined, aerial utilities are mitigated by temporarily relocating or protecting in place.

SPMT Staging and Setup

Execution



ONE-NIGHT TRANSPORT Freeway is closed, barrier is removed, and transitions are constructed. Bridge is then transported, rotated, and set down in a mere few hours.

Execution

Execution

Bridge Placement