



Pecos Street over I-70 Bridge Replacement Project

Pre-Bridge Move
Technical Workshop
July 17, 2013





Project Funding

- Colorado Bridge Enterprise – FASTER
 - \$4.38 million grant FHWA's Highways for Life Program – Every Day Counts
 - Hazard Elimination Safety (HES) funds
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CM/GC Project Delivery

- Allows input from Contractor for project elements unique to ABC methods
 - Permanent structure can be designed and detailed for specific ABC method selected
 - Costs of ABC will be more accurate with Contractor pricing
 - Contractor has advantage to pick the best Bridge Staging location early in process
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Project Team

- ***Owner:*** Colorado Department of Transportation (CDOT)
 - ***Design Engineer:*** Wilson & Company
 - ***Contractor:*** Kiewit Infrastructure
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Existing Bridge

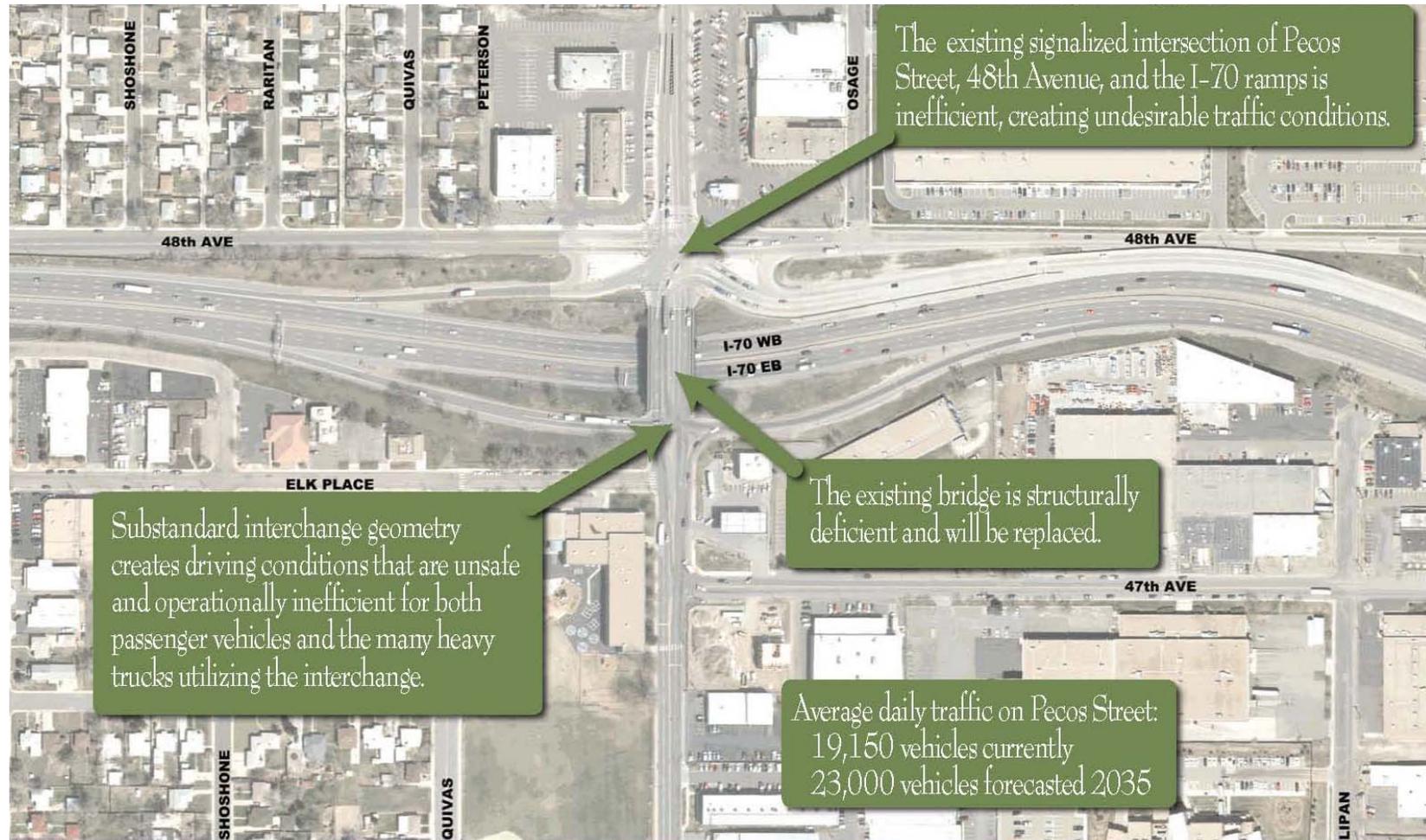




Project Overview

- Structure E-16-FW was selected for replacement – sufficiency rating 43.9
 - Originally directed to only replace the existing structure in kind
 - 3 phases needed for normal construction
 - Required to maintain 5 lanes of traffic across structure
 - Potential widening needed to maintain traffic
 - Noticed congestion and substandard geometry was also a problem for the interchange
 - Bridge Enterprise authorized funding for traffic study
-

