

Design and Construction of Curved Precast Girder Bridge Projects in Colorado





Colorado Bridge Projects using Curved Precast Girders

1. IH25 / SH270 Ramp K, Denver - Complete
2. SH270 / IH76 Ramp Y, Denver - Complete
3. E470 / IH70, Ramp H, Denver - Complete
4. SH58 / IH70, Ramp A, Golden - Complete
5. Austin Bluffs, Colorado Springs - Complete
6. IH25 Viaduct Phase I, Trinidad - Complete
7. IH25 Viaduct Phase II, Trinidad - Design

Southbound IH25 / SH270 Ramp K

- Contractor Alternate Design to Steel Base Bid
- 200' Spans, 800' Horizontal Curve
- Designed by Summit Engineering, Littleton, CO and PBS&J, Denver
- Built by Sema Construction



IH70 / E470 Ramp H

- Contractor Design/Build Project.
- 100 to 195' Spans
- 1400' Horizontal Curve
- Designed by DMJM Harris, Denver
- Built by Lawrence Construction Co, Littleton, CO



IH76 / SH270 Ramp Y

- Span Lengths from 100' to 230'.
- 760' Radius horizontal curve.
- Colorado DOT Design.
- Value Engineering by Summit Engineering
- Built by Edward Kraemer & Sons, Castle Rock CO

