



The FARM (Fixing Access to Rural Missouri) Bridge Program and MoDOT's Experience with Design Build Bridge Bundling

Presented to The 69th Annual Structural Engineering Conference
Lawrence, Kansas
March 7, 2024

Bryan Hartnagel
State Bridge Engineer

Presentation Topics



- History and Missouri Law of design build at MoDOT
- Summary of bridge bundling projects
- Benefits of design build bridge bundling
- Specifics of Fixing Access to Rural Missouri (FARM) bridge project

History of Design Build Law



- 2004 Design build authority legislation
 - Limited to three projects
- Missouri Statute: Section 227.107
 - Expanded in 2012
 - Limited to 2% of # of STIP projects per fiscal year
- Must pre-qualify (Use 2-phase procurement), RFQ than RFP
 - Advertising requirements
 - Shortlist no more than 5



History of Design Build Law



- Design Build teams must provide DBE plan
- Must pay reasonable stipend
- RFQ and RFP procedures
- SOQ scoring requirements
- Stipend guidance
- Risk allocation guidance
- Proposal scoring guidance

MoDOT Design-Build Program



- 27 Awarded Contracts
 - Lowest \$14.4M (I-70 Climbing Lanes 2020)
 - Largest \$487M (Safe and Sound Bridge Program 2010)
- 9 in progress, \$1.49 billion under contract
- MoDOT Design-Build target is 10% of overall program
 - 1-3 projects per year





Bridge Bundling Projects



Bundle projects completed

- Safe and Sound Bridge Improvement Program
 - 802 Bridges (554 Design build), \$685 million total
- I-44 Project Bridge Rebuild
 - 19 Bridges, \$31 million
- Bootheel Bridge Bundle Project
 - 17 Bridges, \$25.5 million
- Fixing Access to Rural Missouri (FARM) Bridge Program
 - 31 Bridges, \$26 million



A2276 St Francois Co. Rt O
10-2-06 Looking East



St. Francois County Route O





New Madrid County Route EE





I-44 at Lawrence County Route 1147

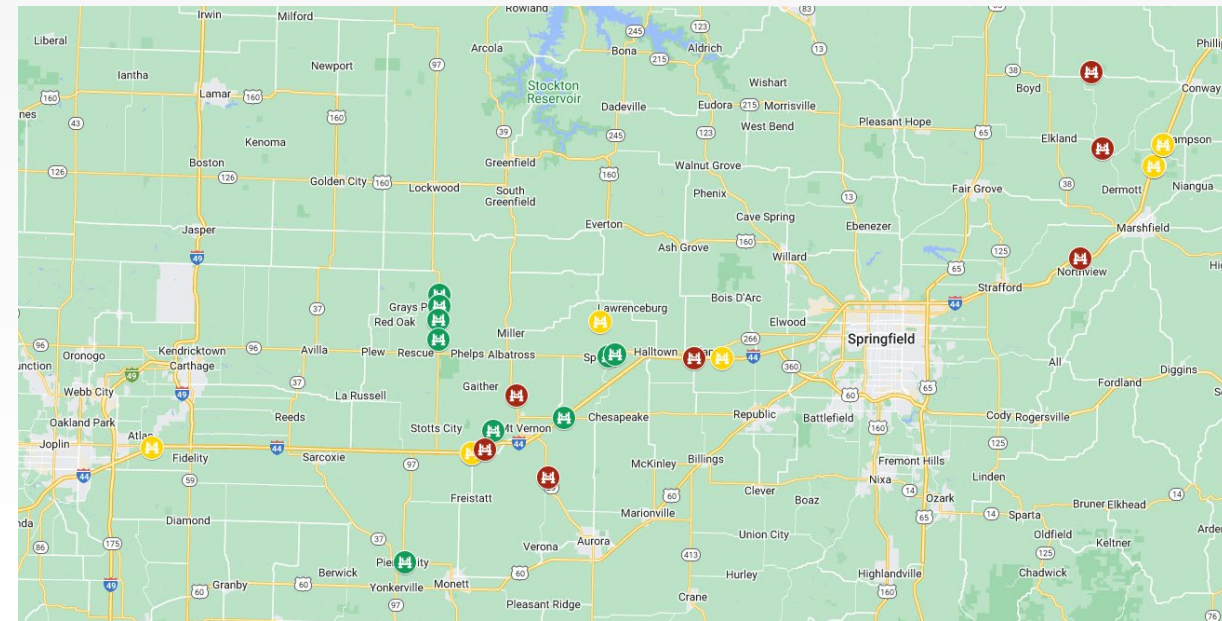
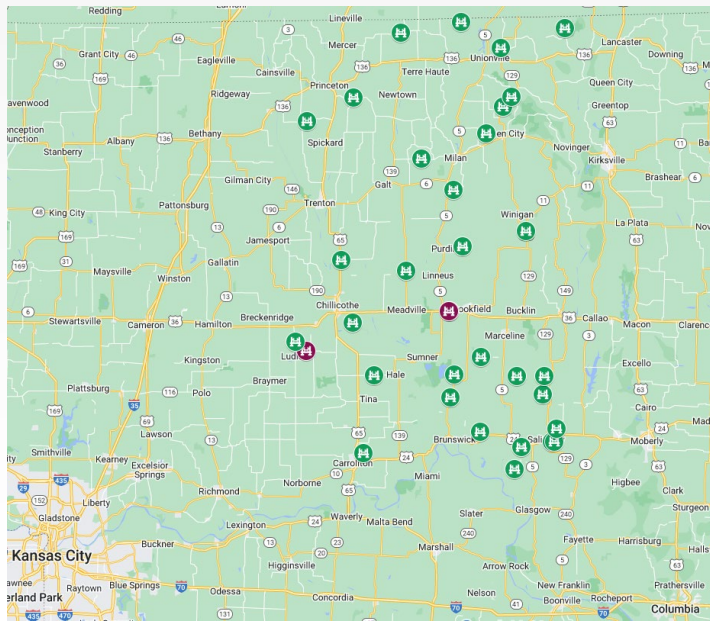


Bridge Bundling Projects



Bundle projects underway

- I-44 Corridor Bridge Bundle
 - 25 Bridges, \$43.2 million
- Northwest Bridge Bundle
 - 31 Bridges, \$30 million



Bridge Bundling Projects



Bundle projects upcoming

- Two more potential bridge bundles
 - Southwest Bridge Bundle 3.0 (Truman Lake Area) FY25
 - St. Louis I-44 Corridor Bridge Bundle FY26



Design Build Bundling Benefits



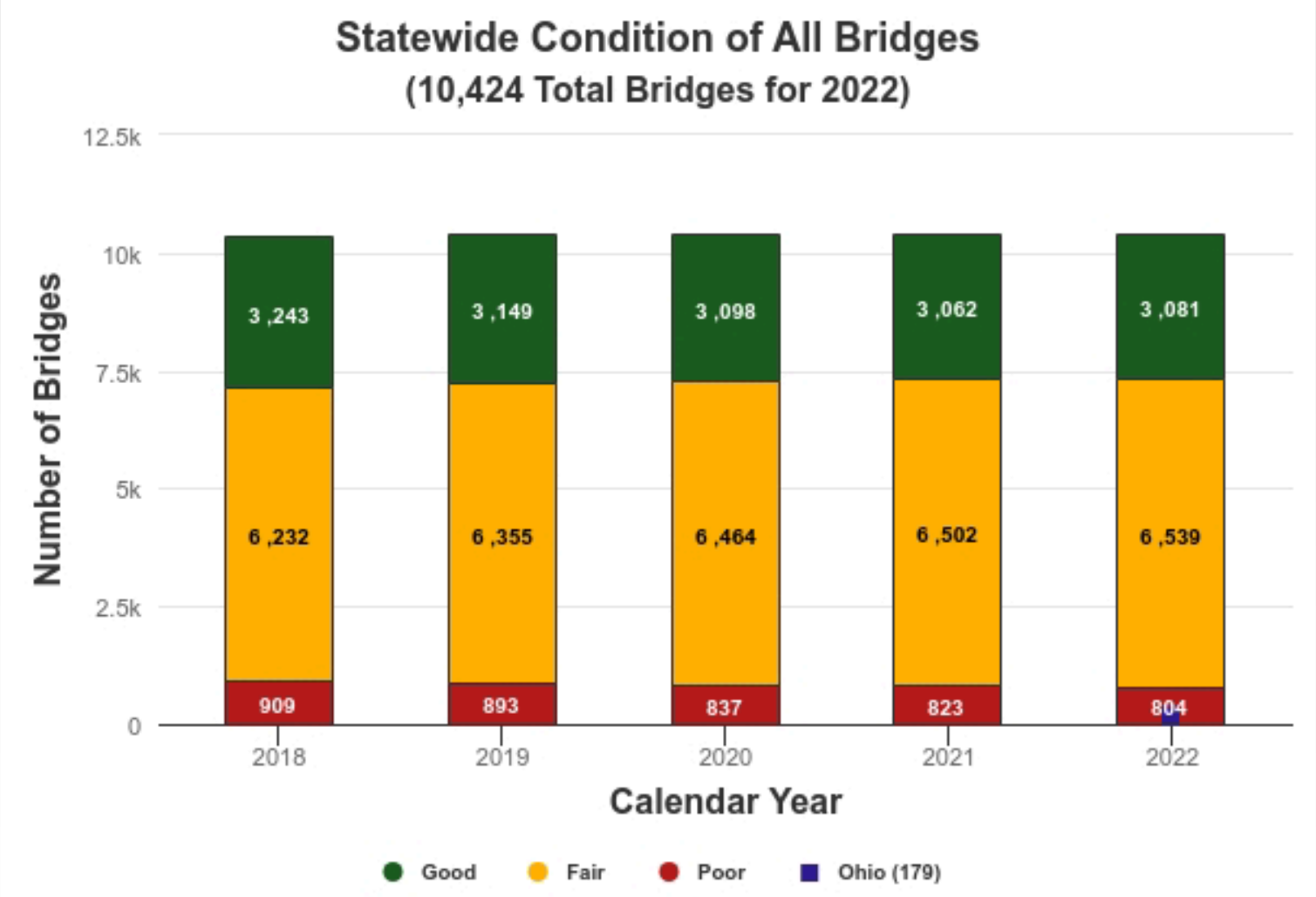
- Maximize scope for a fixed budget
- Control design cost
- Promote innovation
- Speed delivery of project