Existing Interchange





Existing Traffic Volumes

- Pecos Street ADT
 - 10,000 North of I-70 (5-10% Large Trucks)
 - 19,000 South of I-70 (5% Large Trucks)
 - 4-5,000 West Ramps (6% Large Trucks)
 - 8-9,000 East Ramps (9% Large Trucks, 10-25% Loop movement)
 - W. 48th Ave. ADT
 - 5,000 West of Pecos Street (5% Large Trucks)
 - 10,700 East of Pecos Street (8% Large Trucks)
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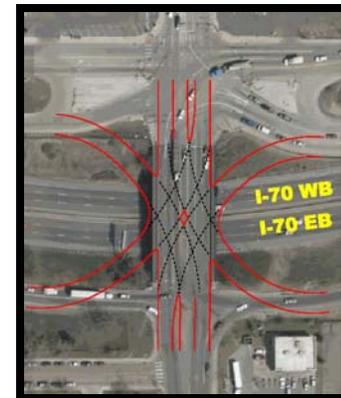


Design Considerations

- ROW restrictions – minimize impacts
 - 6 legs on north intersection
 - Truck traffic – industrial area
 - Pedestrian traffic
 - I-70 traffic
 - Construction phasing
-

Alternatives Considered

- Restripe bridge to provide 2 SB lefts
- Add lanes to bridge – 2 alternatives
- Relocate north movements – 7 alternatives
- Full interchange – 3 alternatives
 - Single Point Urban Interchange
 - Diverging Diamond Interchange
 - Offset Intersection with flyovers
- Modern Roundabouts





Project Goals

1. Advance knowledge, experience & cost efficiency of the CDOT construction program and the construction industry in ABC and CM/GC project delivery
 2. Provide a well publicized, highly successful ABC project
 3. Replace the poor structure, and improve traffic operations and safety within the project budget
 4. Accelerate delivery of construction schedule & complete by October 1, 2013
 5. Minimize inconvenience to traveling public, & maximize safety of workers & traveling public
 6. Facilitate a collaborative partnership with all of the members of the project team and stakeholders
 7. Provide a high quality design and construction
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Pedestrian Movements



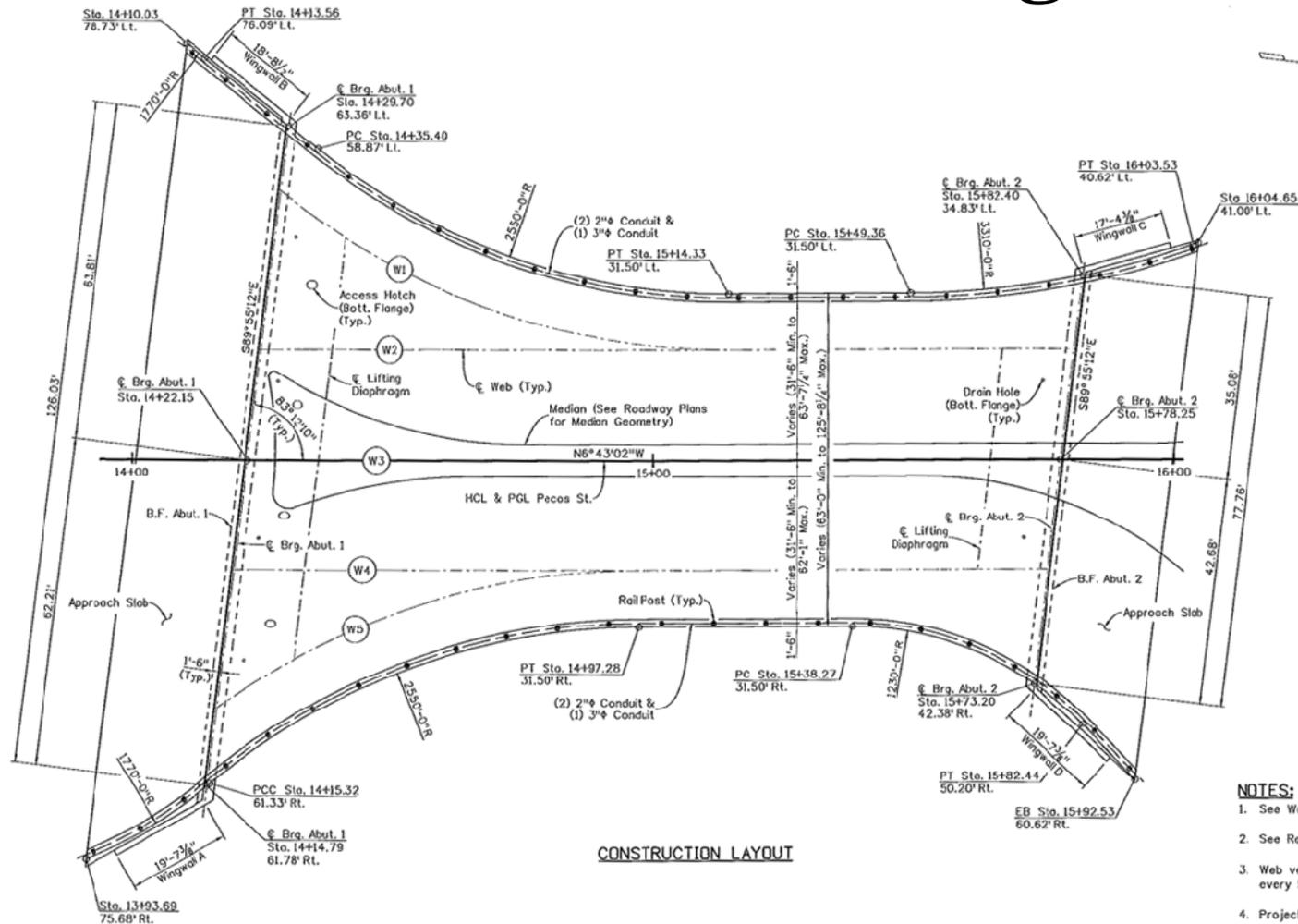
Pedestrian Hybrid Beacon



Pedestrian Bridge



Pecos Street Bridge



CONSTRUCTION LAYOUT

NOTES:

