

Industry Collaboration Meeting

BIM For Bridges & Structures

Iowa DOT BIM Pilot Project
I-80/I-380 Interchange

Presented By
HDR Engineering, Inc.



AGENDA

1 PROJECT OVERVIEW

2 BENTLEY BIM DEVELOPMENT SOFTWARE

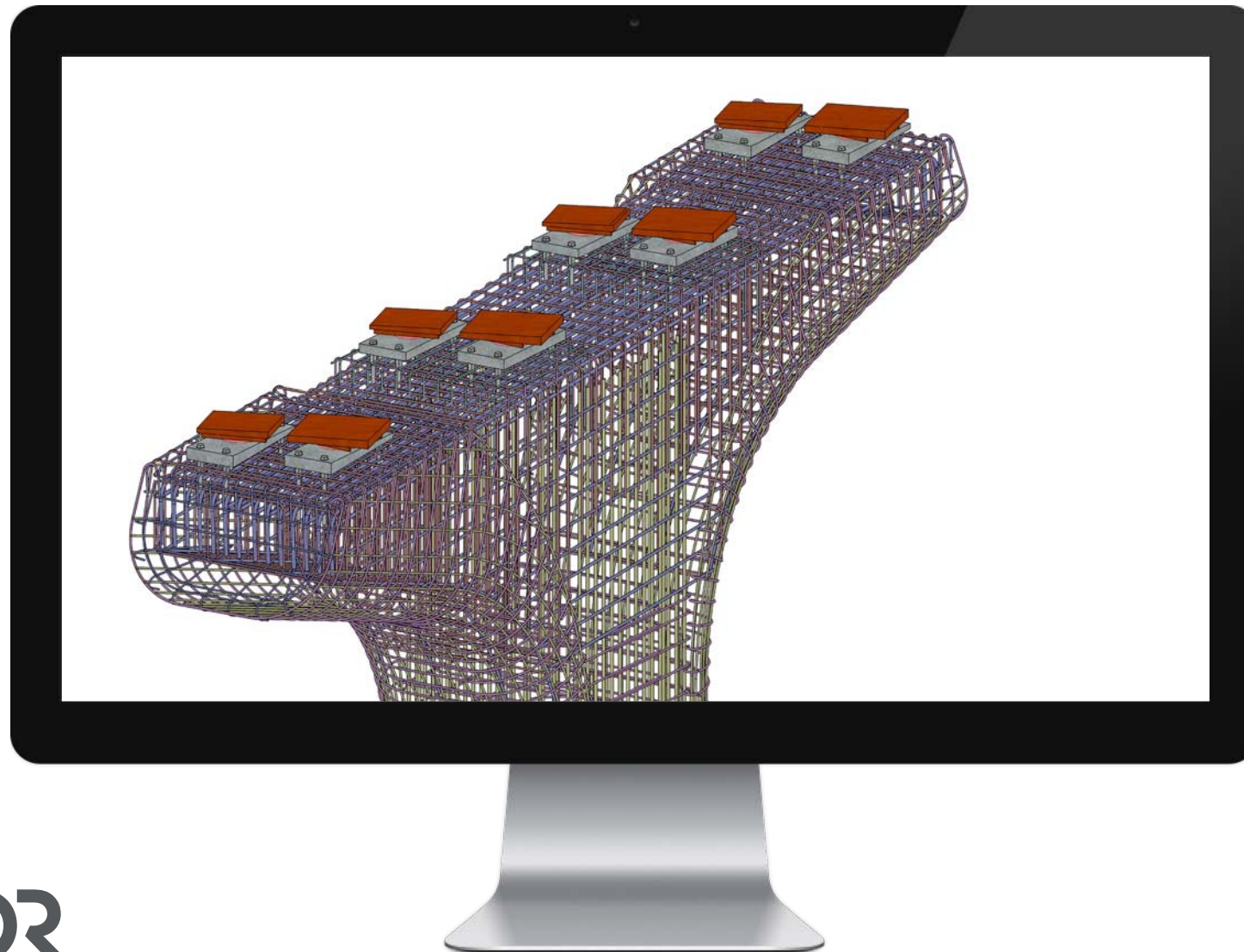
3 BIM MODEL USE DURING CONSTRUCTION

4 FINAL THOUGHTS

PROJECT OVERVIEW

PROJECT OVERVIEW