Distribution by Decade



About 52% of our bridges are older than their intended useful life of 50 years (those built prior to 1970).

Why Bridge Bundling



Target: Below 900 Poor

FARM Bridge Program



FARM Bridge Program



- Fixing Access to Rural Missouri (FARM)
- MoDOT identified 41 rural bridges in northern MO
- MoDOT applied for a grant through the Competitive Highway Bridge Program



FARM Bridge Program



Four criteria were used to identify bridges

- In poor condition
- Weight-restricted
- One-lane but carry 2-way traffic
- On timber piles



Project Overview

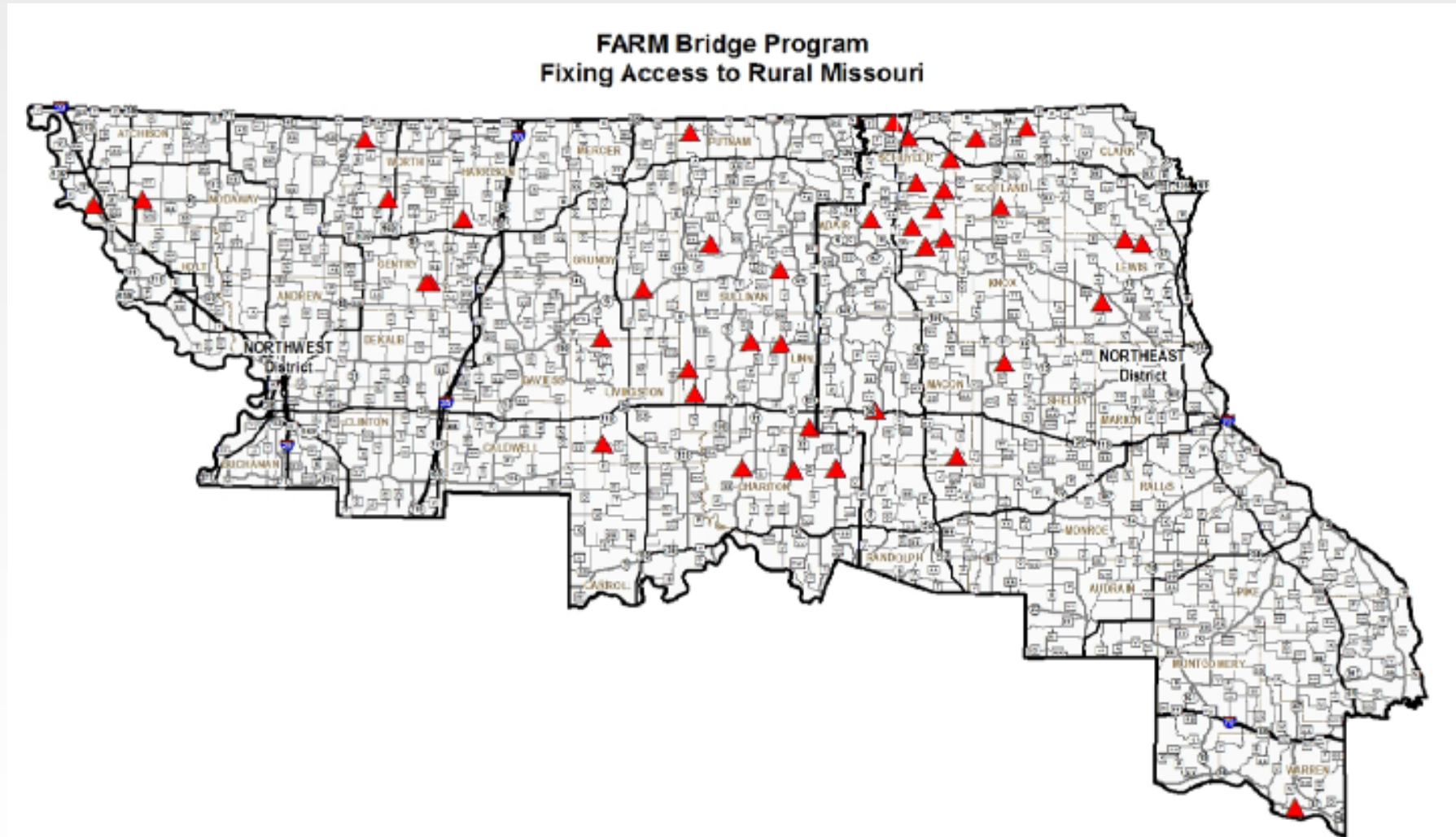


- Bridges located in 17 counties in the NE and NW Districts
- Bridges range in length from 198' down to 28'
- AADT ranges from 1199 vpd down to 36 vpd
- Bridges were constructed between 1927 and 1955

Typical Bridge



FARM Bridge Project



▲ Poor/One Lane/Weight Restricted/Timber Pile (41 Total)



Missouri Department of Transportation
Transportation Planning
1-888-ASK-MODOT
WWW.MODOT.ORG

FARM Bridge Project



Grant application submitted through USDOT Competitive Highway Bridge Program

- Only available to rural states
- Applied for \$28 Million – Received \$20.8 Million
- Minimum of 30 bridges to be constructed
- Project to be delivered using Design-Build

Project Goals



1. Safely deliver the project within the program budget of \$25.99 million on or before October 31, 2023
2. Use innovation to maximize the number of locations to be addressed
3. Provide quality long-lasting structures
4. Minimize public inconvenience through increased construction speed and flexibility in scheduling

Procurement Schedule



	Activity	Proposed Date
Phase 1	Project Advertisement	October 15, 2020
	Industry Meeting/RFQ Release	November 16, 2020
	SOQ's Due	December 14, 2020
	Shortlist	December 23, 2020
Phase 2	RFP Release	January 12, 2021
	One-on-one Technical Meetings	January through April
	Proposals Due	April 6, 2021
	Award at MHTC Meeting	May 5, 2021

Construction Schedule



Activity	Proposed Date
Design Begins (NTP-1)	Summer 2021
Construction Begins (NTP-2)	Fall 2021
Project Completion	October 2023

Budget



- Total Program Budget is \$25.99 million
- Project was awarded \$20.8 million grant through Competitive Highway Bridge Program
- Matching funds of \$5.2 million will come from the NE and NW Districts

- Design-Build Contract is \$21.5 million

Risk Mitigation



- MoDOT performed preliminary work in the following risk areas:
- Environmental
 - Performed all environmental field work
 - Determined that all locations were permissible
- Utilities
 - Known utilities were located and are shown in the survey information
 - Utility contact list was developed
- Right-Of-Way
 - It is anticipated that no new R/W will be required for this project

Project Requirements



- All construction will consist of structure replacement
- No bridge rehabilitations will be allowed
- Alternative solutions related to structure type and structure elimination will be entertained
- DBE and workforce goals are also required

Proposal Evaluation



- Proposals evaluated in 3 scoring categories
 - Bridge Bundle Definition was scored from data entered in the DB-903a form
 - Bridge Quality and Longevity was scored by a team of 8 technical experts.
 - Location Completion and Maintenance of Traffic was scored by a team of 6 technical experts.

Category	Available Points
Bridge Bundle Definition	55
Bridge Quality and Longevity	30
Location Completion and Maintenance of Traffic	15
Total	100

Bridge Bundle Definition



Project Goal #2: Use innovation to maximize the number of locations to be addressed.

Category	Available Points
Bridge Bundle Definition	
Part 1 – DB-903a Bridge Definition Summary	40
Part 2 – Bonus Points	15
Total	55

DB-903a FORM



The DB-903a Form is a self scoring spreadsheet provided to the teams. The teams selected from allowable treatments and were self-scored according to the selections they proposed.