1. See Web Layout sheet for web locations.
2. See RailPost Layout for rail post locations.
3. Web ventilation holes shall be placed every 50'-0" Min. See Sheet
4. Project oil conduits 2'-0" minimum at ends.

Print Date: 4/10/2012	File Name: 18149BRDG_Const_Layout.dgn
Horiz. Scale: 1:1	Vert. Scale: As Noted
Unit: 0224	Unit Leader: AJP



Sheet Revisions		
Date:	Comments	Init.

Colorado Department of Transportation

2000 South Holly Street
Denver, CO 80222
Phone: 303-512-4105 FAX: 303-757-9059

Region 6 REG

As Constructed
No Revisions:
Revised:
Void:

PECOS STREET OVER I-70 CONSTRUCTION LAYOUT	
Designer: I. Johnson	Structure: E-16-YQ
Detailer: K. Kathrineberg	Numbers: ? of ??
Sheet Subset: BRIDGE	Subset Sheets: ? of ??

Project No./Code	FBR 0704-224
	18149
Sheet Number	



Why ABC for this Project?

- Reduced construction schedule
 - (preferred by local businesses)
 - Reduced road user costs and delays
 - Improved safety
 - (work zone & road user)
 - Strong public support for ABC
 - Meets project goal to expand ABC construction knowledge in Colorado
 - (for Contractor and Owner)
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ABC Decision Making Process

- Used UDOT's ABC Rating Procedure for Pecos
 - Based on FHWA "Decision-Matrix Framework for PBES", May 2006
 - Rating procedure is easy to use
 - 8 evaluation measures for decision making
 - Road User Delays/Costs - major consideration
 - CDOT Report CDOT-2010-2 confirms road user delay/costs can be significant
 - Favorable site conditions must be satisfied
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Evaluation Measures

Colorado Department of Transportation		Project: Pecos over I-70	
		By: TVM	Checked:
		Date: 9/15/2011	
		Sheet No. 1	of 3
ABC Rating Procedure		August 2011	
Enter values for each aspect of the project. Attach applicable supporting data.			
Average Daily Traffic	<input type="text" value="5"/>	0	No traffic impacts
Combined on and under		1	Less than 5000
Enter 5 for Interstate Highways		2	5000 to 10000
		3	10000 to 15000
		4	15000 to 20000
		5	More than 20000
Delay/Detour Time	<input type="text" value="2"/>	0	No delays
		1	Less than 5 minutes
		2	5-10 minutes
		3	10-15 minutes
		4	15-20 minutes
		5	More than 20 minutes
Bridge Classification	<input type="text" value="1"/>	1	Normal Bridge
		3	Essential Bridge
		5	Critical Bridge
User Costs	<input type="text" value="5"/>	0	No user costs
		1	Less than \$10,000
		2	\$10,000 to \$50,000
		3	\$50,000 to \$75,000
		4	\$75,000 to \$100,000
		5	More than \$100,000
Economy of Scale (total number of spans)	<input type="text" value="0"/>	0	1 span
		1	2 to 3 spans
		2	4 to 5 spans
		3	More than 5 spans
Use of Typical Details	<input type="text" value="1"/>	1	Complex geometry or unfavorable site conditions
		3	Some complexity, but favorable site conditions
		5	Simple geometry and favorable site conditions
Safety	<input type="text" value="3"/>	1	Short duration impact with simple MOT scheme
		2	Short duration impact with multiple traffic shifts
		3	Normal duration impact with multiple traffic shifts
		4	Extended duration impact with multiple traffic shifts
		5	Extended duration impact with complex MOT scheme
Railroad Impacts	<input type="text" value="0"/>	0	No railroad or minor railroad spur
		3	One mainline railroad track
		5	Multiple mainline railroad tracks

1. Average Daily Traffic
2. Delay/Detour Time
3. Bridge Classification
4. User Costs
5. Economy of Scale
6. Use of typical details
7. Safety
8. Railroad impact

Scoring and Costs

Colorado Department of Transportation	Project: Pecos over I-70	
	By: TWM	Checked:
	Date: 9/15/2011	
	Sheet No. 2	of 3

ABC Rating Procedure

August 2011

Note: Do not adjust weight factors without prior consultation with Project Team.

