MoDOT's Experience with Design Build Bridge Bundling and the FARM Bridge Program

Presented to Short Span Steel Bridge Alliance
Semi-Annual Meeting
Orlando, Florida
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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)
  - Advertising requirements
  - Shortlist no more than 5

History of Design Build Law

- DB 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's Design-Build Program

- 22 Awarded Contracts
  - Lowest $14.4M (I-70 Climbing Lanes 2020)
  - Largest $487M (Safe and Sound Bridge Program 2010)
- $2.53 billion awarded, $821 million under contract
- MoDOT Design-Build target is 10% of overall program
  - 1-3 projects per year


THE NEW I-64


kcICON


SAFE & SOUND


daniel boone bridge


364
PHASE 3


Manchester Bridge
70


ROGERSVILLE
Project Freeway


MISSOURI RIVER BRIDGE
69
Kansas
MoDOT


INTERSTATE
70
Columbia


141
INTERSTATE
44
Design Build


Road to Saving Lives


Champ Clark
BRIDGE
U.S. 54 OVER THE MISSISSIPPI RIVER


INTERSTATE
435
SOUTH
LOOP
LINK


44
PROJECT
BRIDGE
REBUILD


I-270 NORTH
Build. Progress. Together.


Climbing Lanes
INTERSTATE
70
Mineola Hill


BOOTHEEL BRIDGE BUNDLE


BUCK O'NEIL BRIDGE
US 169
MoDOT
CITY OF KANSAS CITY, MISSOURI


FARM
BRIDGE PROGRAM


BRIDGES CONNECT US
ROCHEPORT
BRIDGE
INTERSTATE 70


INTERSTATE
44
CORRIDOR
BRIDGE BUNDLE


I-70
CAVE SPRINGS
TO FAIRGROUNDS

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

SAFE & SOUND

PROJECT BRIDGE REBUILD

SAFE & SOUND

St. Francois County Route O

SAFE & SOUND

New Madrid County Route EE

PROJECT
BRIDGE
REBUILD

I-44 at Lawrence County Route 1147

Bridge Bundling Projects

Bundle projects underway

- Bootheel Bridge Bundle Project
  - 17 Bridges, $25.5 million
- I-44 Corridor Bridge Bundle
  - 25 Bridges, $43.2 million
- Fixing Access to Rural Missouri (FARM) Bridge Program
  - 31 Bridges, $26 million

Bridge Bundling Projects

Bundle projects upcoming

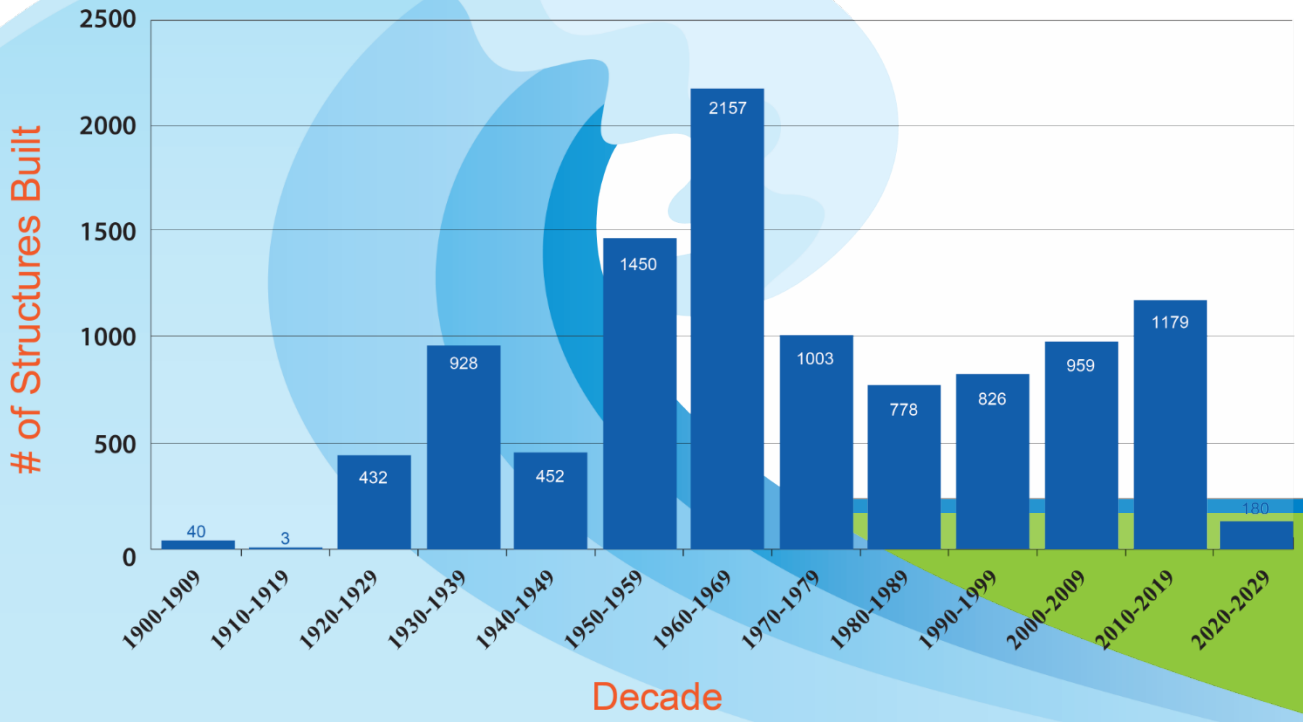
- Northwest Bridge Bundle
  - Up to 34 Bridges, $30 million

- Two more potential bridge bundles
  - I-44 Corridor Bridge Bundle FY26
  - I-49 Corridor Bridge Bundle FY25

Benefits of Design Build

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

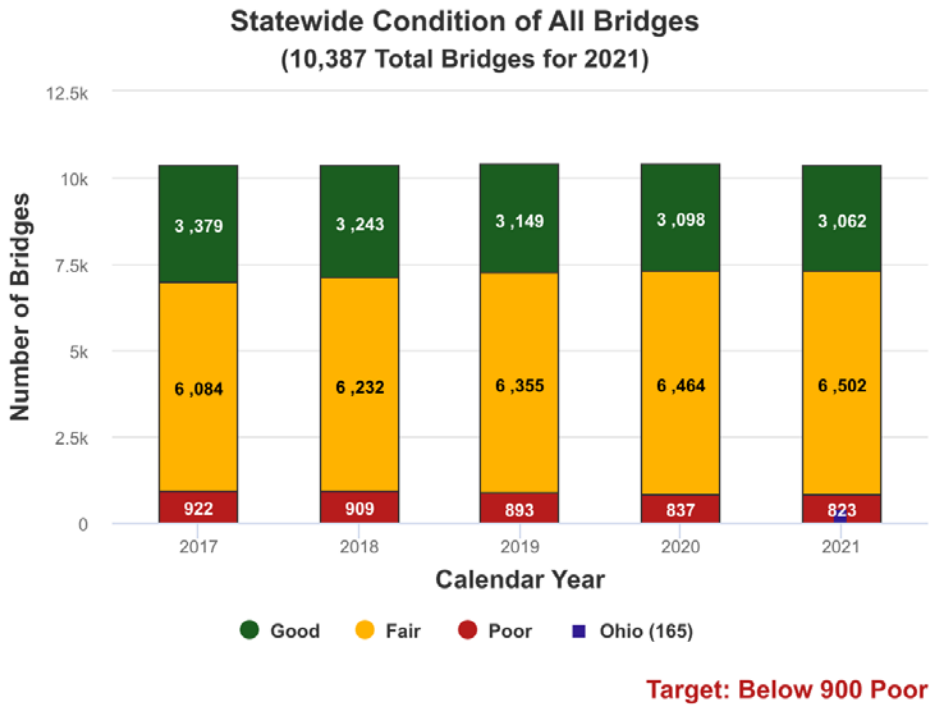
Distribution by Decade



About 53% of our bridges are older than their intended useful life of 50 years (those built prior to 1970).