Bridge Treatment	Method Credits Points
No Treatment	0
Replacement	1
Alternative Treatment Method	*
*Method Credit to be determined by MoDOT after submission as ATM	

DB-903a FORM



- **Method Credit:** Based on Proposed work (None, Replacement, or ATM)
- **Size Factor:** Based on the size of the existing structure
- **Weighted Factor:** Based on the bridge condition ratings, ADT factor, and priority factor
- **Total Credit** = Method Credit * Size Factor * Weighted Factor
- **Sum Total:** Sum of Total Credit for locations completed

DB-903a FORM



When printing, set paper size to 11x17 landscape									Fields Completed by Proposer						
Bridge Count	District	Bridge Number	Route	County	Year Built	Feature Crossed	Benefit / Cost Ratio (BCR)	ADT	Proposer's Choice Method of Work	Proposed Alternate Treatment Method	Method Credit	Size Factor	Weighted Factor	Total Credit	
28	NE	P0251	E	LEWIS	1952	DERRAHS BR	44.2	201	Replacement		1	3.34	1.45	4.851	
29	NE	X0769	J	LEWIS	1948	BIG GRASSY CR	16.3	192	Replacement		1	3.70	1.09	4.017	
30	NE	P0315	Y	MACON	1953	HOOVER CR	35.1	362	Replacement		1	4.06	1.15	4.669	
31	NE	P0233	C	SCHUYLER	1952	N FK MID FABIVS RV	25.5	254	Replacement		1	3.19	1.11	3.555	
32	NE	P0398	M	SCHUYLER	1954	S FK N FABIVS RVR	4.8	52	Replacement		1	2.57	1.86	4.778	
33	NE	S0911	A	SCHUYLER	1933	BRUSHY CR	28.3	290	Replacement		1	4.53	1.88	8.519	
34	NE	T0891	E	SCHUYLER	1941	N FK S FABIVS RVR	11.4	117	Replacement		1	3.95	1.86	7.350	
35	NE	X0097	A	SCHUYLER	1935	N FK MID FABIVS RV	40.0	408	Replacement		1	3.53	1.67	5.892	
36	NE	S0414	W	SCOTLAND	1932	TOBIN CR	11.2	129	Replacement		1	5.08	1.50	7.629	
37	NE	X0174	H	SCOTLAND	1949	N FK N WYACONDA RV	36.4	296	Replacement		1	3.84	1.51	5.788	
38	NE	X0201	B	SCOTLAND	1949	N FK N FABIVS RVR	27.9	296	Replacement		1	4.21	1.51	6.334	
39	NE	T0391	M	SHELBY	1932	BLACK CR	21.2	264	Replacement		1	4.53	1.86	8.447	
40	NE	X0212	MO 94	WARREN	1947	TRELOAR CR	77.9	1460	Replacement		1	4.31	1.29	5.556	
Total Number of Locations Completed=											40	Must be greater than 30			
Average Benefit/Cost Ratio=											25.6	Must be greater than 23.7			
Sum Total:													244.969		

Best Value Proposal

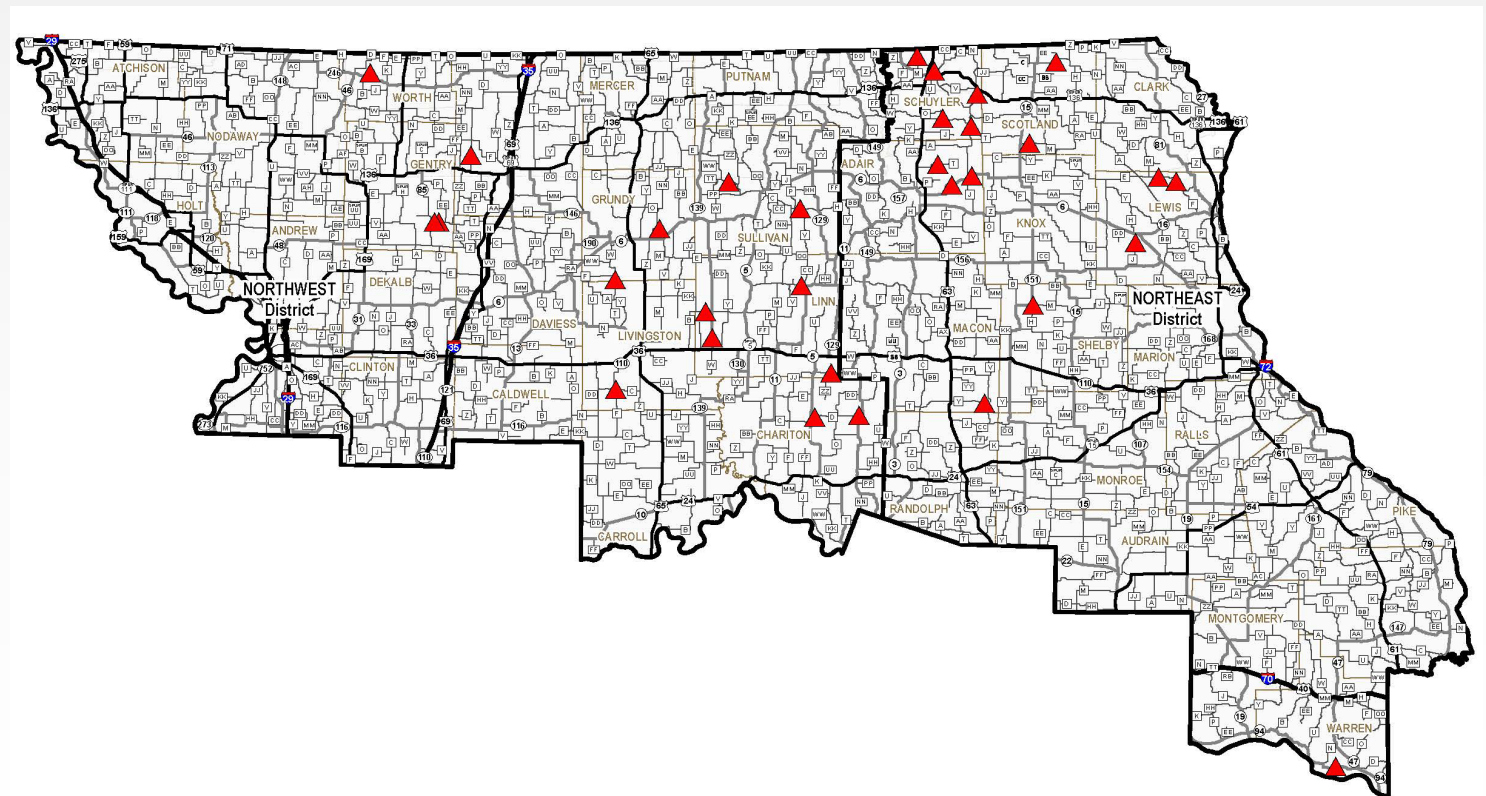


- The Lehman-Wilson proposal includes:
- 31 structures replaced
- Low maintenance steel structures that allow for future redeck and rehabilitation
- Additional 2321 SQFT of existing bridge deck replaced
- Highest average ADT for routes included of any proposal
- Highest average Benefit Cost Ratio of any proposal

Best Value Proposal



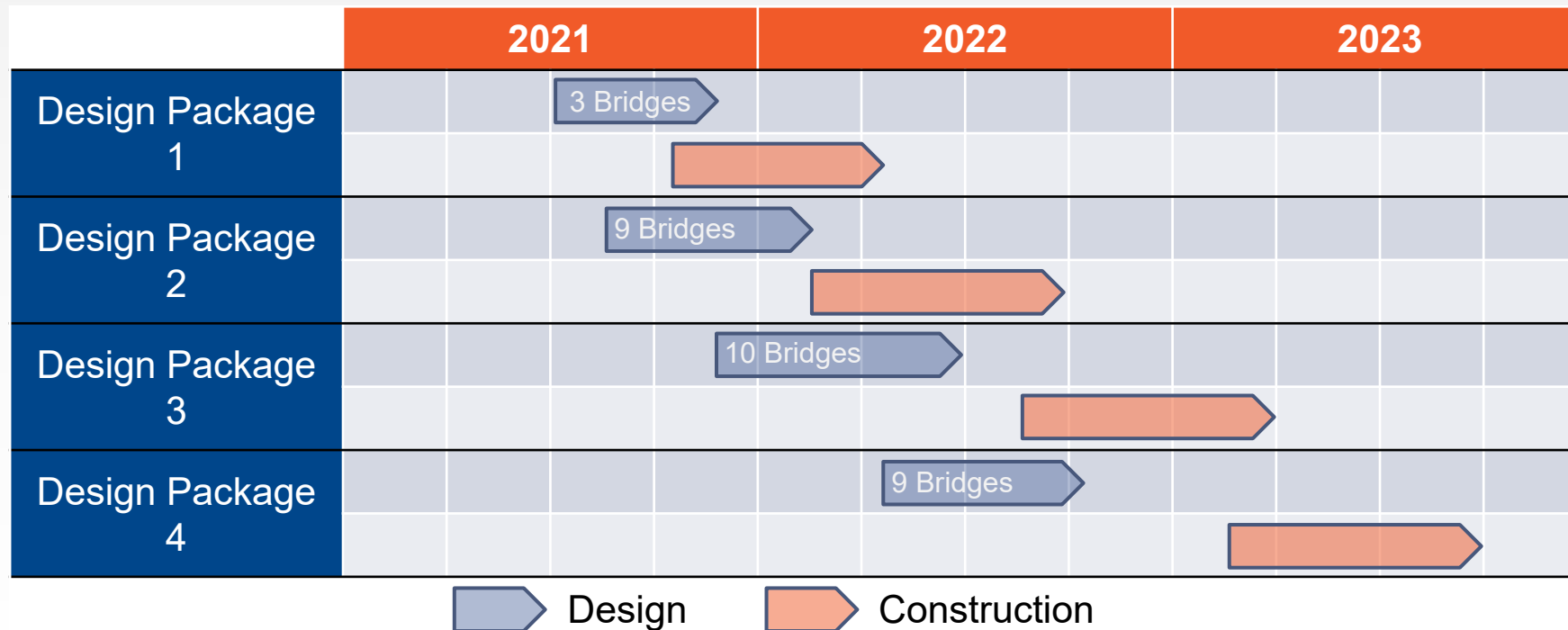
- No. of Bridge Replacements: 31 of 41 (30 minimum)
- 3 – RCB
- 3 – Single Span
- 25 – SDCL