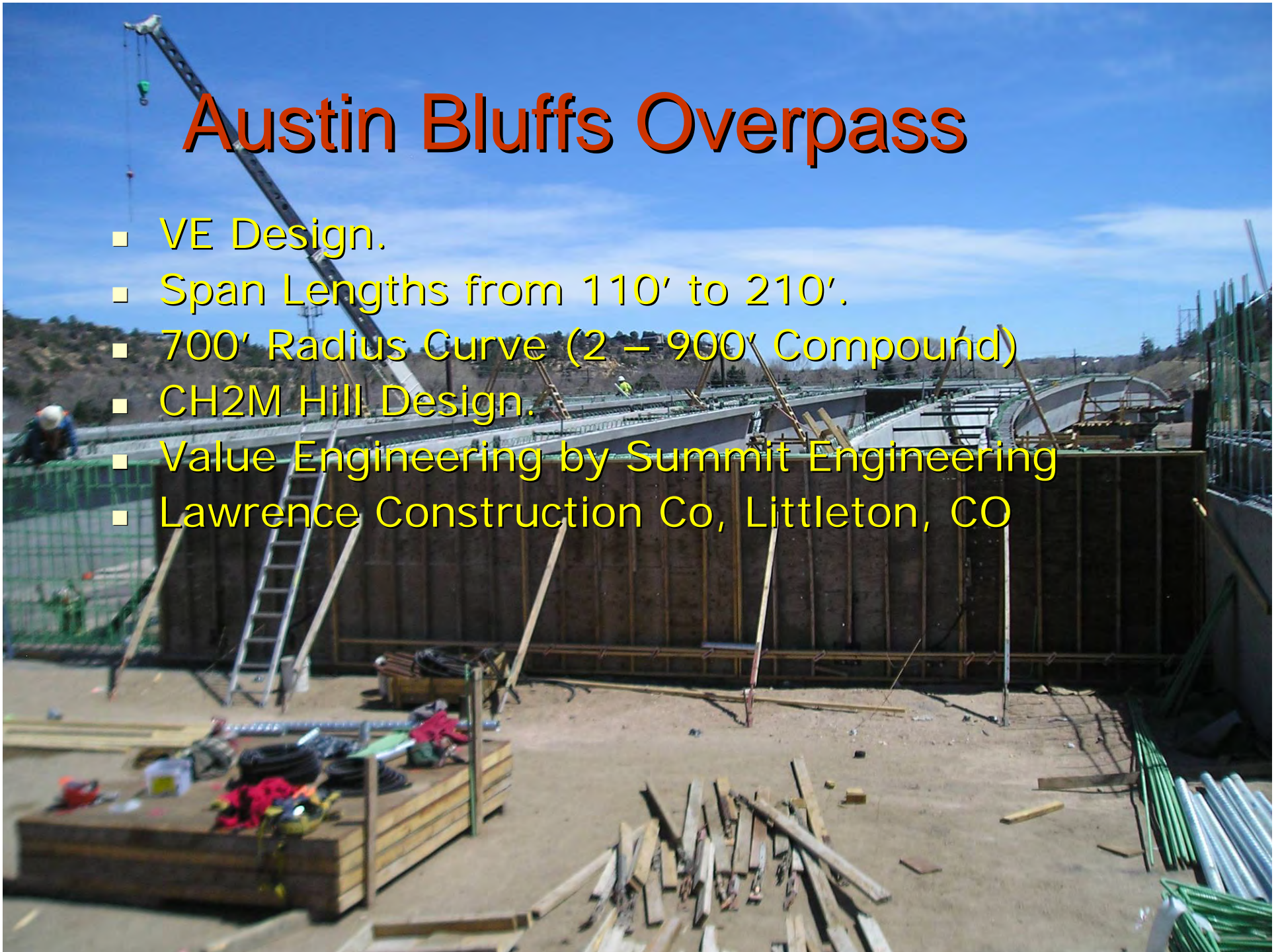
IH70 / SH 58 Ramp A

- VE Design
- Span Lengths from 150' to 235'.
- 820' Horizontal Curvature.
- CH2M Hill Design.
- Value Engineering by Summit Engineering
- Built by Ames Construction Co, Denver, CO



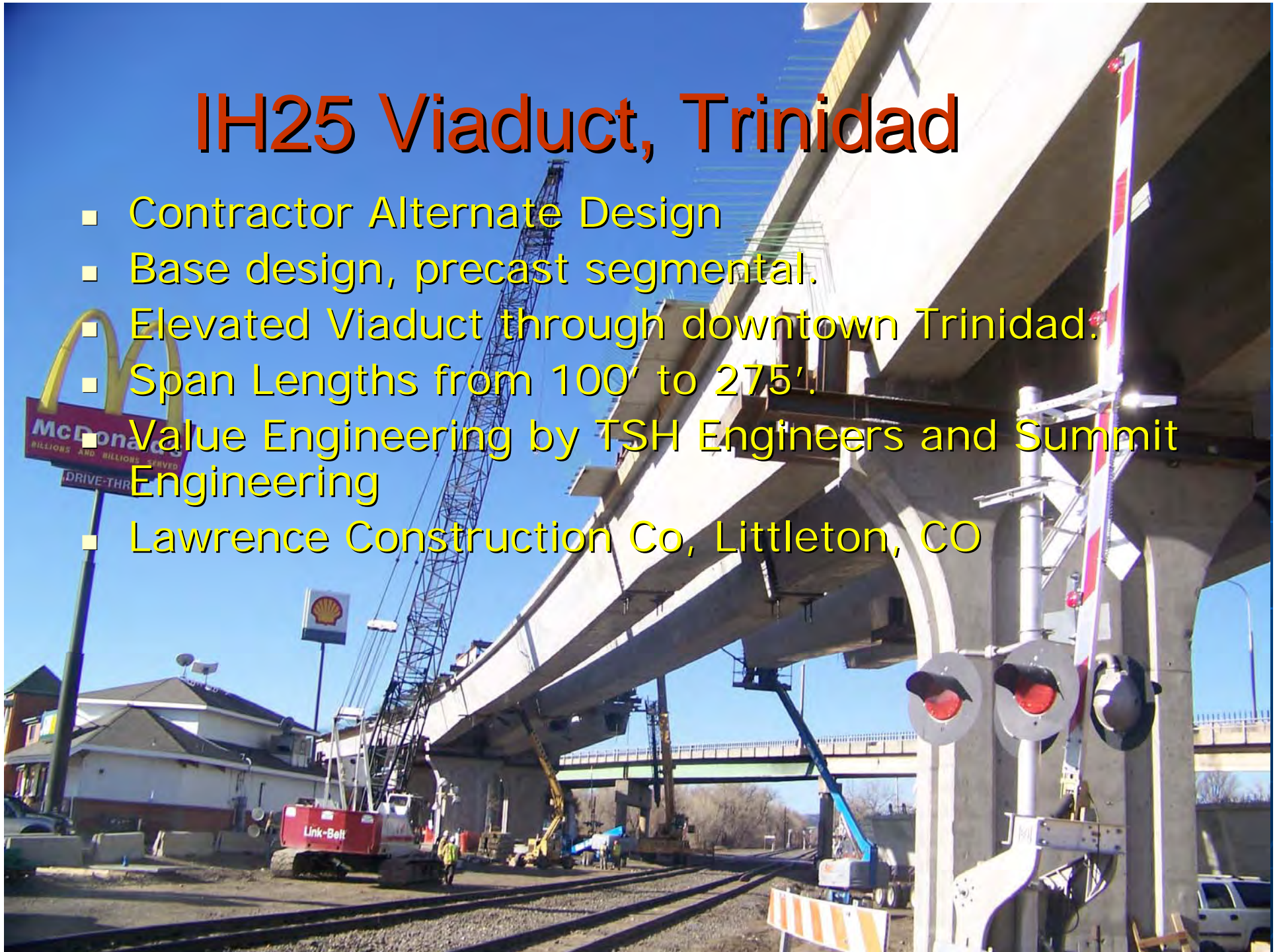
Austin Bluffs Overpass

- VE Design.
- Span Lengths from 110' to 210'.
- 700' Radius Curve (2 – 900' Compound)
- CH2M Hill Design.
- Value Engineering by Summit Engineering
- Lawrence Construction Co, Littleton, CO