Based on 2022 NBI Data

Why Bridge Bundling



FARM Bridge Program

WHAT IS THE FARM DESIGN BUILD PROJECT

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

WHAT IS THE FARM DESIGN BUILD PROJECT

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

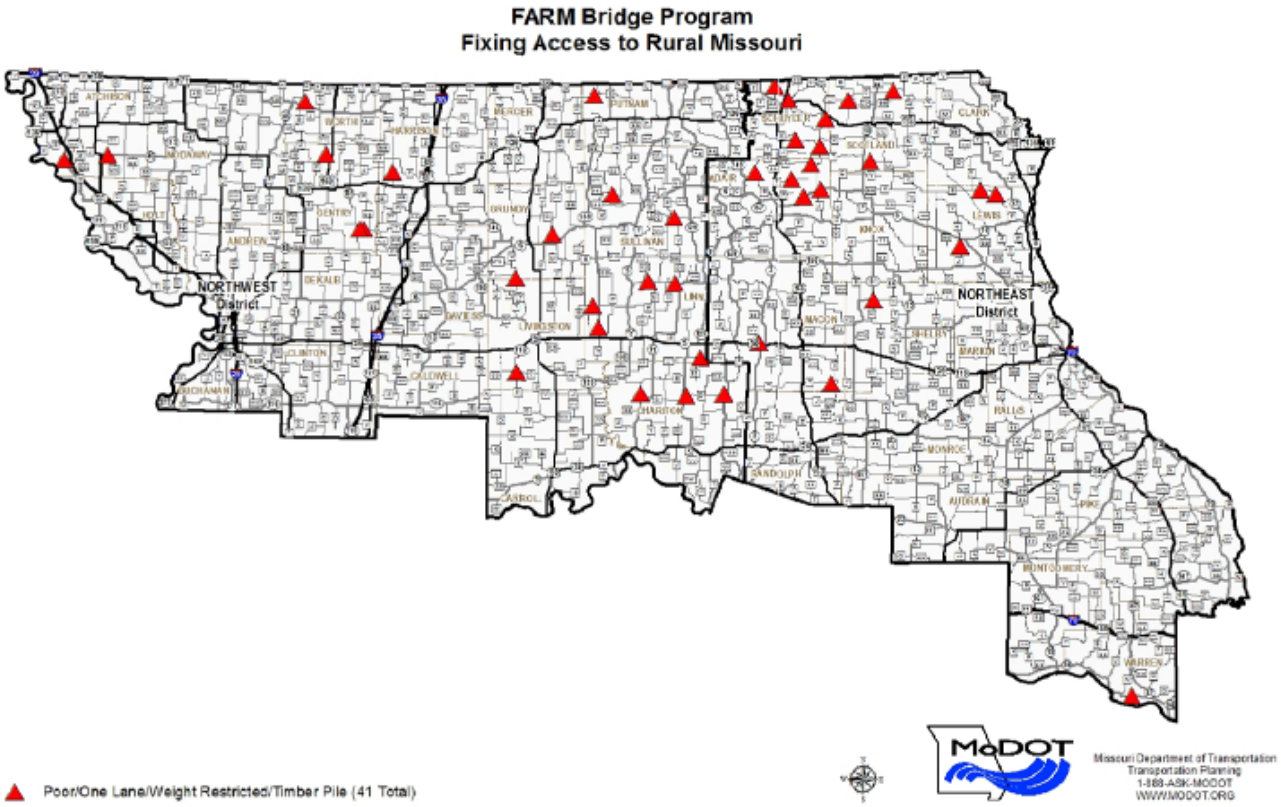
Typical Bridge

Typical Bridge

Typical Bridge

WHAT IS THE FARM DESIGN BUILD PROJECT

Location



WHAT IS THE FARM DESIGN BUILD 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 $20.794 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 permittable
- 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.

Early Release Information

- As-Built roadway plans
- As-Built Bridge Plans
- Geotechnical data
- Preliminary survey information

DBE and Workforce Goals

- DBE Goals
  - 6% for Construction Activities
  - 12% for Professional/Design Activities
- Federal workforce goals apply to project
  - Minority goal varies by county (3.1% to 11.4%)
  - Female goal is 6.9%
  - Goals apply per craft
  - 1 Construction Trainee and 2 Design Trainees at 1000 hours each – On-The-Job Training Requirement
- DBE firms must be certified with the Missouri Regional Certification Committee (MRCC) modot.mo.gov/business/contractor resources/External Civil Rights/DBE program.htm

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

RFQ – Statement of Qualifications

- Submitter Experience (100 points)
  - Relevant Recent Experience
  - Quality and Safety
  - DBE and Workforce
- Key Personnel (100 points)
  - Project Manager
  - Quality Manager
  - Design Manager
  - Construction Manager

Shortlist

- State statute dictates that we shortlist between 2 and 5 teams
  - Shortlisted 5 teams
  - 1 team dropped out immediately

RFP Release

- The RFP release consists of 5 books and the Instruction to Proposers
  - Book 1 – Contract Language
  - Book 2 – Specific requirements of the FARM Bridge Program
  - Book 3 – Applicable Standards
  - Book 4 – Information that MoDOT stands behind
  - Book 5 – For information only
  - ITP – Instructions to Proposers

One-on-One Technical Meetings

- Meet separately with each team that is pursuing the project
  - Meetings are normally every other week
  - Discuss design details, innovations, and other aspects of their proposal
  - Confidentiality is paramount

Proposal Evaluation
Technical Reviews

- Proposals evaluated in 3 scoring categories
  - Bridge Bundle Definition was scored from data entered into 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

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
									Fields Completed by Proposer					
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 FABIUS RV	25.5	254	Replacement		1	3.19	1.11	3.555
32	NE	P0398	M	SCHUYLER	1954	S FK N FABIUS 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 FABIUS RVR	11.4	117	Replacement		1	3.95	1.86	7.350
35	NE	X0097	A	SCHUYLER	1935	N FK MID FABIUS 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 FABIUS 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

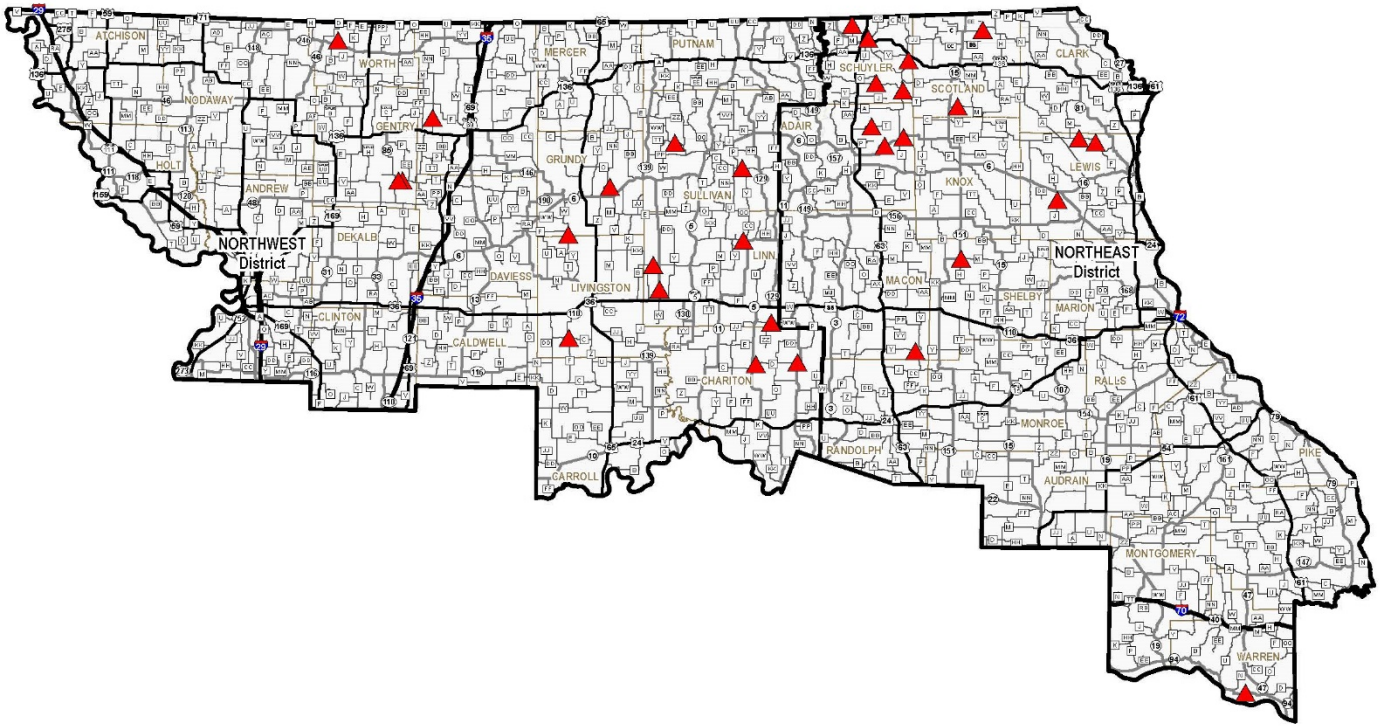
The Lehman-Wilson proposal includes:

- 31 structures replaced
- Low maintenance steel structures that allow for future re-deck and rehabilitation
- Added value of $760,000 over other Proposals (Based on MoDOT's original estimates)
- 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

FARM DESIGN BUILD PROJECT

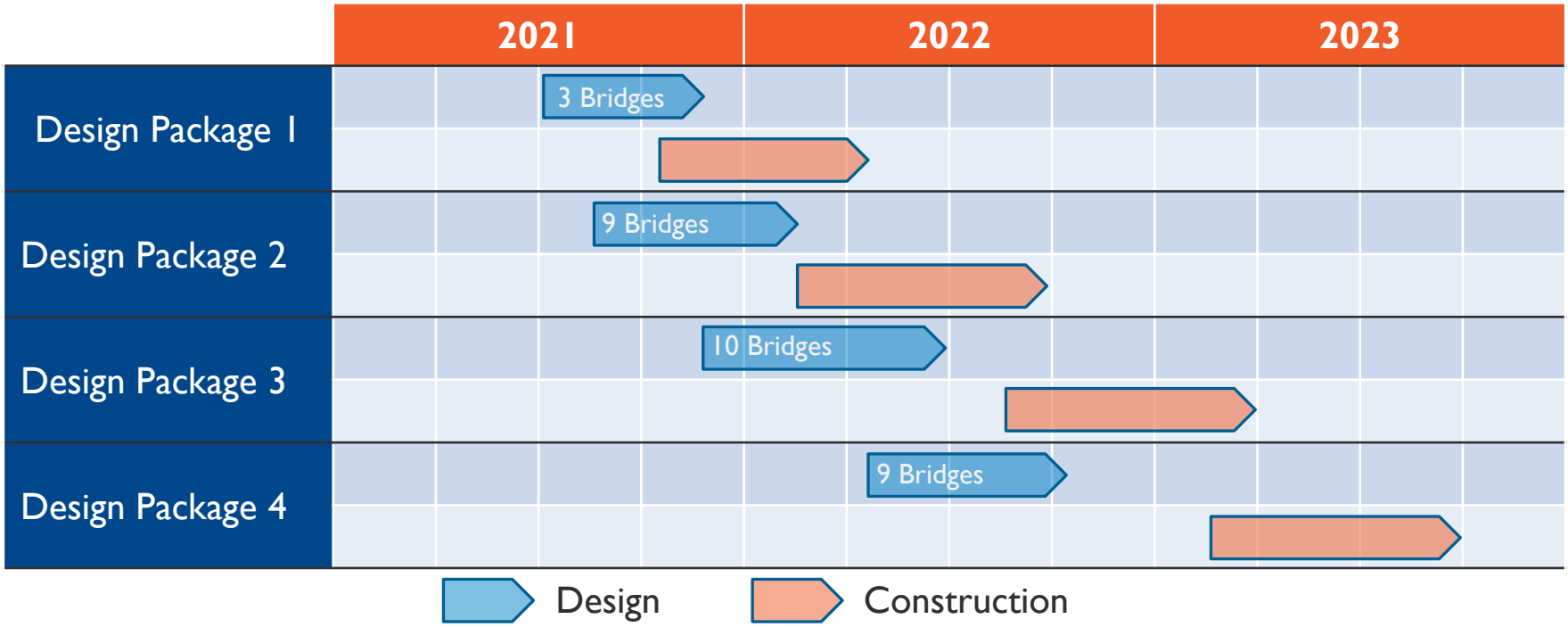
No. of Bridge Replacements: 31 of 41 (30 minimum)