Project Schedule



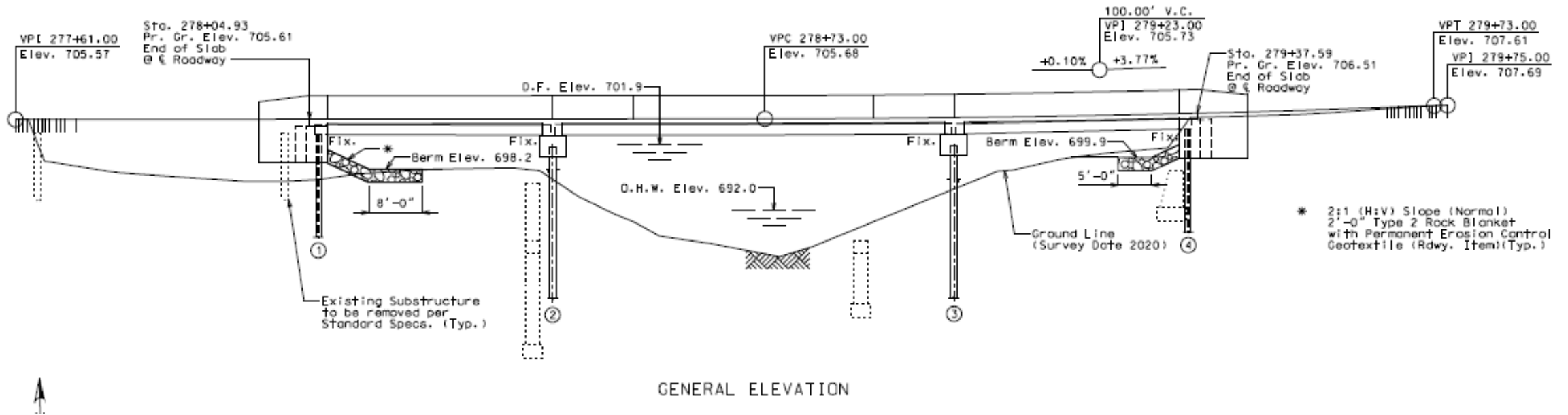
- Four Design Packages



Innovation, What is SDCL?



- Simple for Dead Load and Continuous for Live Load.
- Multi-span bridges using simple span wide flange beams, made continuous (like P/S I-girders)



FARM Bridges

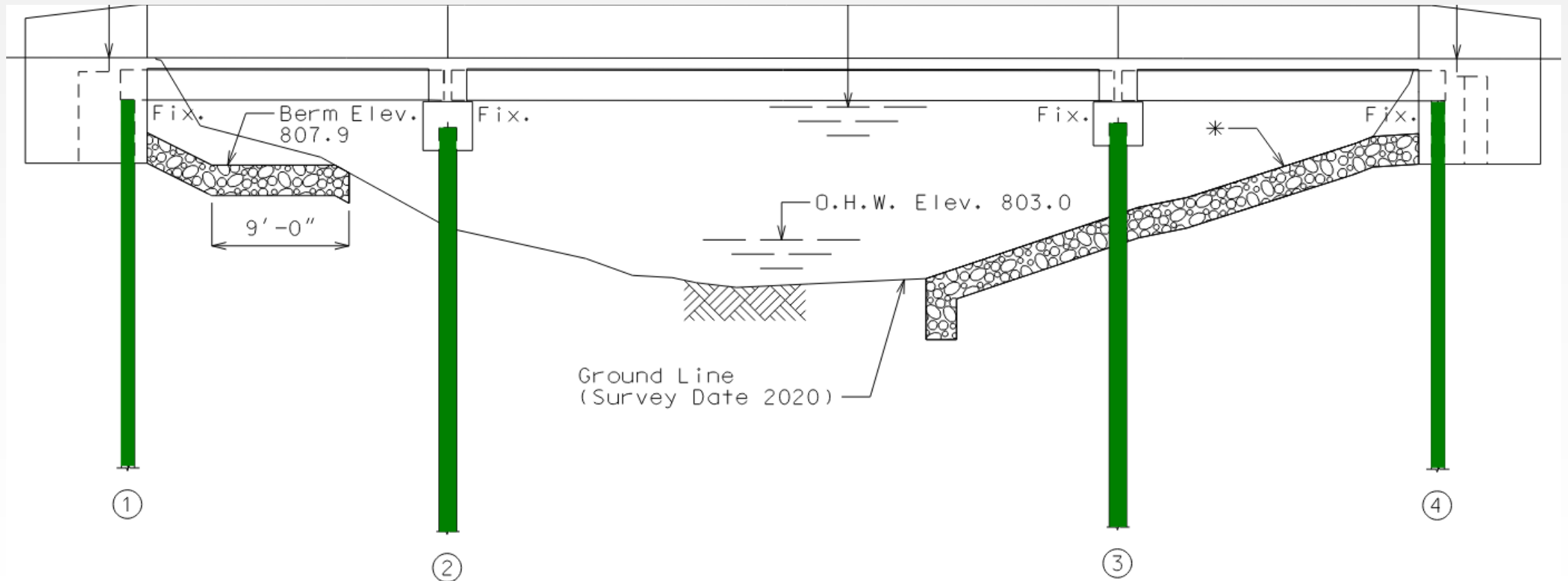


- All multi-span bridges are 3-span structures
- 24 ft. roadway width
- 4 beam lines @ 7'-2" spa. (2'-7" overhangs)
- Type D concrete barrier (528 plf)
- Concrete pile cap integral end bents (3 ft. x 4 ft.)
- Concrete pile cap intermediate bents (3.5 ft. x 3 ft.)
- End bearing and friction pile (HP10x42 thru HP14x117)
- Average square foot per bridge 2,289 sq.ft.
- Average length per bridge 106 ft.

How is SDCL Constructed?



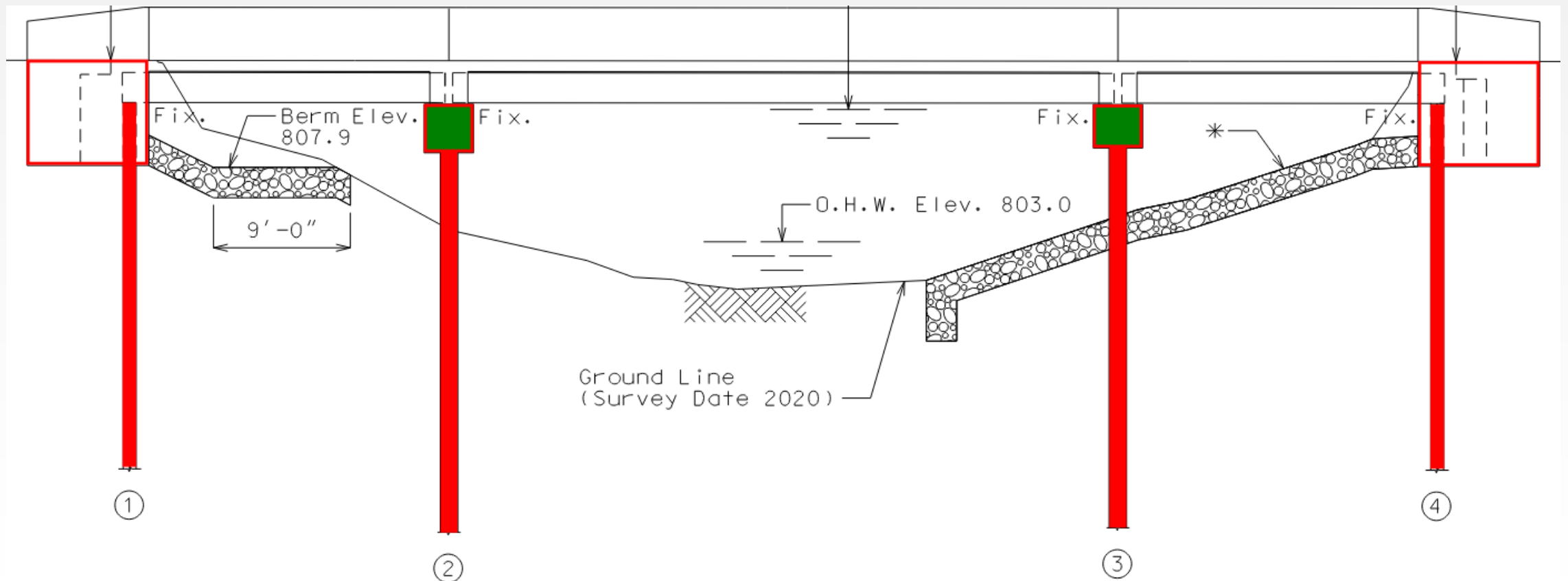
- Week 2 - Drive pile at bents



How is SDCL Constructed?