IH25 Viaduct, Trinidad

- Contractor Alternate Design
- Base design, precast segmental.
- Elevated Viaduct through downtown Trinidad.
- Span Lengths from 100' to 275'.
- Value Engineering by TSH Engineers and Summit Engineering
- Lawrence Construction Co, Littleton, CO



Curved Girder Bridge Quantities

Project	Bridge S.F.	L.F. Curved Precast
IH25 / SH270 Ramp K	66,740 s.f.	2,840 l.f.
IH76 / SH270 Ramp Y	77,248 s.f.	4,544 l.f.
IH70 / SH58 Ramp A	79,995 s.f.	4,095 l.f.
Austin Bluffs	57,715 s.f.	2,380 l.f.
IH25 Trinidad, Phase I	65,728 s.f.	4,141 l.f.
IH70 / E470 Ramp H	75,952 s.f.	3,232 l.f.
Total	414,378 s.f.	21,232 l.f.

270 Ramp Y Cost Comparisons

Item	Steel Design	Curved Precast
Girder Cost	\$5,125,000	\$3,086,240
Erection Costs	\$1,025,000	\$890,000
Falsework	\$50,000	\$250,000
Post Tensioning	\$0	\$506,000
Total	\$6,200,000	\$4,732,240
Cost / Ft.	\$1393 / lf	\$1063