- 3 – RCB
- 3 – Single Span
- 25 – SDCL



FARM DESIGN BUILD PROJECT

Four Design Packages



FARM DESIGN BUILD PROJECT

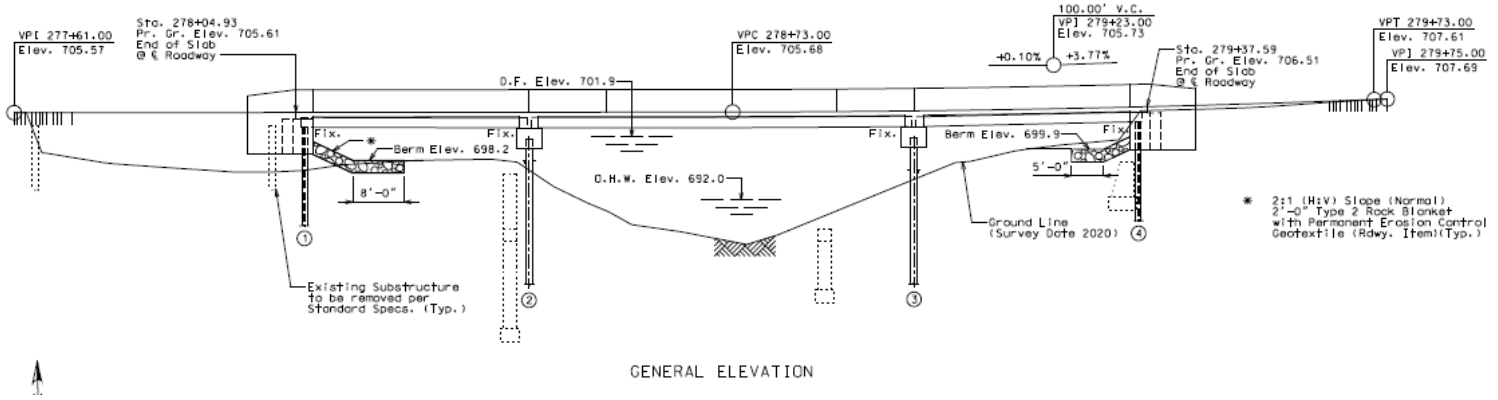
Where are we now?

- 13 bridges complete and open
- 7 currently under construction
- 4 more scheduled to close by the end March

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 DB PROJECT

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.)

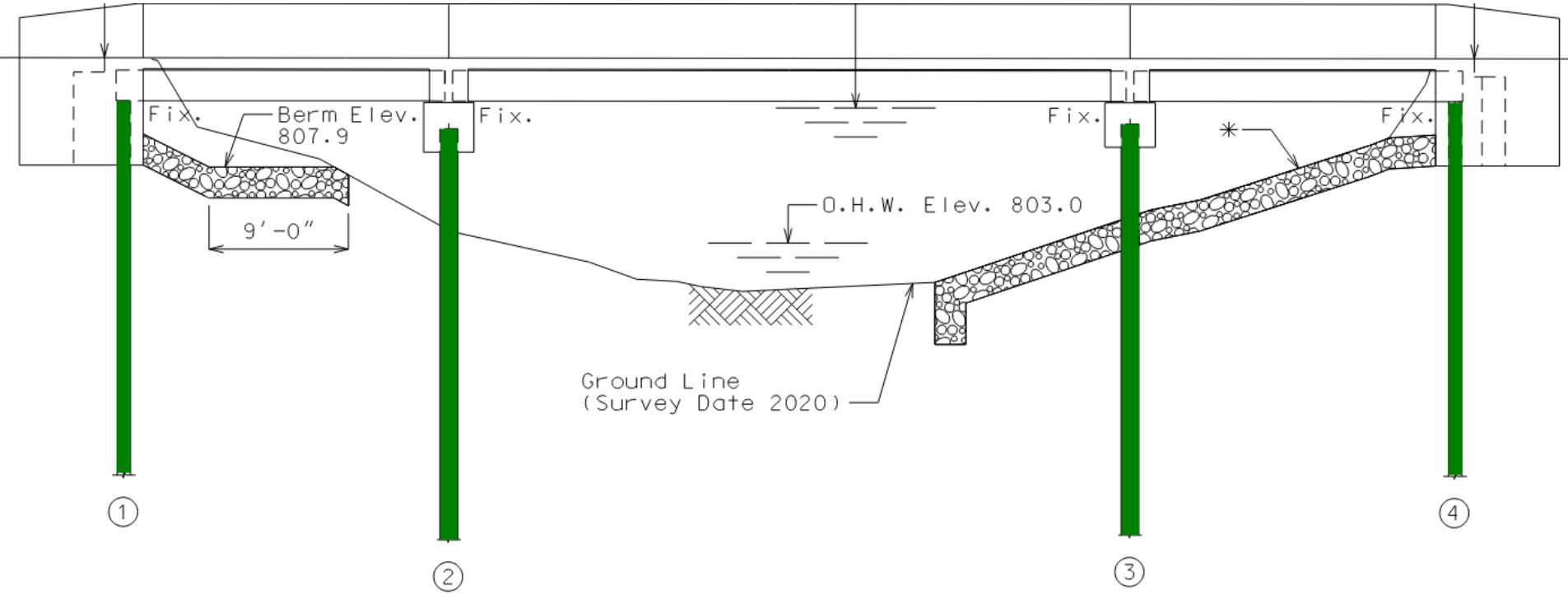
End bearing and friction pile (HP10x42 thru HP14x117)

Average square foot per bridge 2,289sq.ft.

Average length per bridge 106 ft.

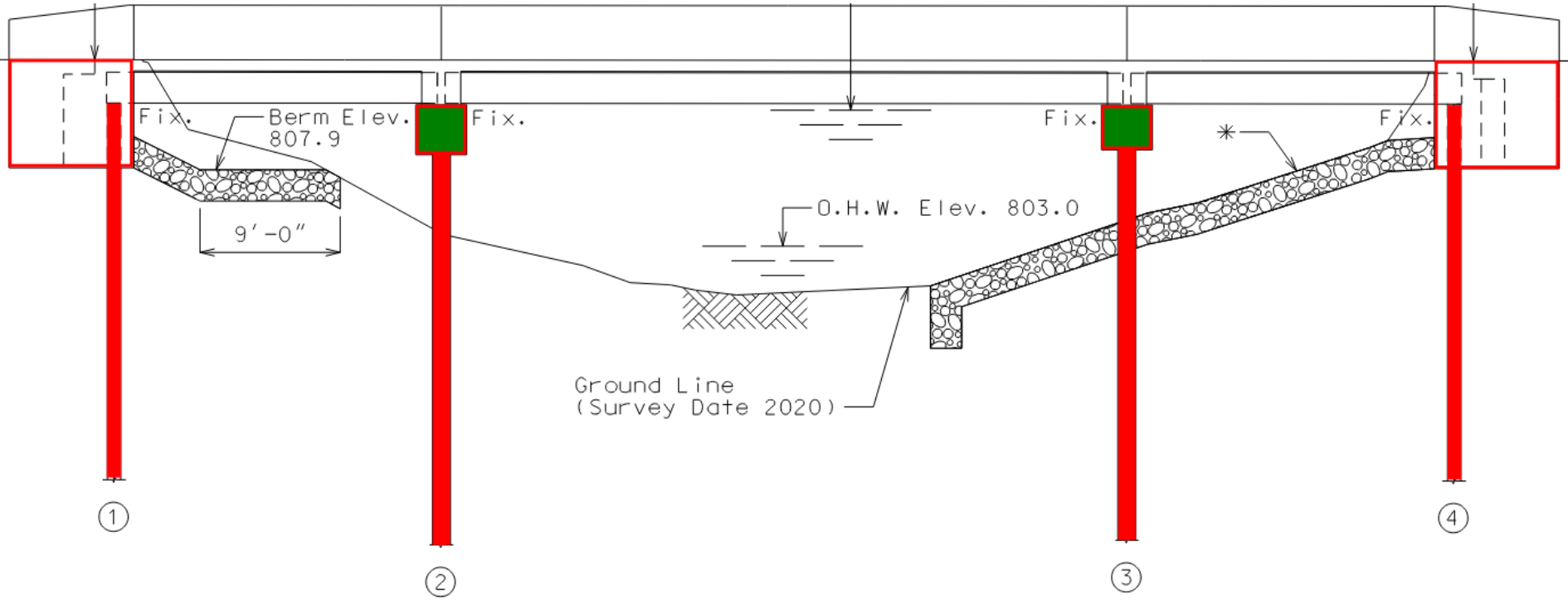
HOW IS SDCL CONSTRUCTED?