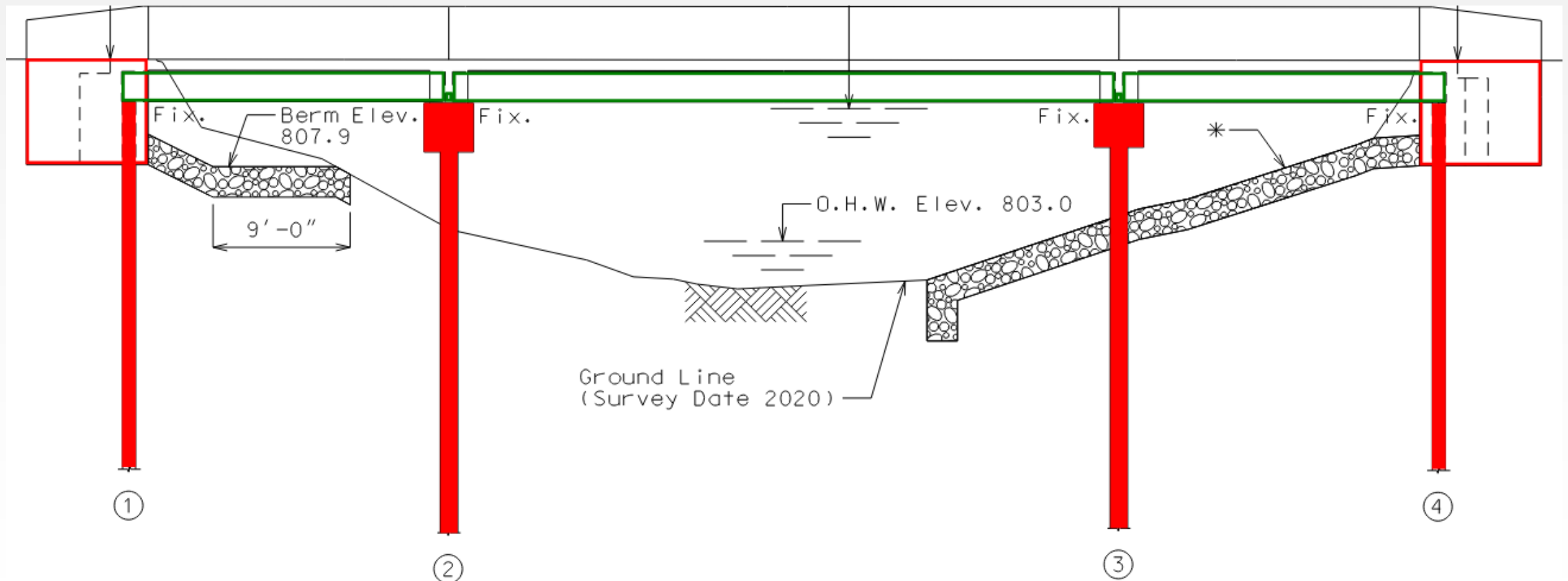
- Week 3 – Place concrete at intermediate bents



How is SDCL Constructed?



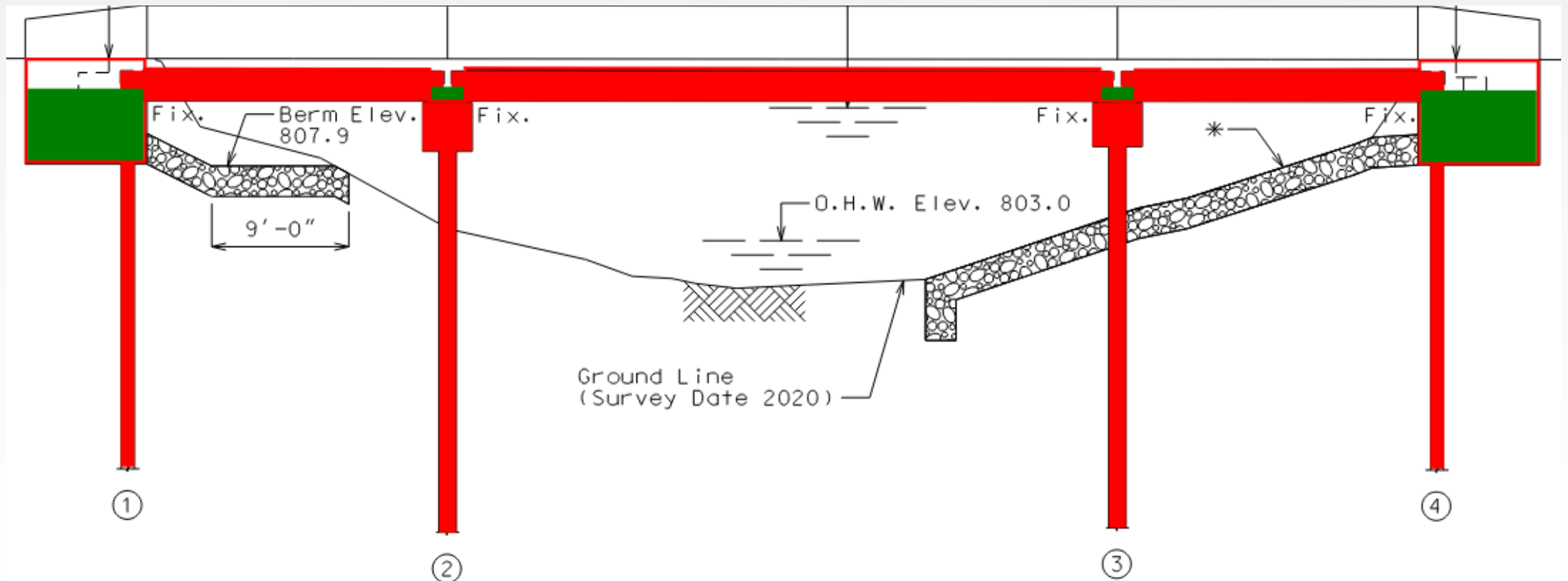
- Week 4 – Place rolled steel beams



How is SDCL Constructed?



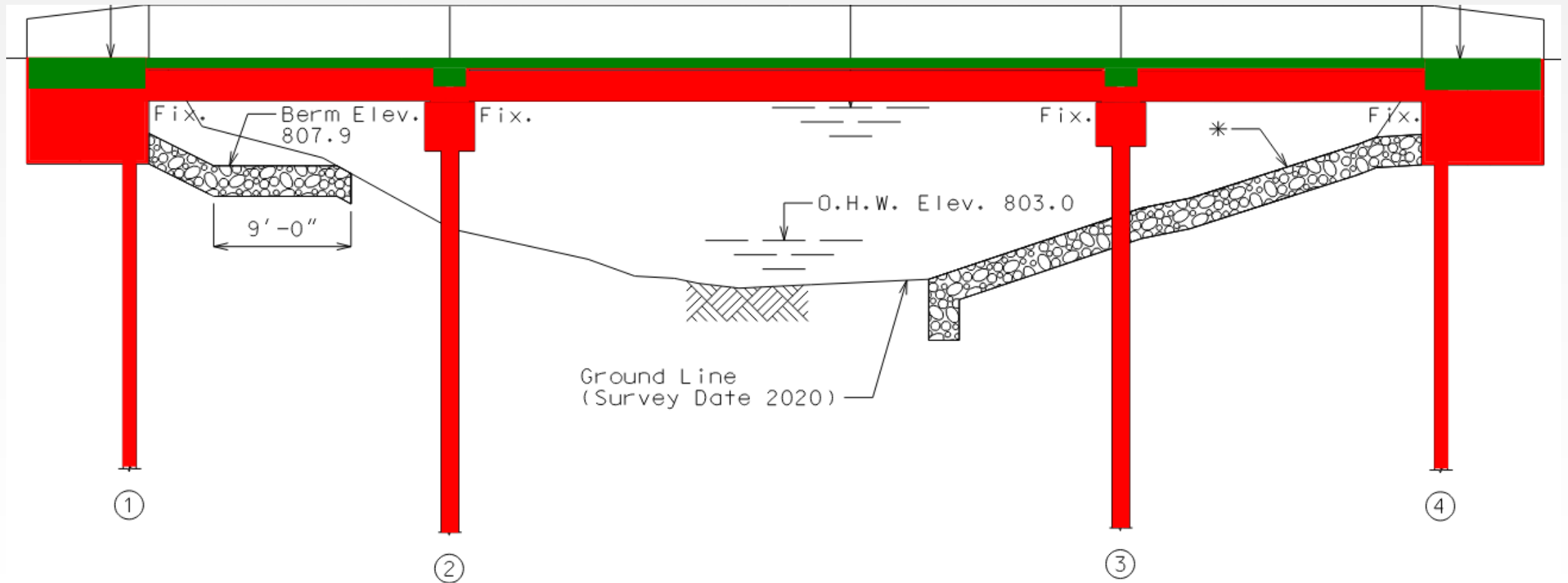
- Week 5 – Place concrete diaphragms at bents



How is SDCL Constructed?