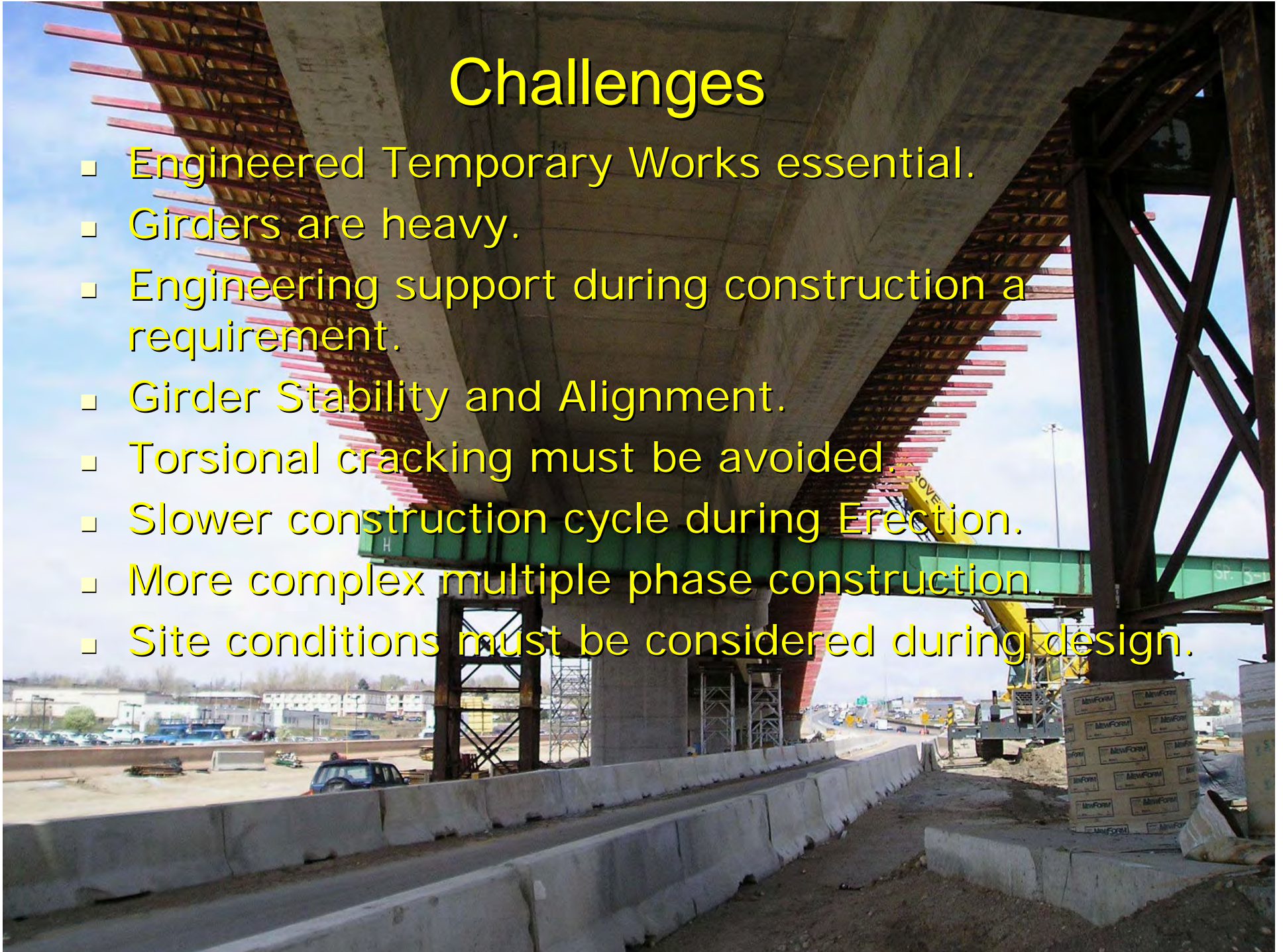
Advantages

- Economy of Construction.
- Speed of Fabrication.
- Setup Costs amortized in initial projects. .
- Vertical Shoring for temporary support.
- Design uses established techniques on new application.
- Pleasing Aesthetics.
- Low maintenance.