Week 2 - Drive pile at bents



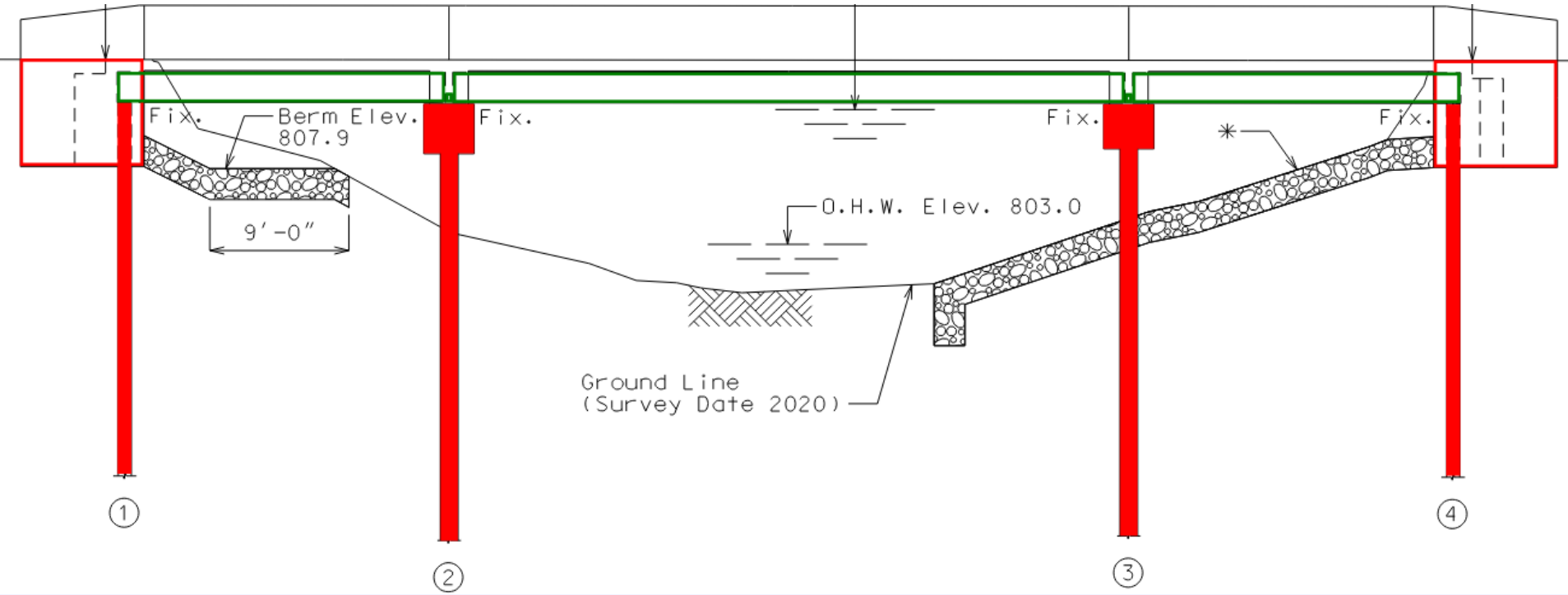
HOW IS SDCL CONSTRUCTED?

Week 3 - Place concrete at intermediate bents



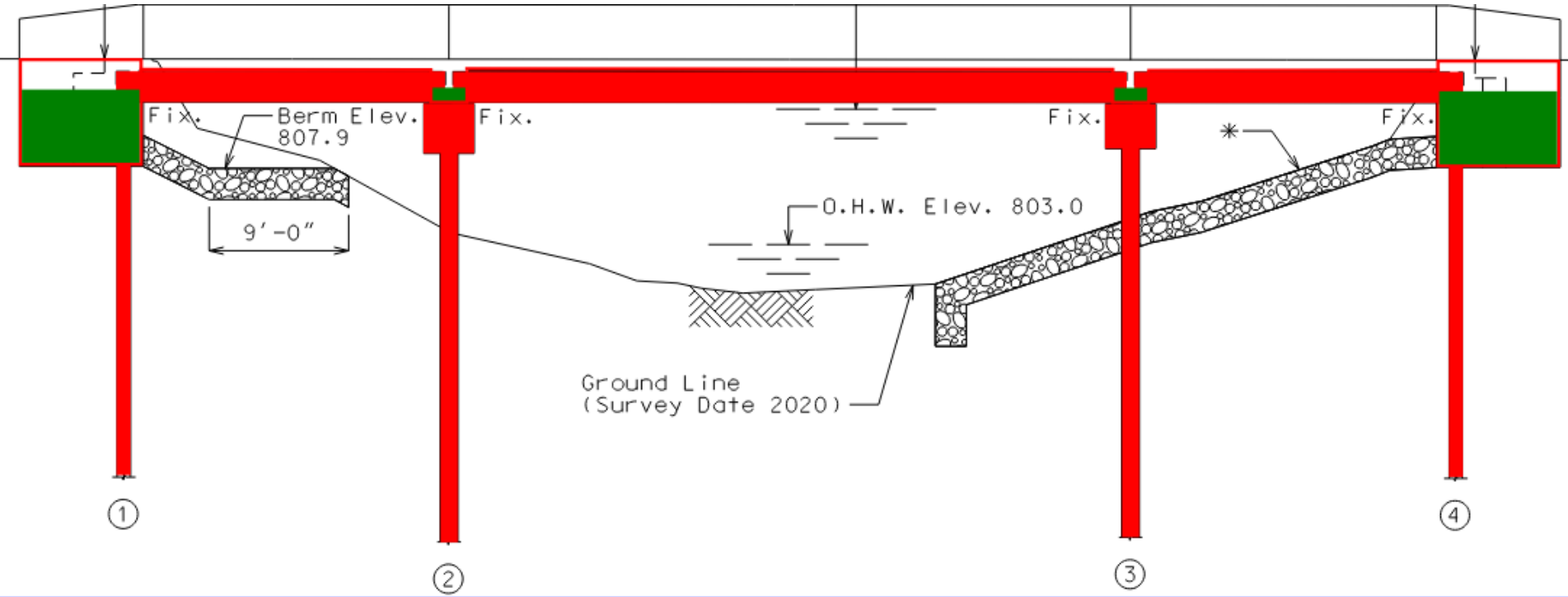
HOW IS SDCL CONSTRUCTED?

Week 4 - Place steel rolled beams



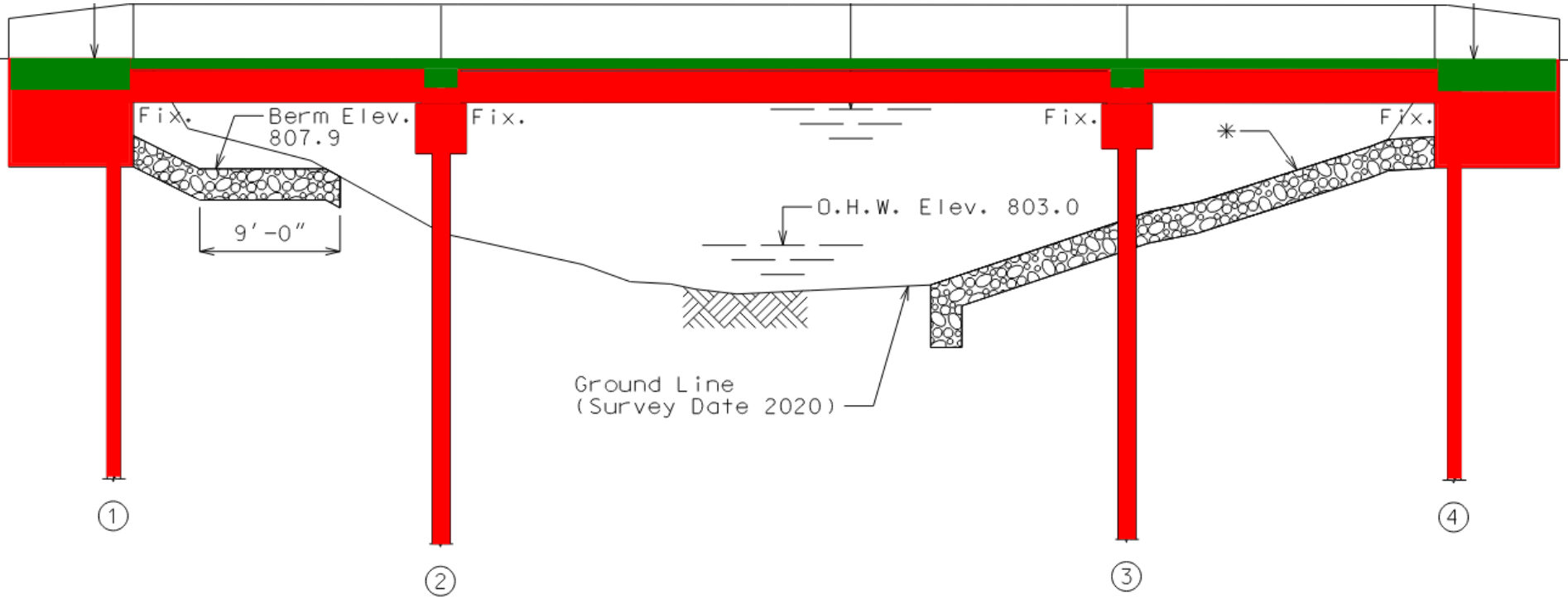
HOW IS SDCL CONSTRUCTED?