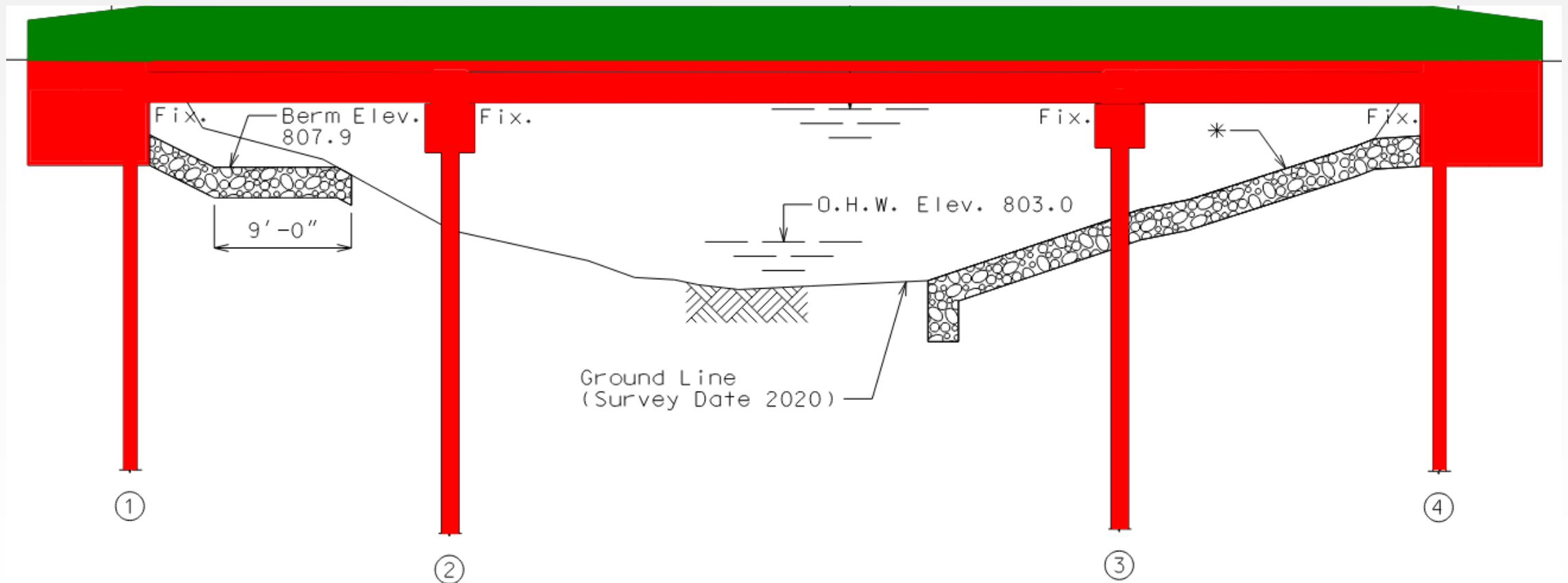
- Place concrete slab



How is SDCL Constructed?



- Slip form concrete barrier



Why Use SDCL?

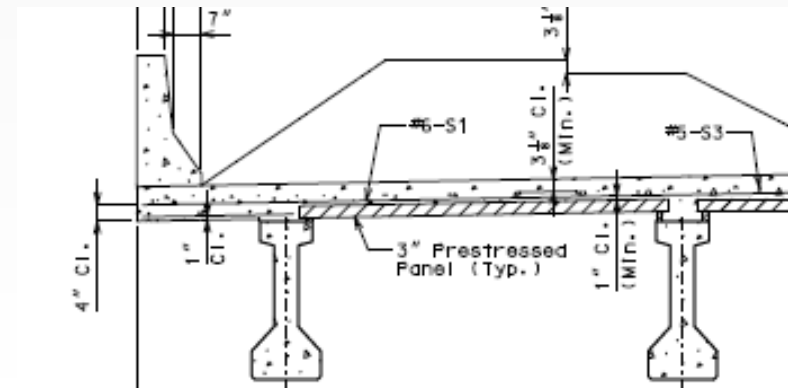
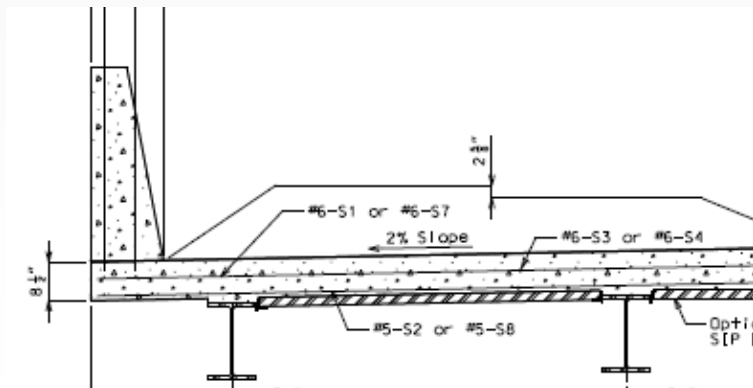


- Ease of construction
- Eliminates the use of traditional field splices
- Advantageous span ratios
 - #7, 21'-44'-21' or #28, 23'-48'-23'
 - Customize beams to the spans
- Simple details make steel much more competitive
 - Certified Bridge Fabricator – Simple (SBR) ←
 - Certified Bridge Fabricator – Intermediate (IBR)
 - Certified Bridge Fabricator – Advanced (ABR)

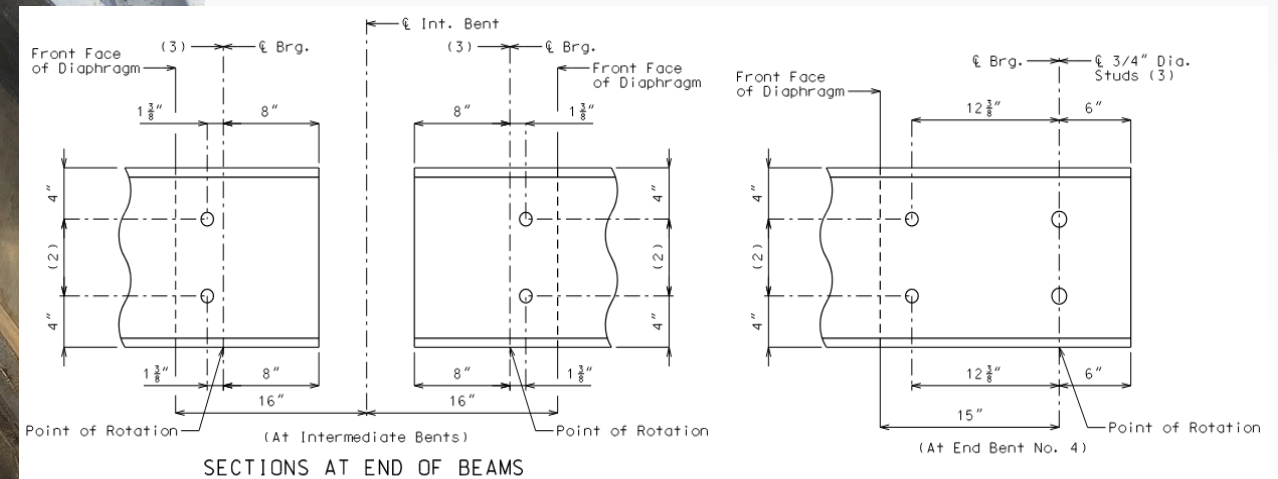
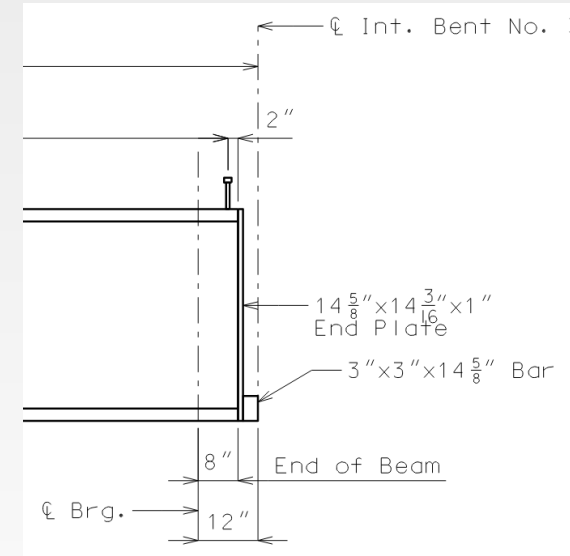
Why Use SDCL?