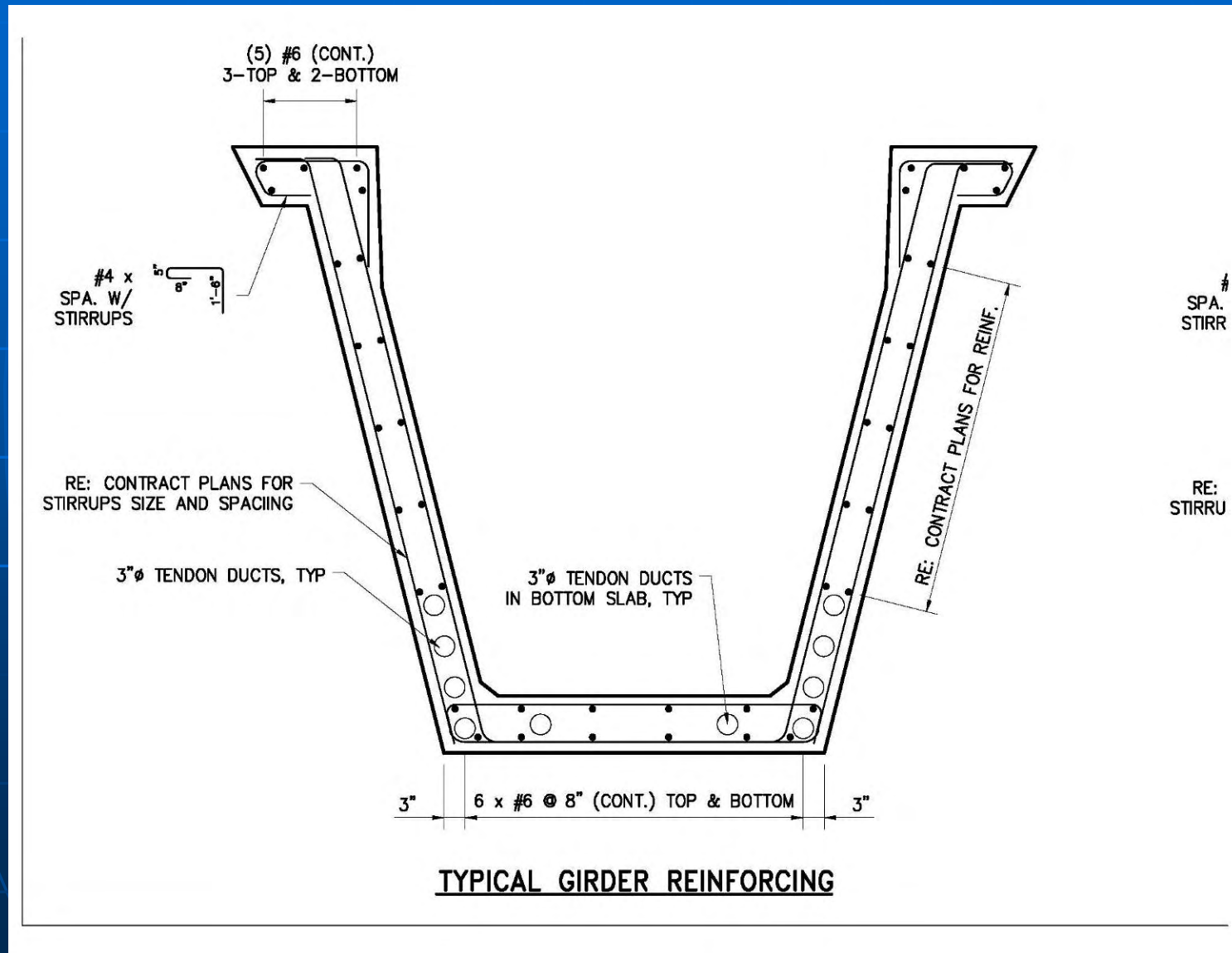


Challenges

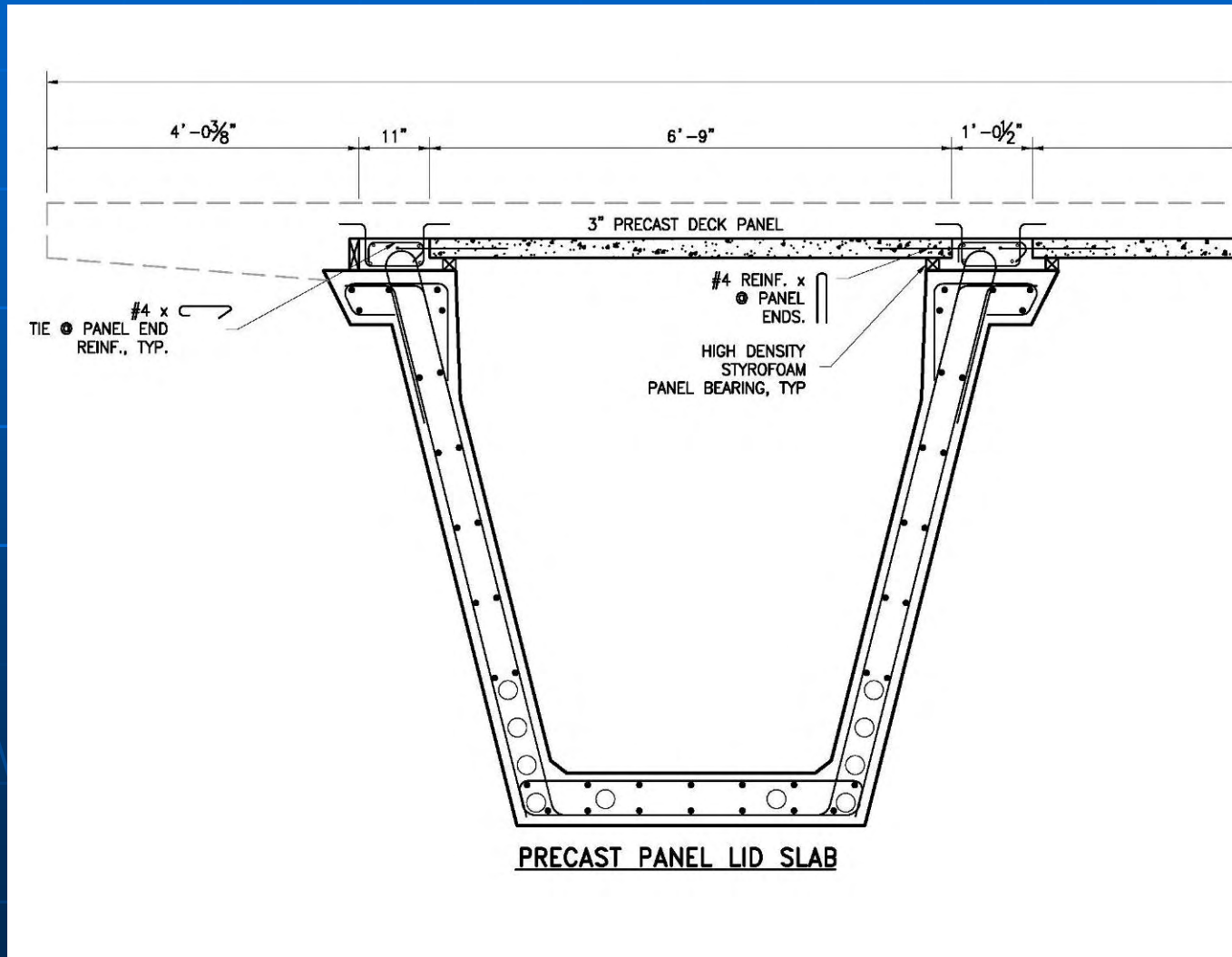
- Engineered Temporary Works essential.
- Girders are heavy.
- Engineering support during construction a requirement.
- Girder Stability and Alignment.
- Torsional cracking must be avoided.
- Slower construction cycle during Erection.
- More complex multiple phase construction.
- Site conditions must be considered during design.