ABC RATING SCORE FACTORS AND WEIGHTS					
	Score	Weight Factor	Adjusted Score	Maximum Score	Adjusted Score
Average Daily Traffic	5	10	50	5	50
Delay/Detour Time	2	10	20	5	50
Bridge Classification	1	5	5	5	25
User Costs	5	10	50	5	50
Economy of Scale	0	3	0	3	9
Use of Typical Details	1	3	3	5	15
Safety	3	10	30	5	50
Railroad Impacts	0	5	0	5	25
		Total Score	158	Max. Score	274

ABC Rating Score: 58

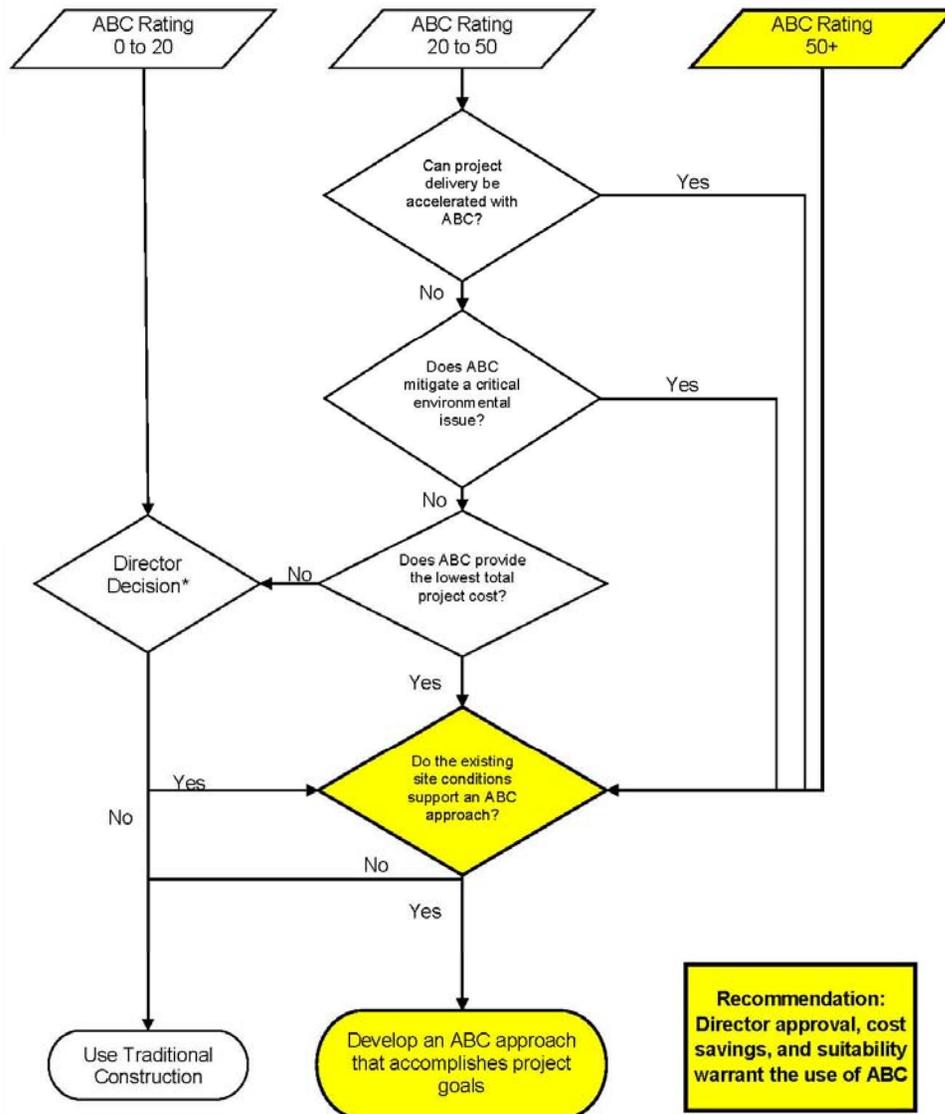
The ABC Rating Score is driven by the four most heavily weighted factors: Average Daily Traffic, Delay/Detour Time, User Costs and Safety. For a detailed explanation, review the narrative of the ABC Decision Making Process.

Cost Considerations:

Calculate the following costs for use in determining the lowest total project cost

TOTAL PROJECT COST EVALUATION			
	Alt. 1: 3-phase Conv.	Alt. #2: ABC with SPMT	Alt. #3: ABC with slide-in
Bridge Const. Costs	\$3,552,000	\$3,552,000	\$3,552,000
ABC costs or overbuild	\$450,000	\$800,000	\$250,000
User Delay Costs	\$3,543,000	\$1,305,000	\$1,452,500
Bridge Project Cost	\$7,545,000	\$5,657,000	\$5,254,500
User costs/bridge costs	1.00	0.37	0.41

Final Tests for ABC

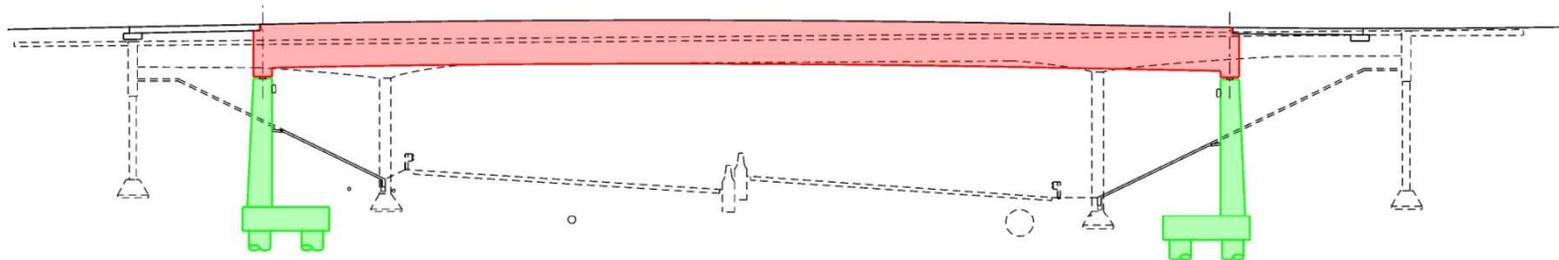


1. Can project be accelerated using ABC?
2. Does ABC mitigate a critical environmental issue?
3. Does ABC provide lowest total project cost?
4. **Do existing site conditions support an ABC approach?**

Do Site Conditions Favor ABC?