Week 5 - Place concrete diaphragms at bents



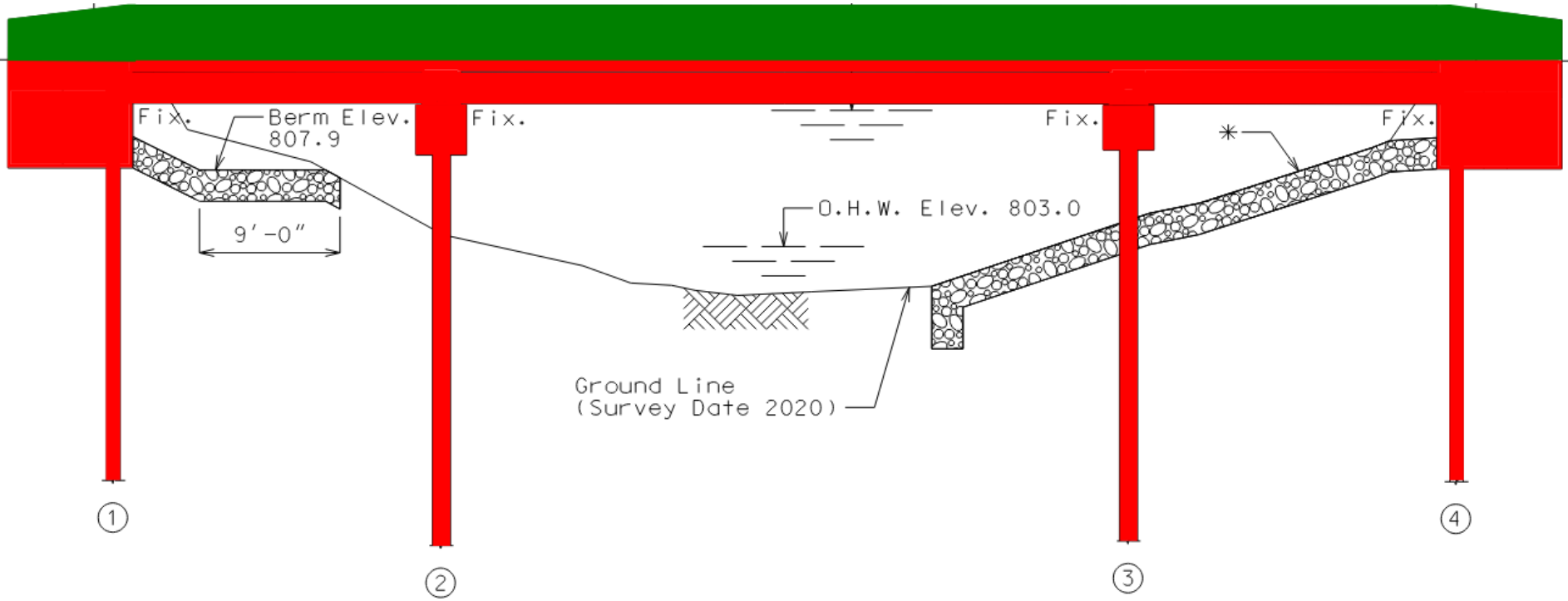
HOW IS SDCL CONSTRUCTED?

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)

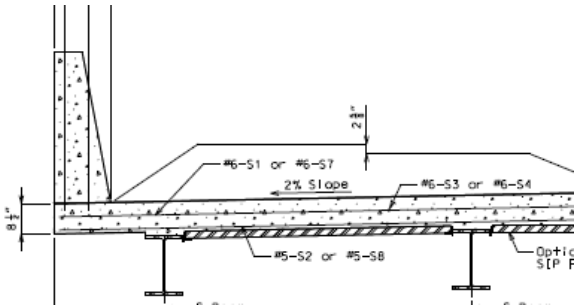
WHY USE SDCL?

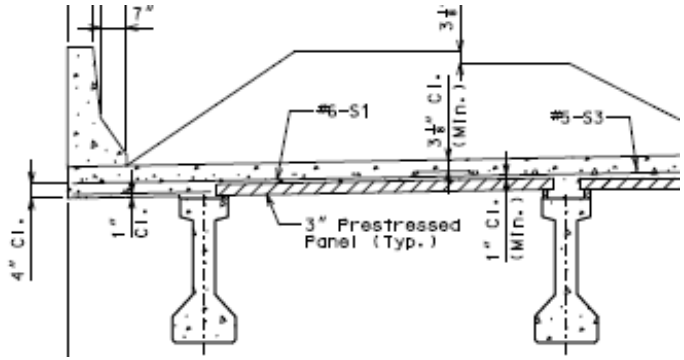
Beam Weights (steel vs. concrete)