Typical Girder Cross Section – U84 Grider



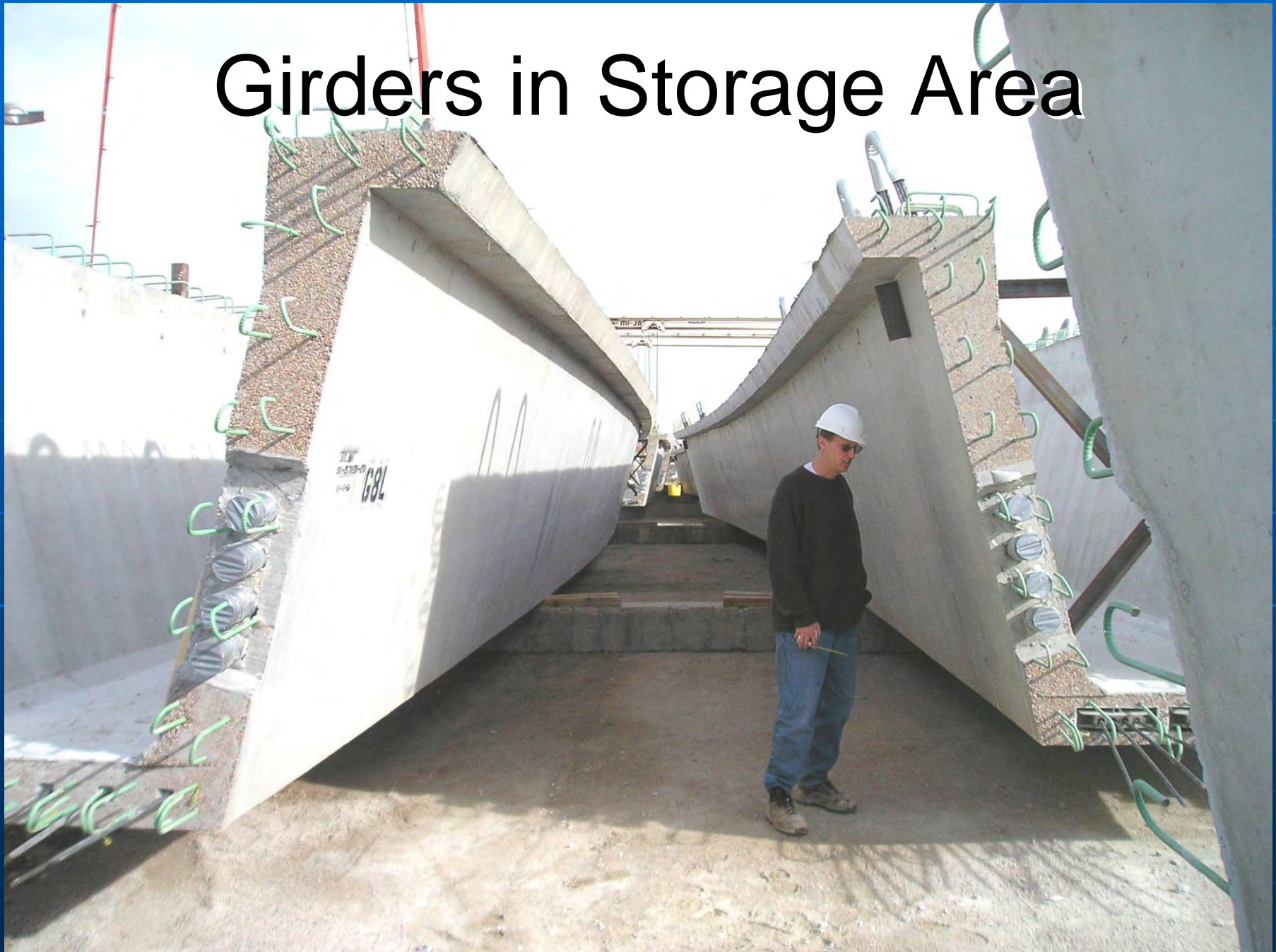
Precast Panel Lid Slab Installed after Girder Erection