Considerations

- Existing and proposed grades
- Room for substructure construction
- Room for maintaining traffic
- Size of Bridge Staging Area
- Suitability of Travel path



PECOS STREET OVER I-70



Decisions Prior to CM/GC Contractor Selection

- Interchange type and geometrics
 - Project Goals
 - ABC approach (using ABC Decision Process)
 - Structure layout
 - Structure type options
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Decisions with CM/GC Contractor

- Structure type
 - Abutment foundation
 - ABC method
 - Bridge Staging Area (BSA) location
 - Temporary supports at BSA
 - Construction schedule
-

ABC: Roll In Approach Selected

- Construct superstructure in Bridge Staging Area
- Construct abutments behind existing piers
- No I-70 lane closures until bridge move
- Replace superstructure in max. 50-hour weekend closure of I-70





Costs Associated with ABC

- Estimated about \$1.5M for ABC approach using roll-in. Actual costs less than \$2M
 - Other elements not included in ABC costs:
 - Lifting Diaphragms
 - Wingwall tops placed after roll-in
 - Low overhead caisson rig for working under existing bridge
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Pecos Street Bridge Design

- 3D analysis was required to determine both permanent and temporary loads
 - Selected plate element model
 - Used to determine reactions in lifting diaphragms
 - Used to develop acceptable distortion limits for bridge move