- 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″

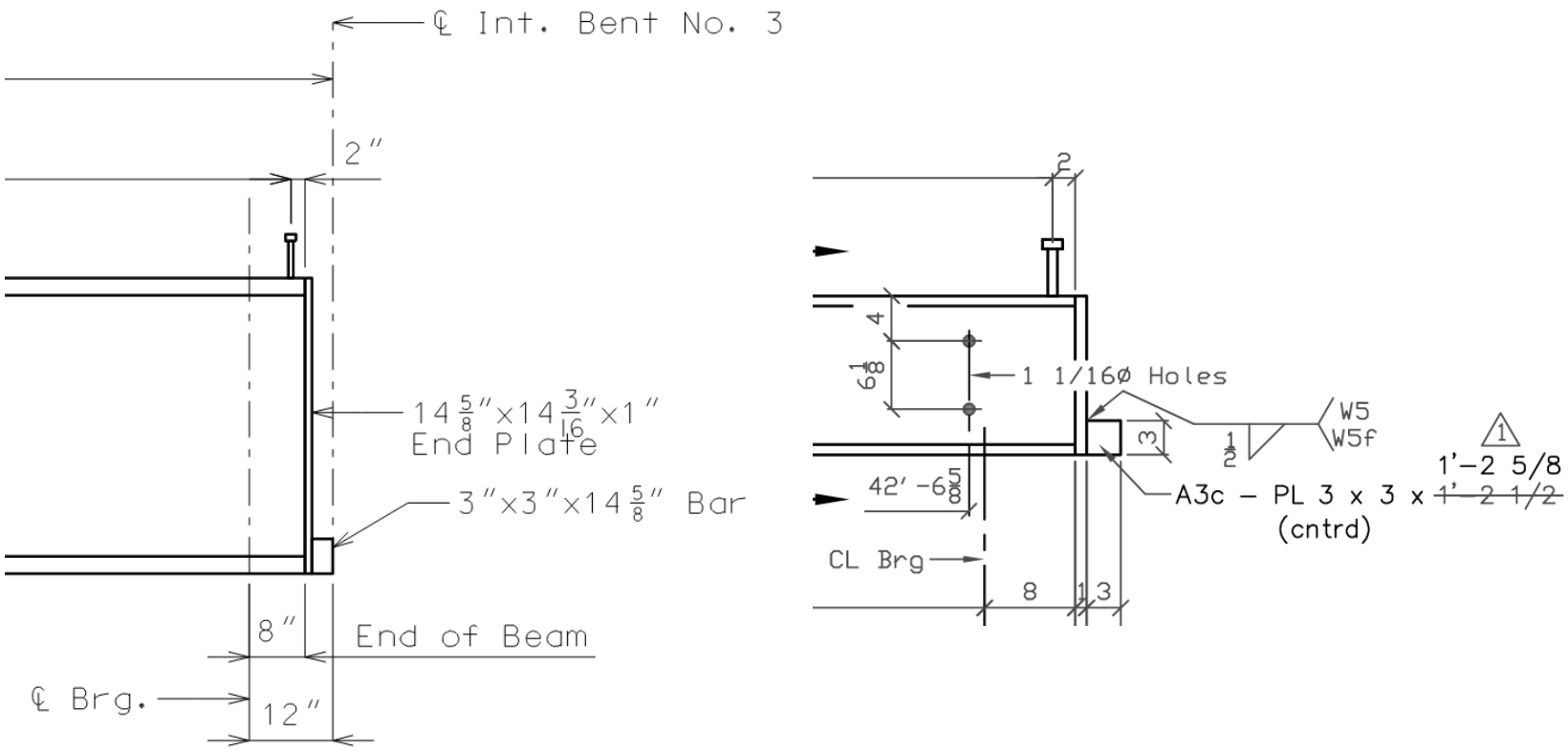




DESIGN SDCL CONNECTION

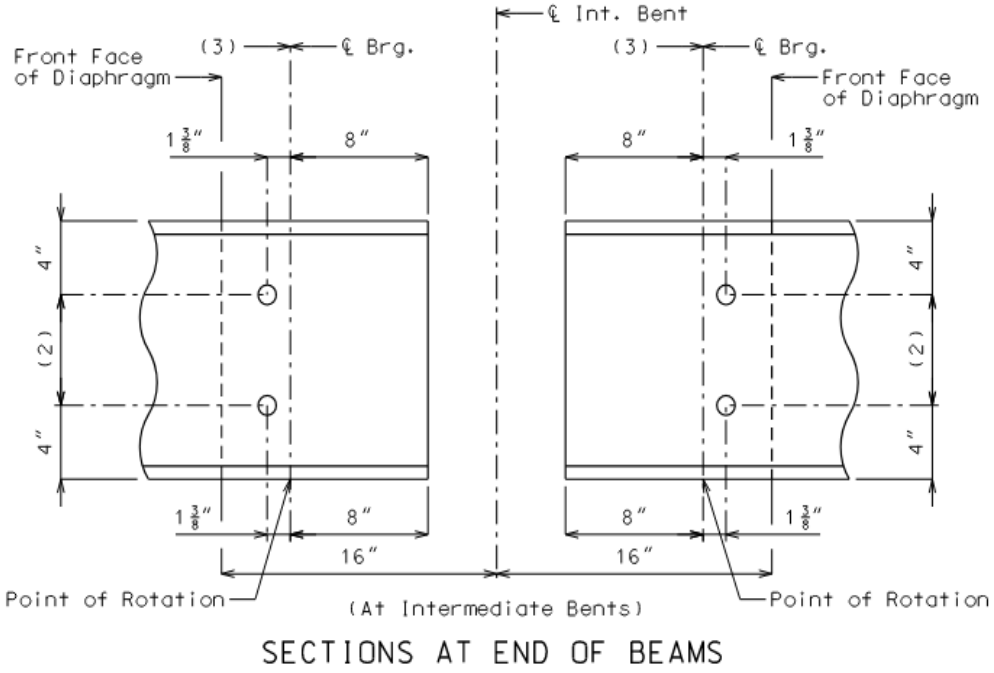
End plates welded to ends of beams

Steel compression block

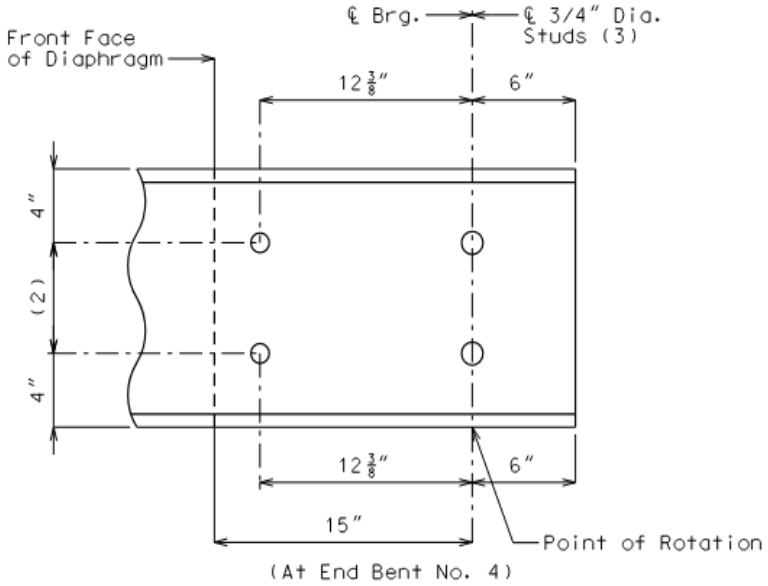


DESIGN SDCL CONNECTION

- Holes for reinforcement at interior bents
- Studs at end bents



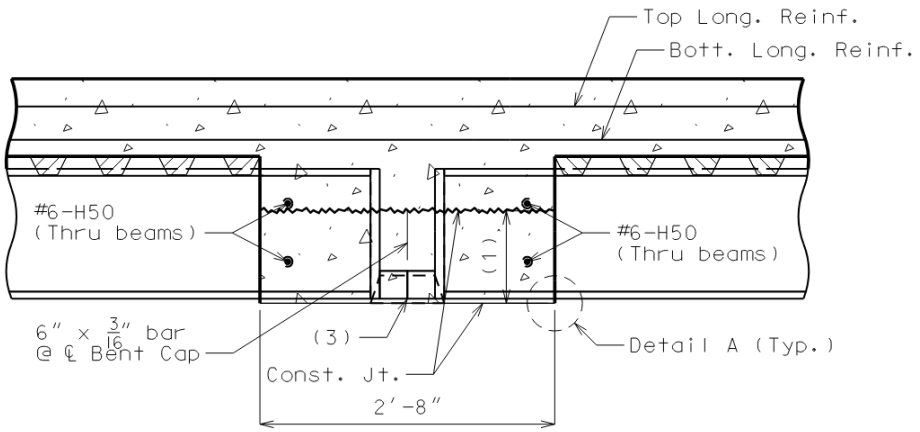
SECTIONS AT END OF BEAMS

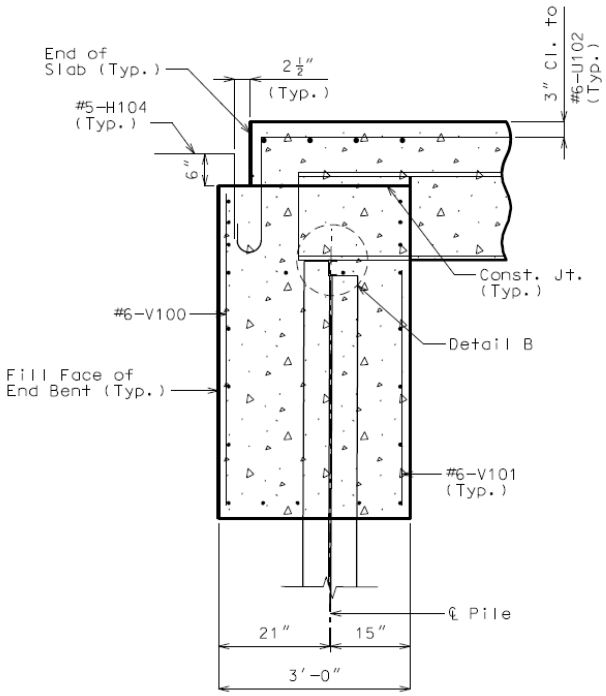


DESIGN SDCL CONNECTION

Concrete diaphragms cast prior to slab

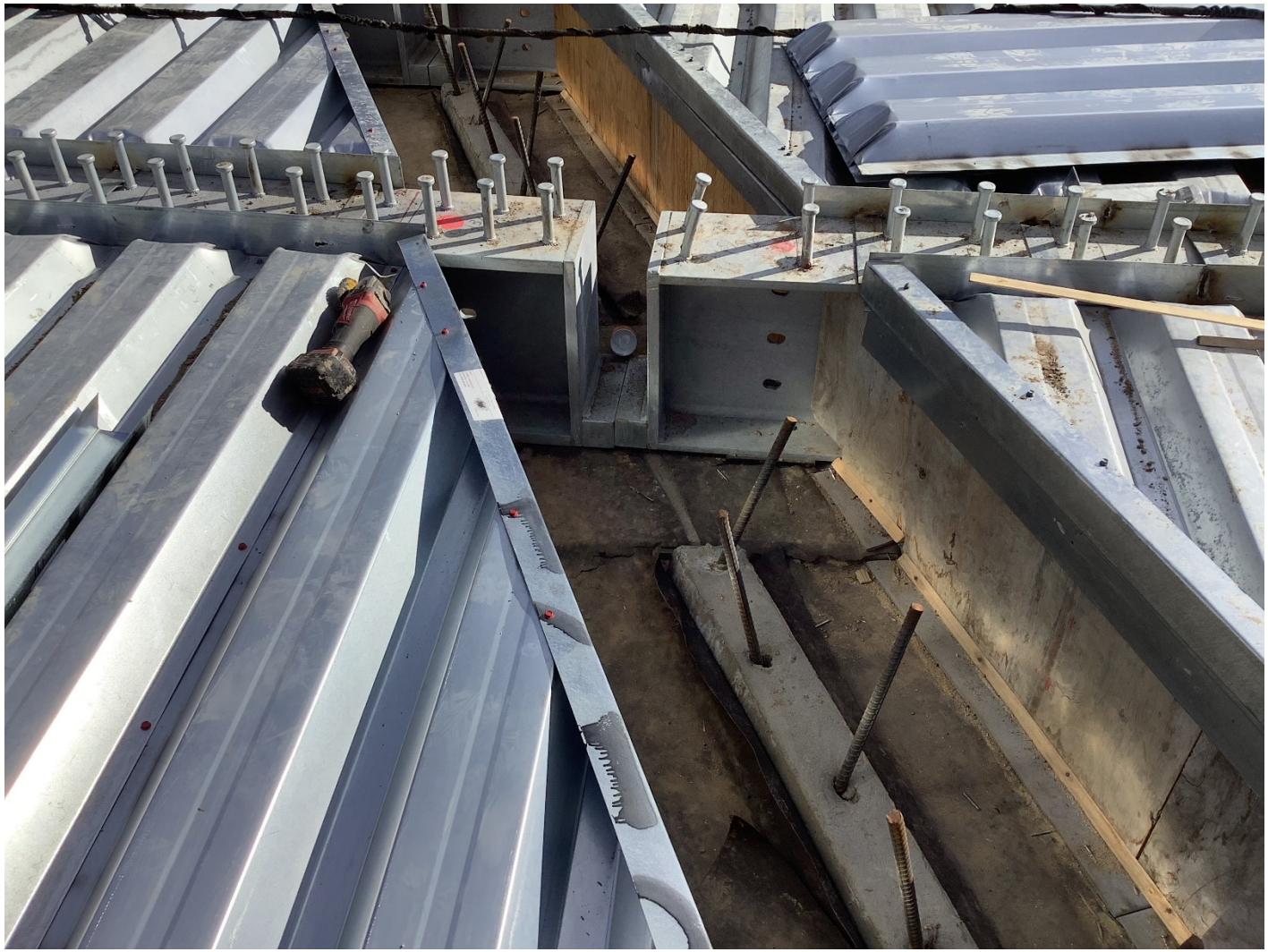
Negative moment slab reinforcement to provide live load continuity





SECTION B-B

DESIGN SDCL CONNECTION



DESIGN TOOLS FOR SDCL

Steel Beams – AASHTOWare BrD/BrR or MDX

Connection at the interior bents – Excel/Mathcad

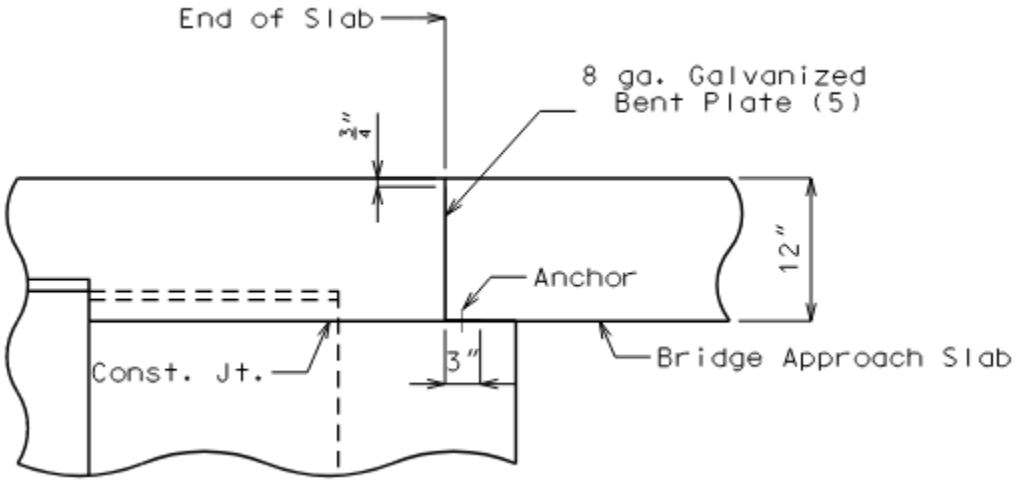
- Design steel block or high strength concrete block to resist compression (P/S vs. Steel end area)
- Design the continuity slab reinforcement and (P/S & SDCL similar) to resist tension