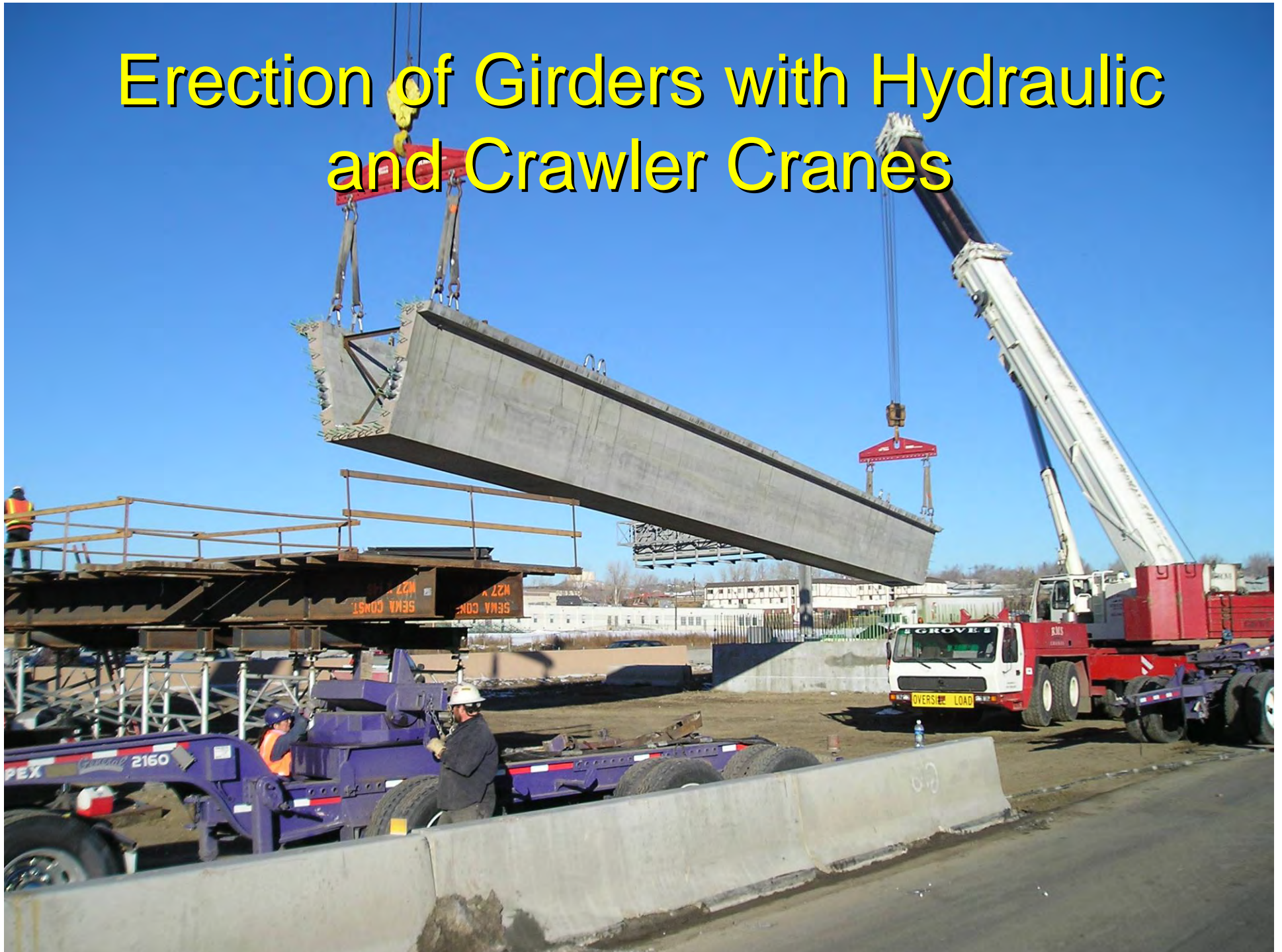
Curved Girder Formwork



Girders in Storage Area



Erection of Girders with Hydraulic and Crawler Cranes



Girders erected on vertical shoring



Girders Spliced and Lid Slabs in Place Post Tensioned Prior to casting Deck Slab



Deck Forms Placed



Deck slab and barriers cast



12/12/2008

Solutions to Site Conditions Straddle bents at Traffic Openings



Cantilevered Girders over existing bridges



Strong back support from previously erected girders



275' Clear Opening over Rail Line



150' Long Field Spliced drop in Girders at RR crossing