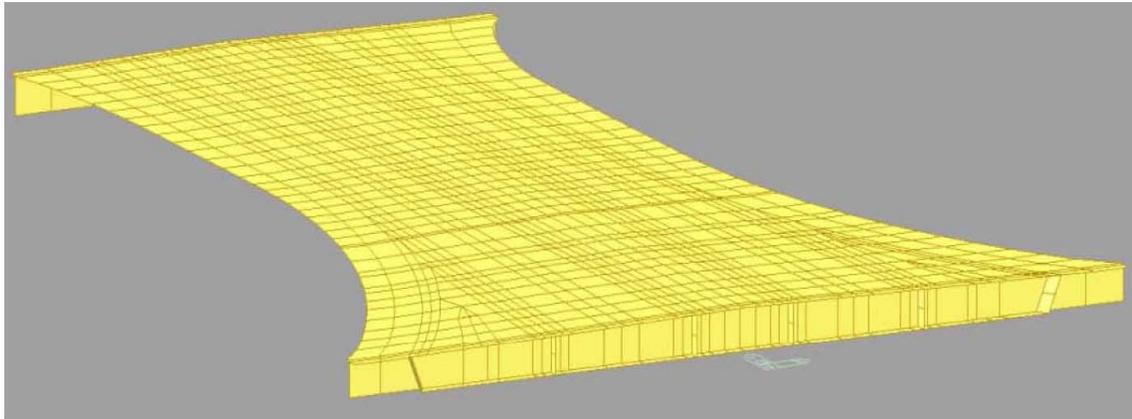


Figure 1 Bridge Overview

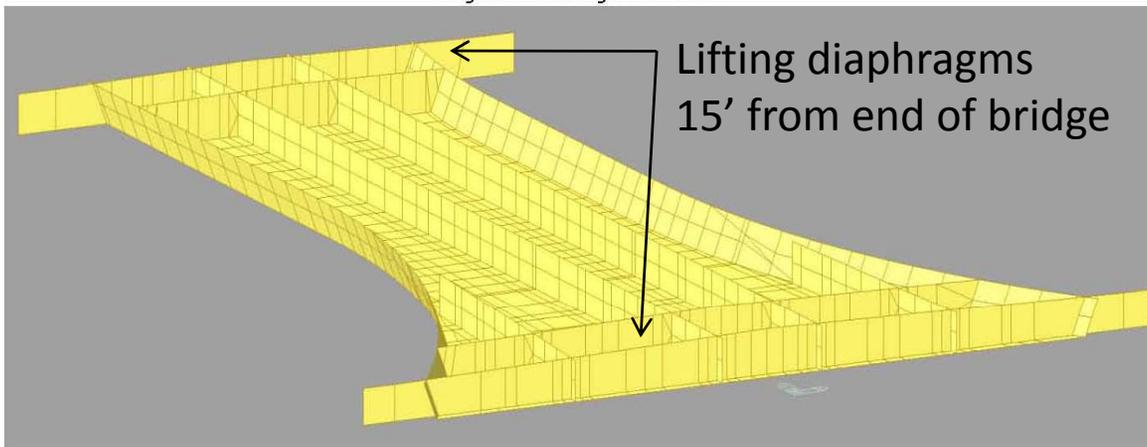


Figure 2 Overview without Deck



Design Lessons Learned

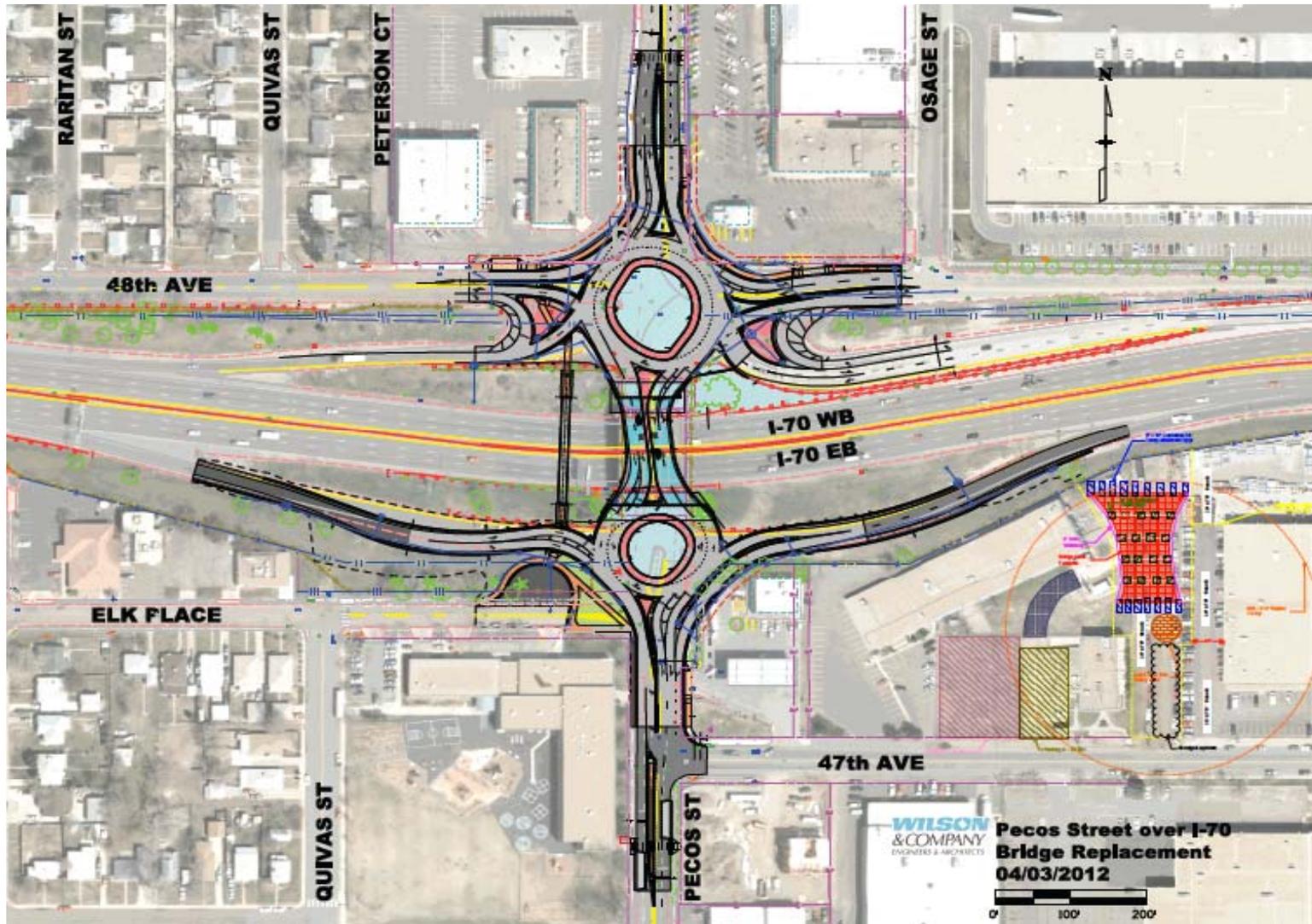
- Simplify geometry when possible
 - Selection of bridge modeling is critical for handling all loading conditions
 - More balanced loads at temporary supports helps simplify SPMT design
 - Engage heavy lifter subcontractor in the design process to better understand loads induced on lifting diaphragms
-



Design Lessons Learned

- Bearings – need better method for setting bearings to evenly distribute loads
 - Deck PT – Type 7 barrier would be better than Type 10 for avoiding rebar conflicts with PT anchorages
 - Lighter weight bridge reduces cost of SPMT (about \$10,000 per axle for Pecos)
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Bridge Staging Area Design