Oregon DOT Standard

☑ Simple DL, continuous LL

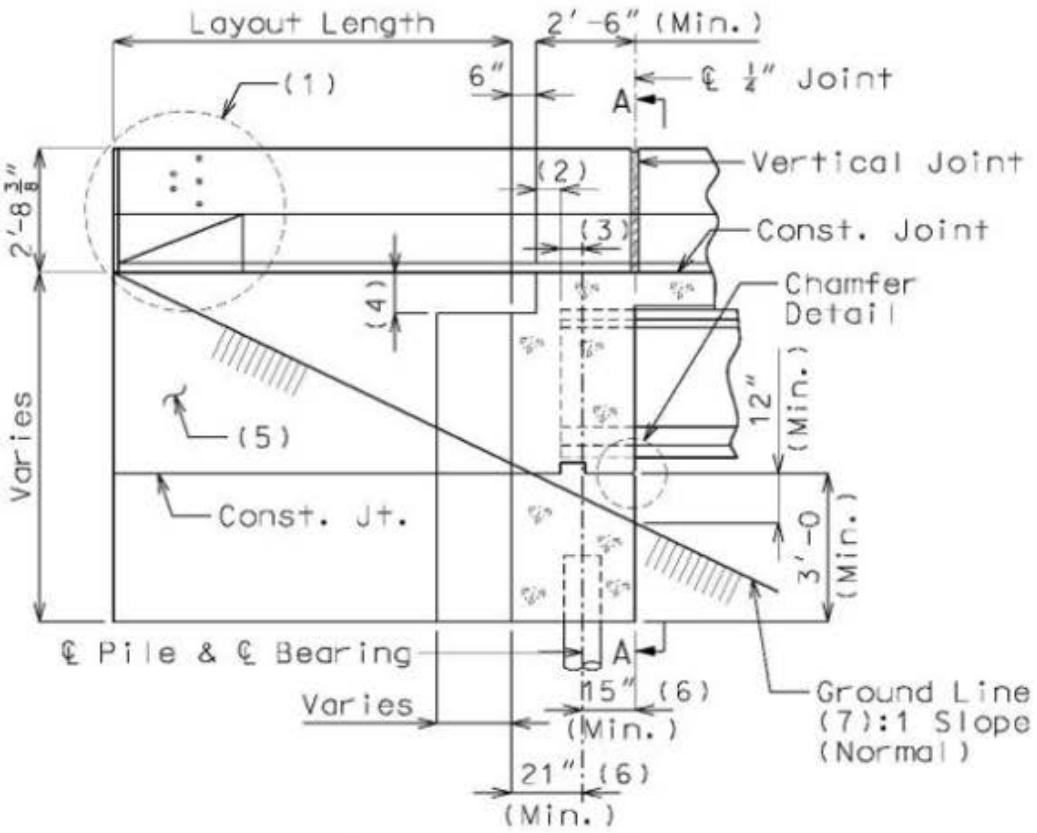
ADDITIONAL APPLICABLE STANDARD (AAS)

Continuous approach slab placement

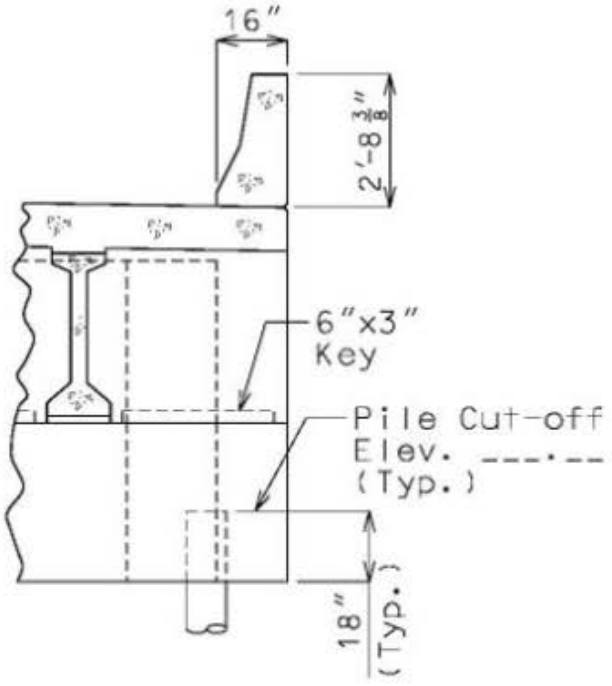


INNOVATION ON FARM

MoDOT standard end bent detail



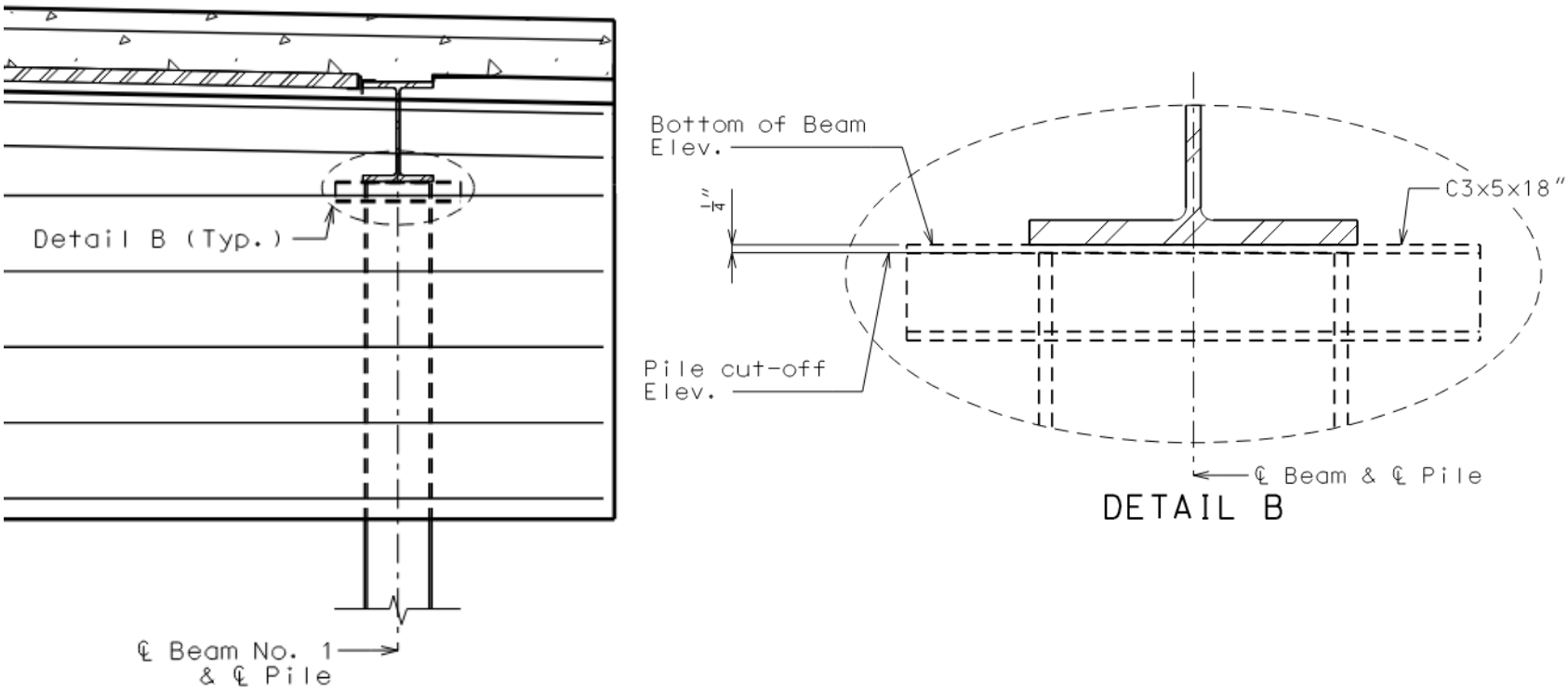
Section Near Wing



Section A-A

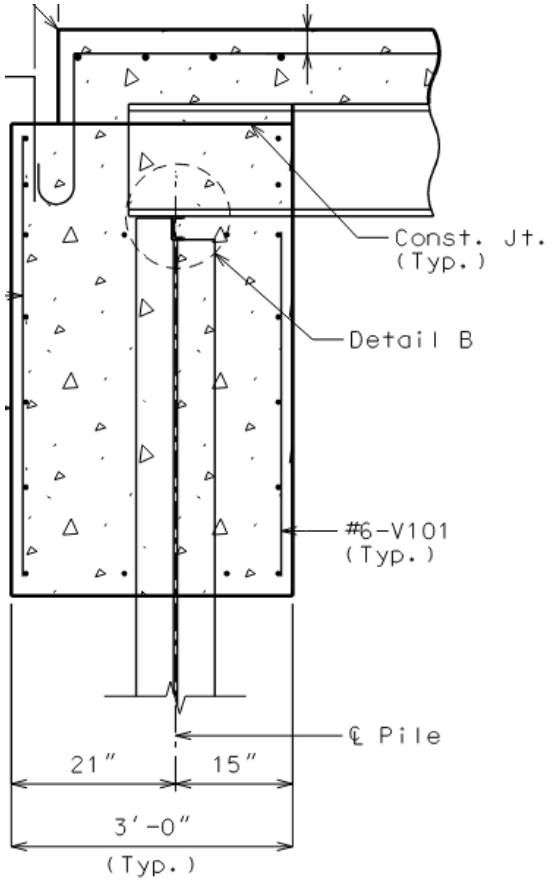
INNOVATION ON FARM

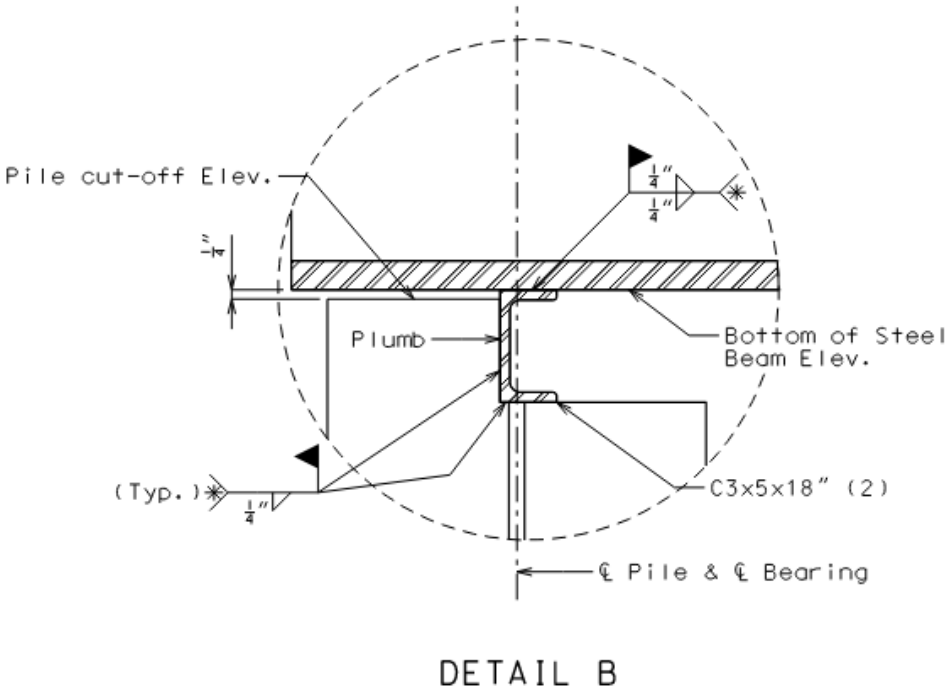
FARM standard end bent detail



INNOVATION ON FARM

FARM standard end bent detail





DETAIL B

HOW IS SDCL CONSTRUCTED?