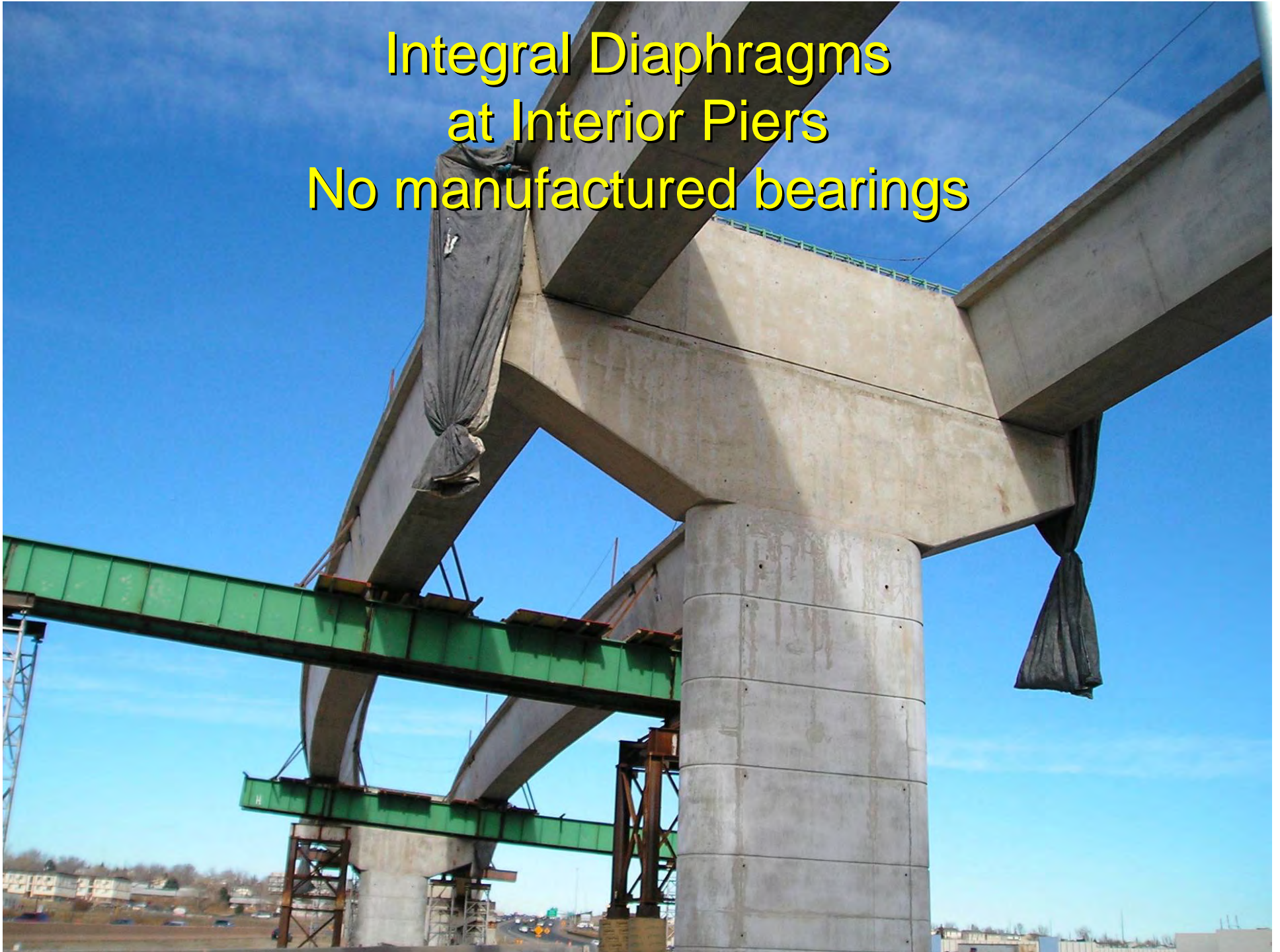
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Design Features

Notched Precast for CIP Anchor Blocks



Integral Diaphragms
at Interior Piers
No manufactured bearings



Long Span Precast Panels



**Notched Ends at Expansion Piers
allow for double end stressing**



CIP Diaphragm/Anchor Blocks at End of Unit



Summary

- Six Completed Projects currently under traffic
- Designs successfully used as alternates to steel and segmental bridges
- Two more projects under design.
- Opportunity for future applications is unlimited.