Bridge Staging Area Design



Bridge Staging Area Construction



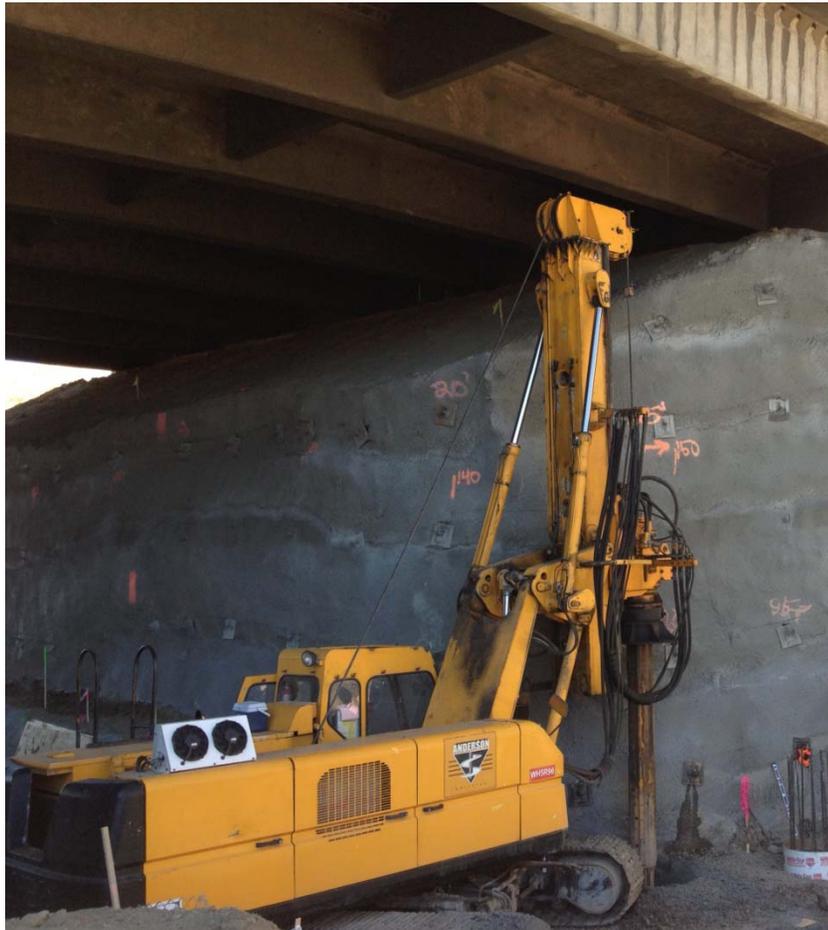
Bridge Staging Area Construction



South Abutment Construction



North Abutment Construction



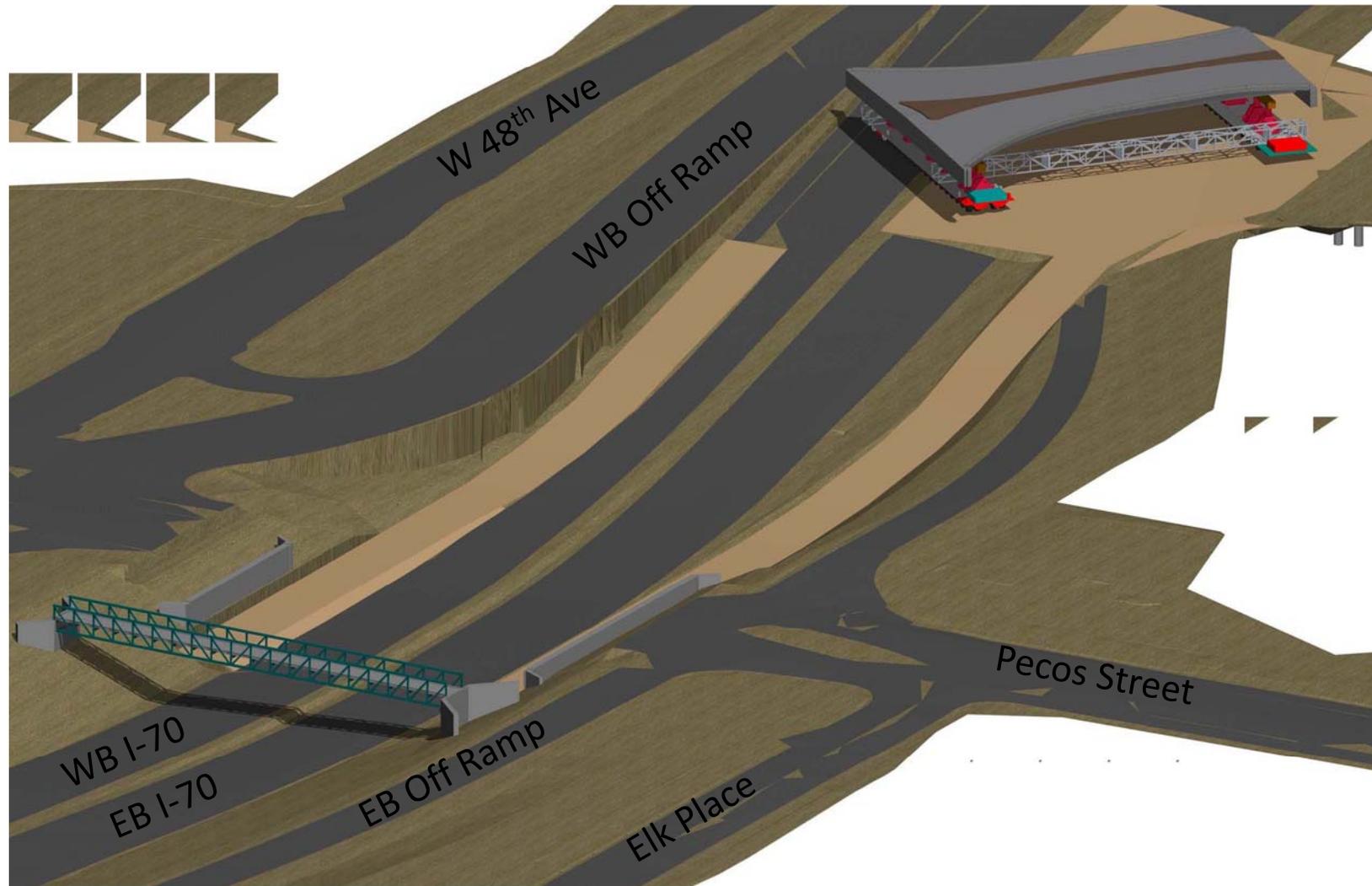
Self Propelled Modular Transport (SPMT)