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HOW IS SDCL CONSTRUCTED?

BEAM COATING OPTIONS (PARTNERING)

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

BEAM COATING OPTIONS (PARTNERING)

Equal or Better Change Proposal

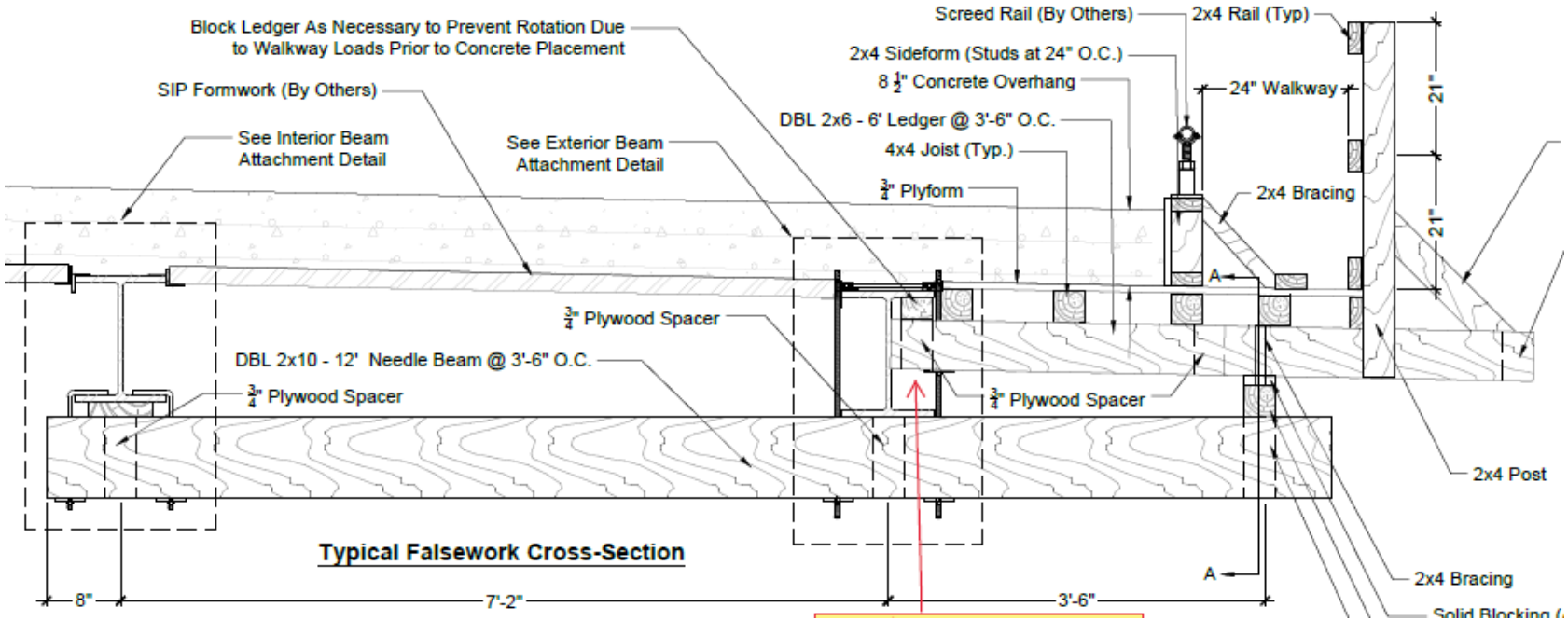
- MoDOT expressed interest in galvanized beams
- Smaller beam sizes and shorter spans allowed galvanization to be a competitive option
- Maintenance of galvanized elements in rural environments is over 100 years, well exceeding the design life of these structures
- First maintenance of a painted steel beam is approximately 40 years with a design life of approximately 75 years

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

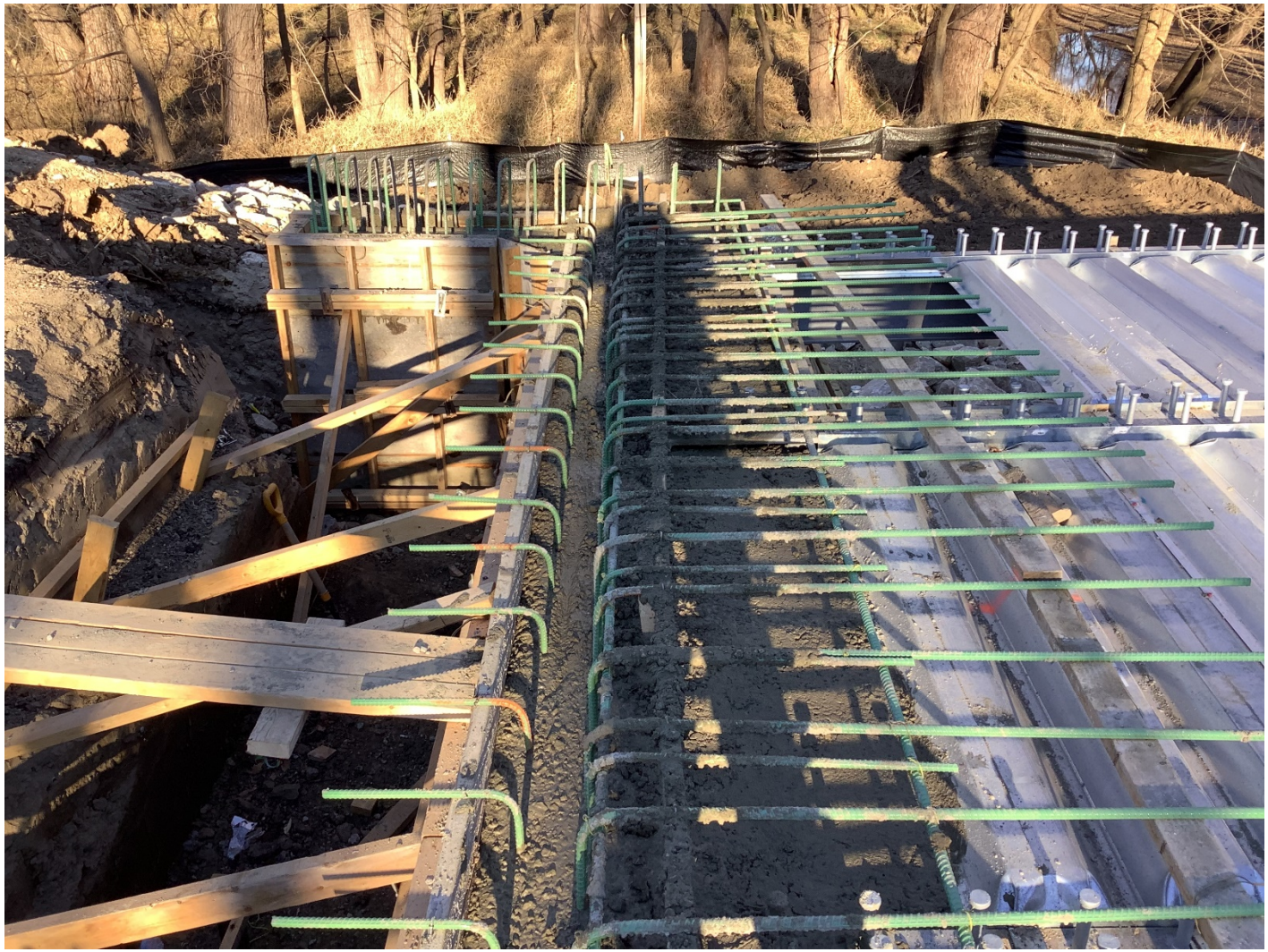


OVERHANG FALSEWORK

OVERHANG FALSEWORK

Beams with webs greater than 18 inches allow the use of traditional C-49 overhang brackets

HOW IS SDCL CONSTRUCTED?



HOW IS SDCL CONSTRUCTED?

VIBRATORY SCREED

Shallow beams require lighter construction methods

- Vibratory screed reduces rotation of exterior beam
- Vibratory screed reduces the amount of falsework

Vibratory screed usage requires:

- Maintaining and exceeding minimum rate of pour
- Ensure consolidation of concrete ahead of screed
- Additional straight edging behind the screed

VIBRATORY SCREED

Set paver up the same as deck paver

COLD WEATHER CURING

Portable Hydronic Heat Machine allows work to continue during winter months

Utilize Cellular Con Cure Nodes & Sensors to monitor and control internal concrete temperature

COLD WEATHER CURING

- Structured schedule to continue through winter



HOW IS SDCL CONSTRUCTED?

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WHAT IS A FARM BRIDGE?

Any Questions?

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