- Beam Weights (steel vs. concrete)
 - W18x158 @ 60' = 9480 lbs.
 - MoDOT Type 3 @ 60' = 23,869 lbs.
 - Easier to handle
 - Cost effective foundation type
- Thinner superstructure (no grade raise, “no-rise” cert.)
 - W18x158 @ 60' = 19.7”
 - MoDOT Type 3 @ 60' = 39”



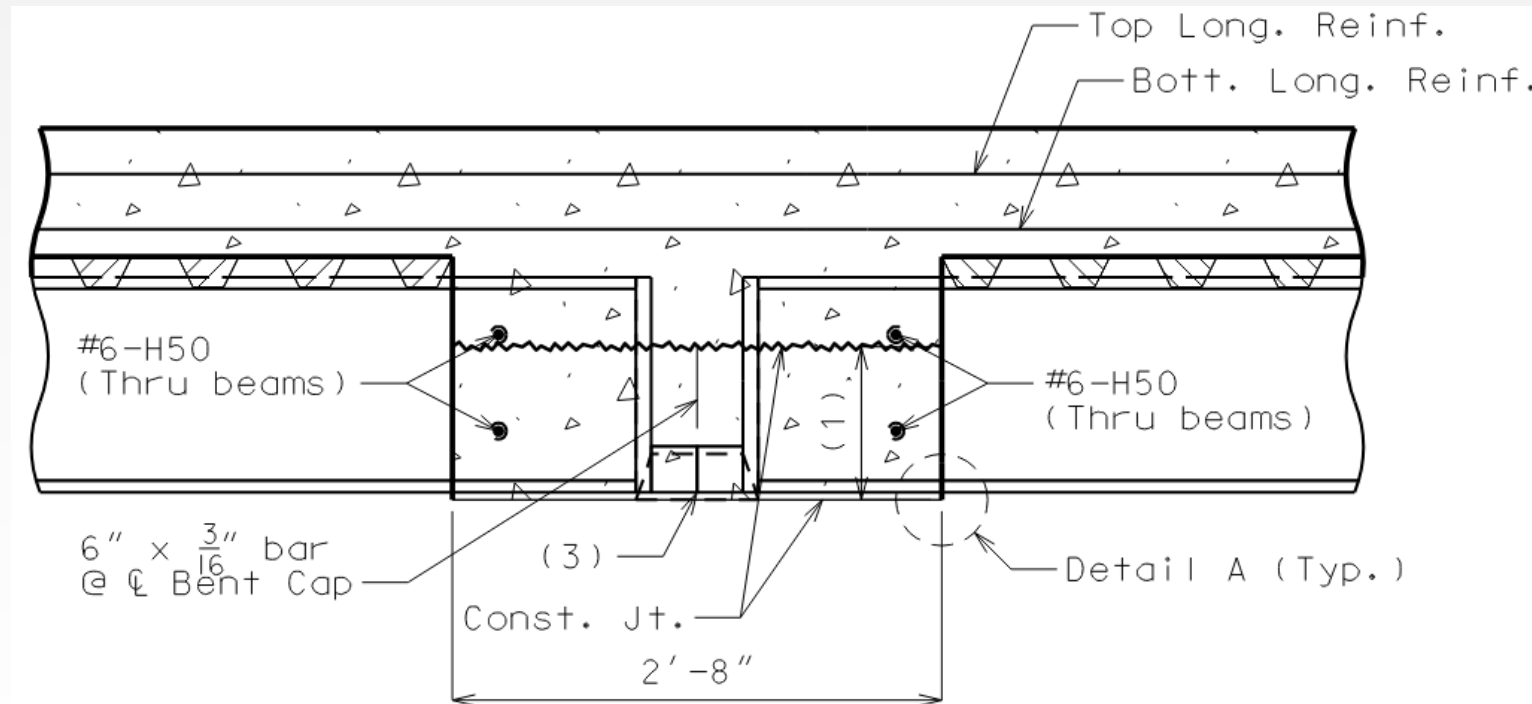
Design of SDCL connection



Design of SDCL connection



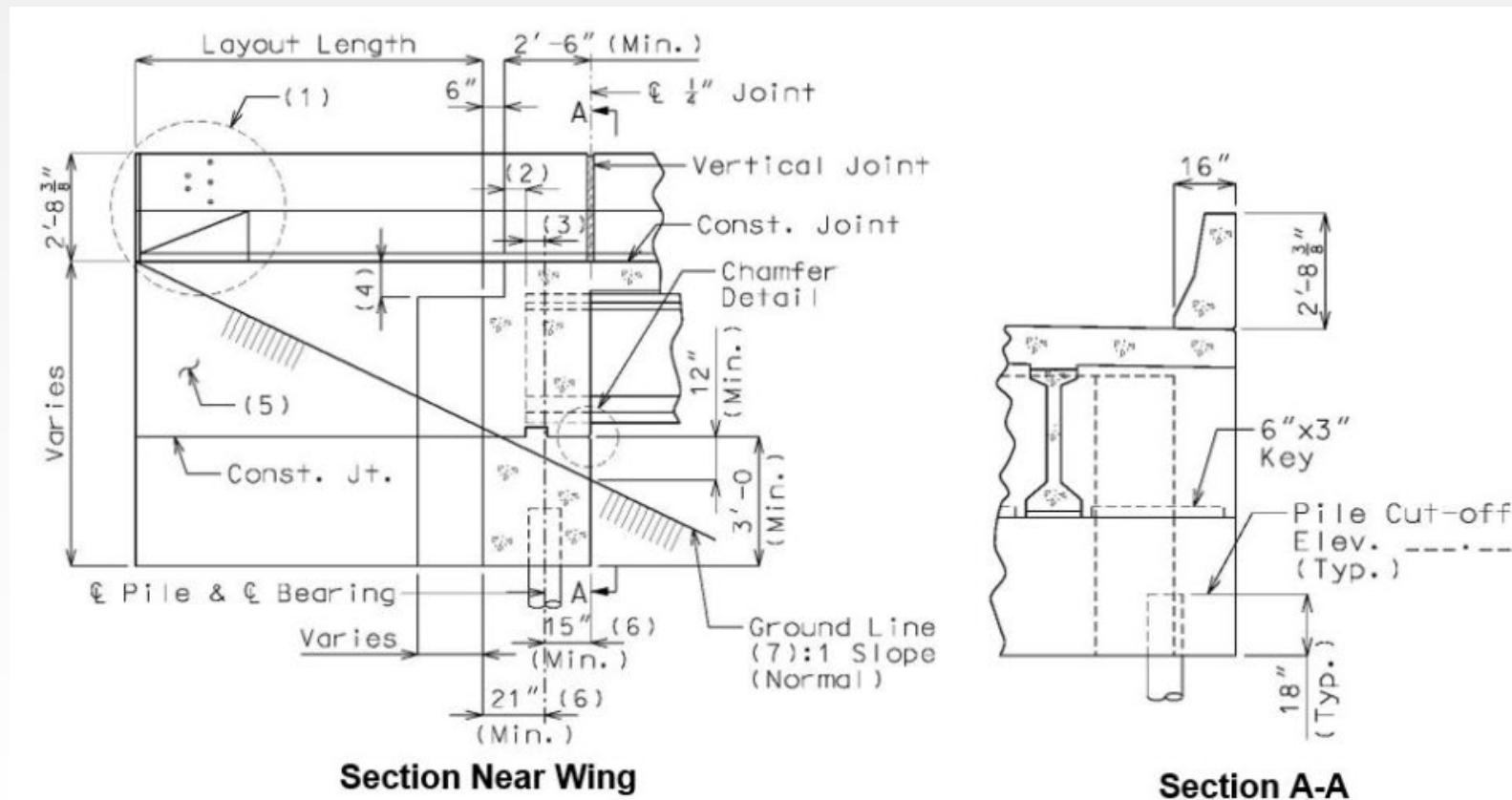
- Concrete diaphragms cast prior to slab
- Negative moment slab reinforcement to provide live load continuity