Raising the Bridge



During I-70 Closure





Project Fun Facts

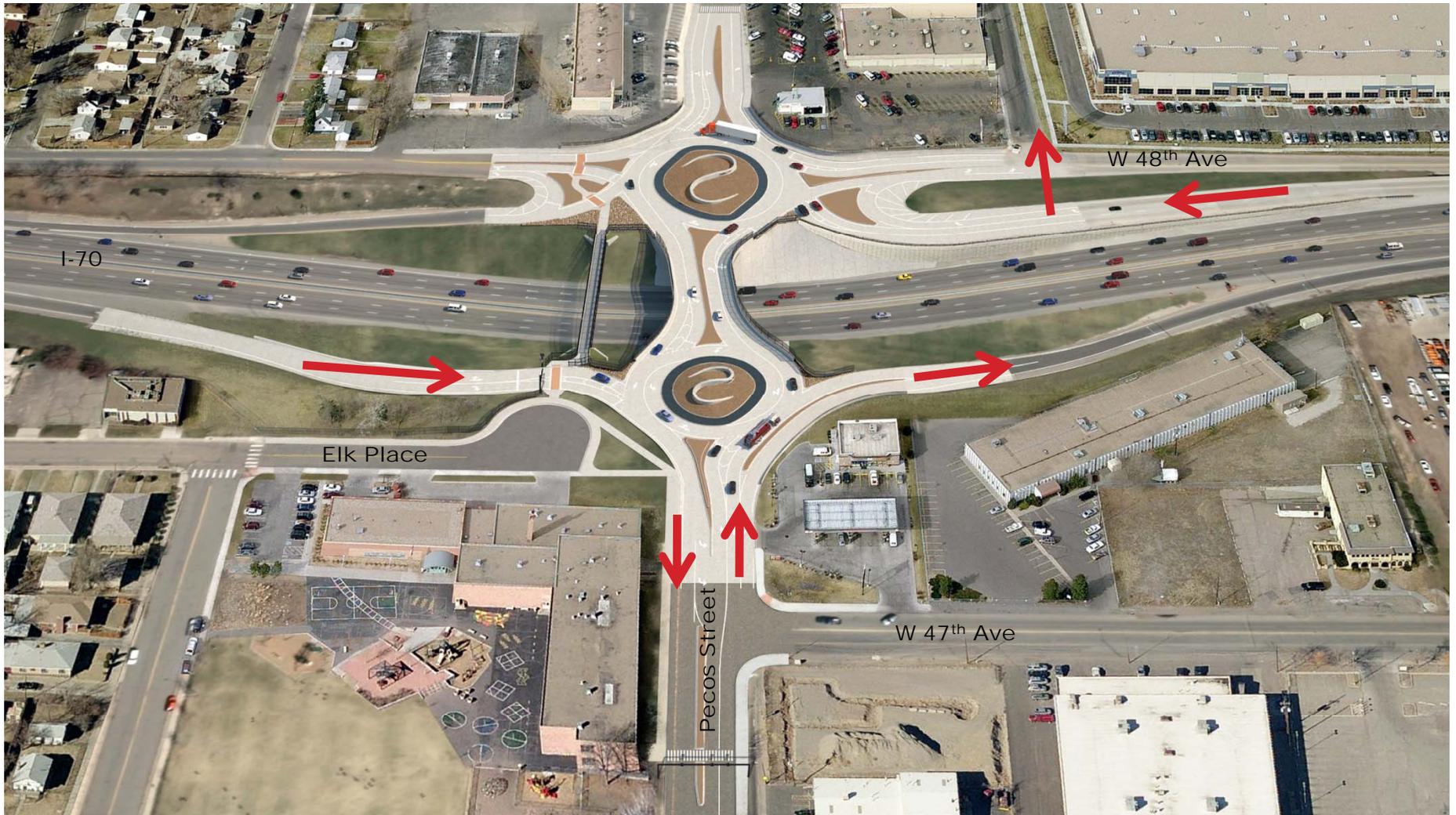
- 88 Self-Propelled Modular Transporters (SPMT) Axles
 - Bridge weighs a total of 2,400 tons
 - 1,080 CY of concrete
 - 240,000 LBS of reinforcing steel
 - 19 miles of post tensioning strand
 - Bridge will be rolled 700 feet
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Construction Schedule

- June 24, 2013: Close Pecos Street for 8 weeks
 - Construct roundabouts
 - July 19-July 21: 50 hour Closure of I-70
 - Friday PM: demolish existing Pecos Street bridge
 - Saturday: Roll in bridge on SPMT's
 - Sunday PM: finish connections and re-open I-70
 - First week of September
 - Construction complete
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Pecos Street Full Closure





Learn more about the Project

- Visit: www.coloradodot.info/projects/pecosoveri70
 - Email: Pecos.I70@kiewit.com
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