Innovation on FARM



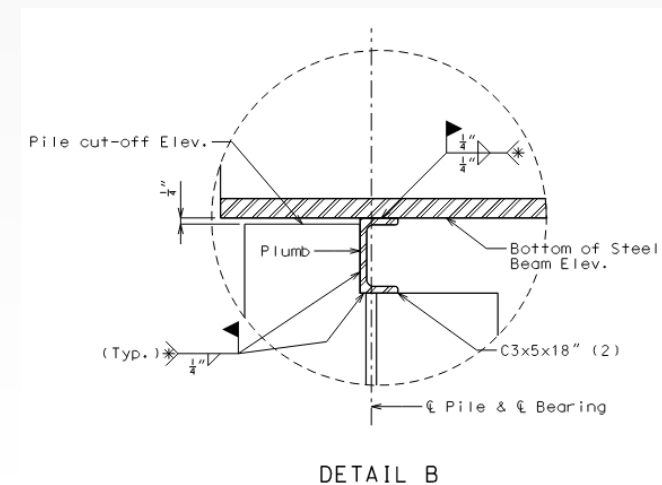
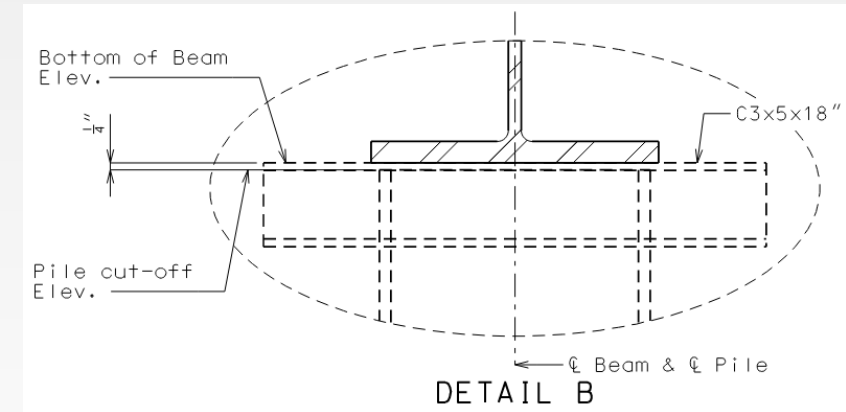
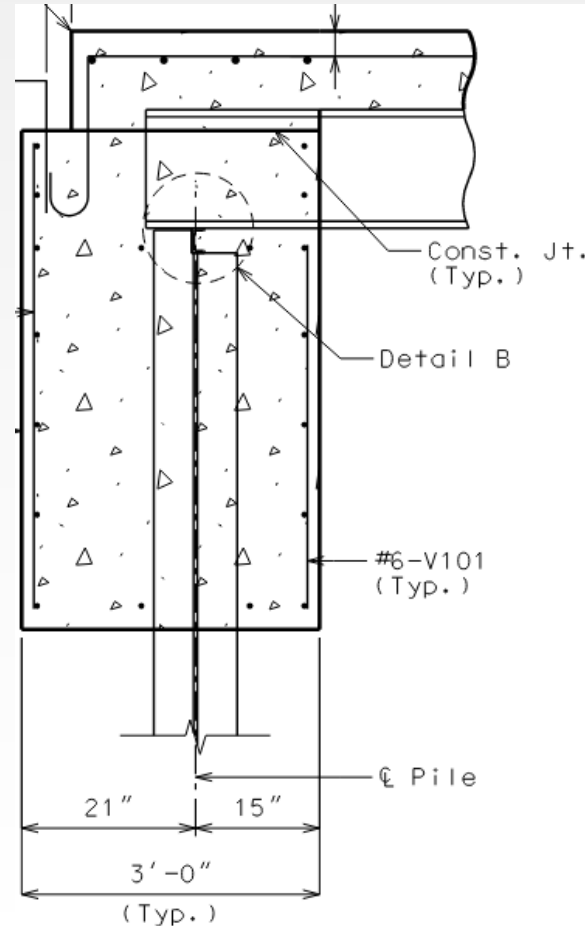
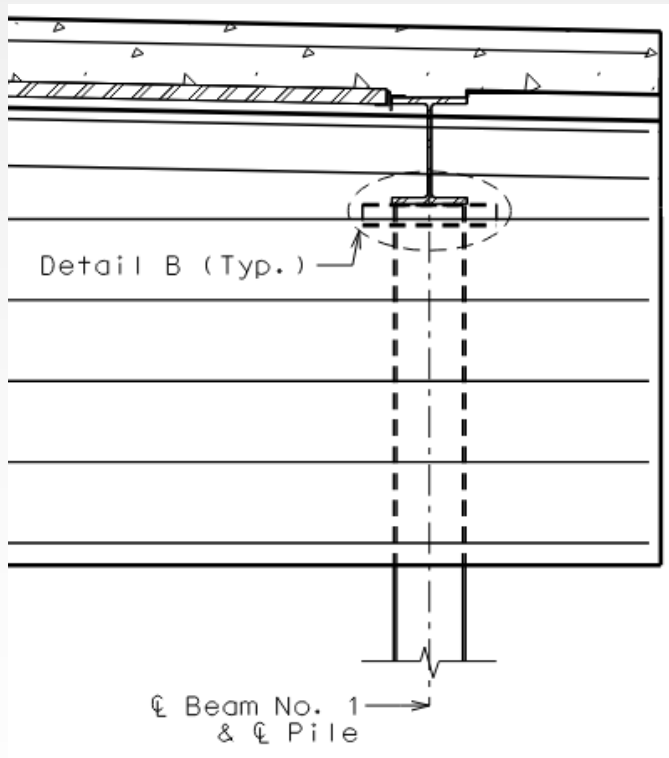
- Standard MoDOT end bent has pile cut off in concrete



Innovation on FARM



- FARM end bent had beam resting on pile encased in concrete



How is SDCL constructed?



How is SDCL constructed?



How is SDCL constructed?



How is SDCL constructed?



How is SDCL constructed?



How is SDCL constructed?



Beam Coating Options



- Original plan for beam coating
 - Weathering steel (when conditions allowed)
 - Painted steel
- Covid-19 caused issues with weathering steel and paint availability
 - Warehouses had reduced inventory
 - Paint availability was a challenge early on
- Equal or Better Change Proposal
 - MoDOT expressed interest in galvanized beams
 - Smaller beam sizes and shorter spans allowed galvanization to be a competitive option

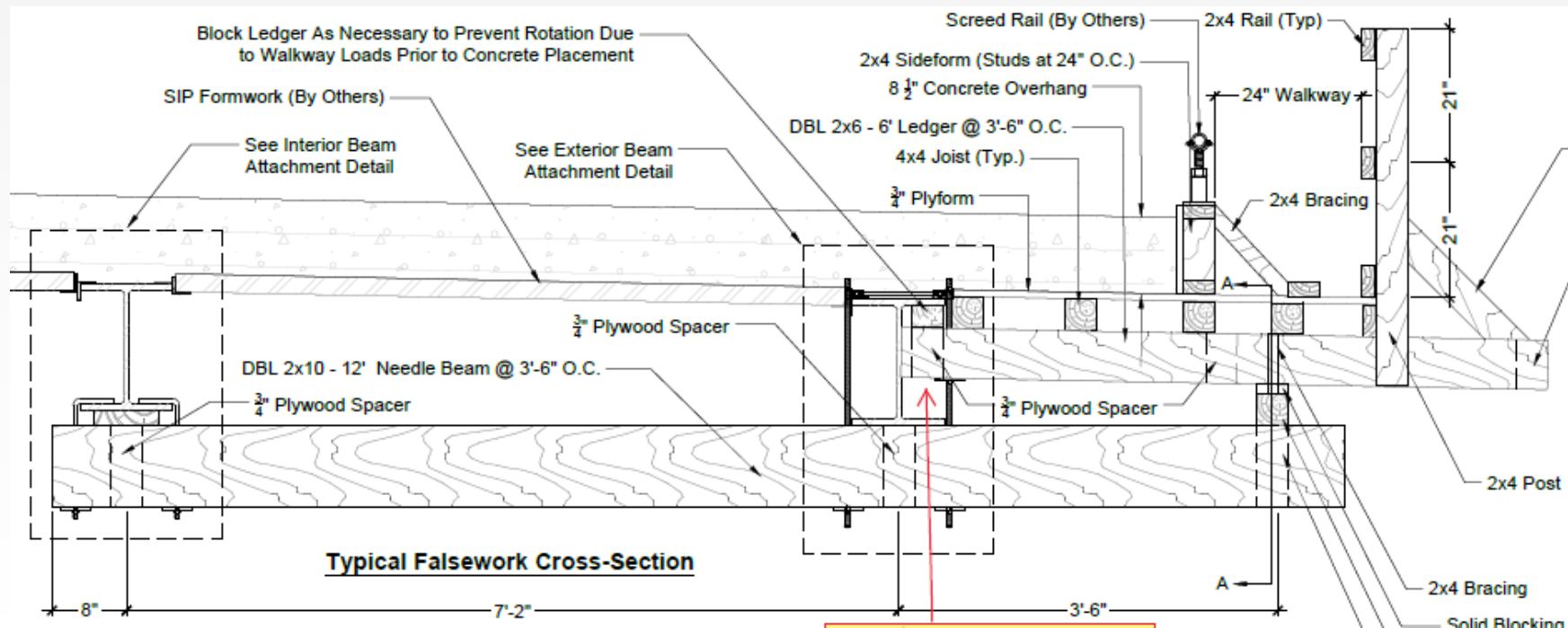
Beam Coating Options



Overhang Falsework



- Shallow beam depths require alternate overhang construction methods
- Needle beam overhang falsework is required for webs shallower than 18 inches



Overhang Falsework



How is SDCL constructed?



How is SDCL constructed?



Vibratory Screed



Cold Weather Concrete Curing



Cold Weather Concrete Curing



Completed FARM Bridge



Completed FARM Bridge



Completed FARM Bridge



Completed FARM Bridge





We get people safely where
they want to go.

Bryan Hartnagel, State Bridge Engineer

Bryan.Hartnagel@modot.mo.gov

(573) 751-4676