Goals



1

**DEVELOP BIM
MODEL**

AS COMPLETE AS POSSIBLE

2

**EVALUATE
BENTLEY
SOFTWARE**

OPENBRIDGE MODELER

PROSTRUCTURES

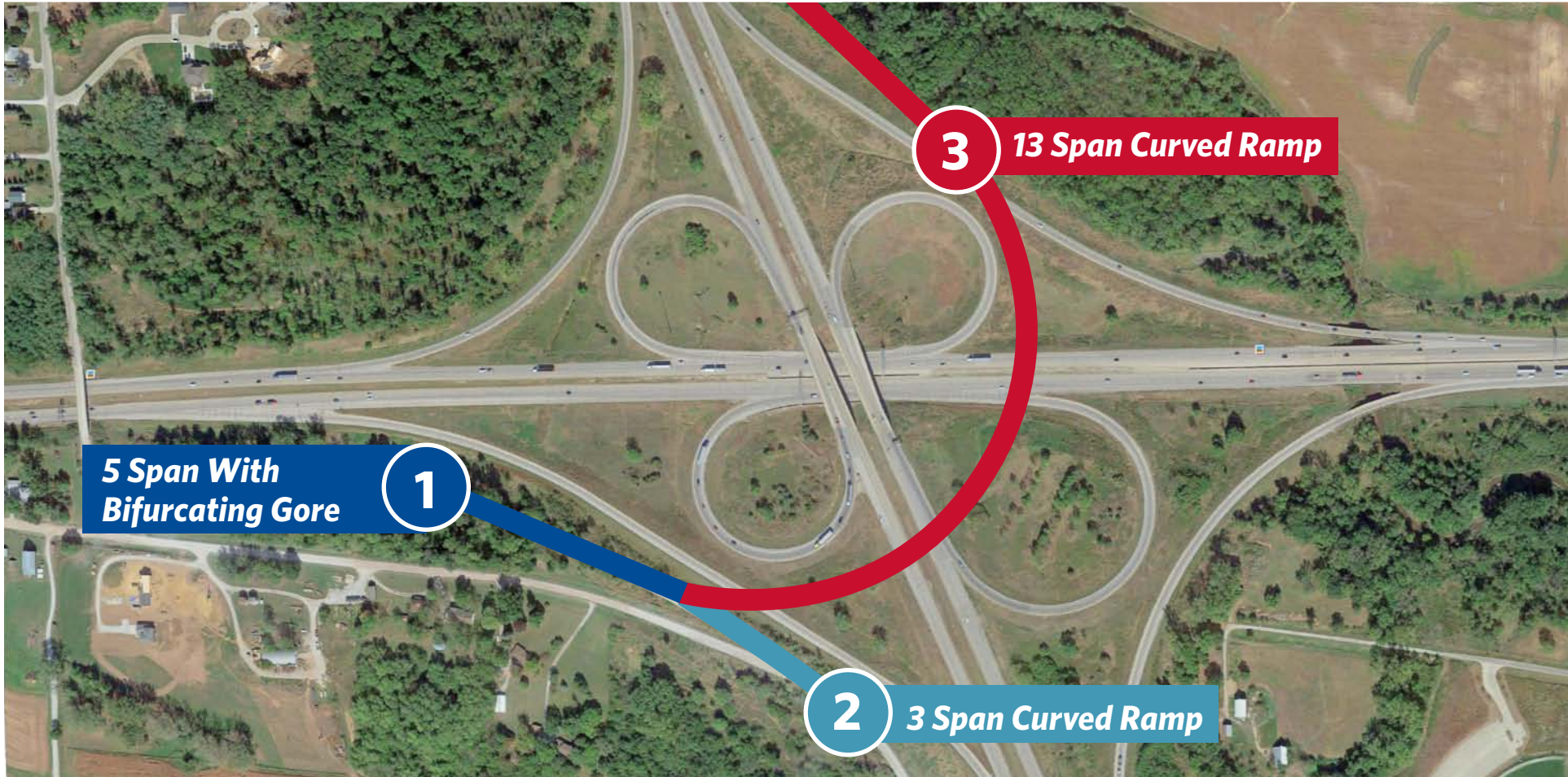
NAVIGATOR CONNECT

3

**ENCOURAGE
CONTRACTOR USE**

PROJECT OVERVIEW

3 Complex Curved Steel Plate Girder Bridges



TOTAL LENGTH = 4200 FT

BIFURCATING GORE

DISCONTINUOUS GIRDERS

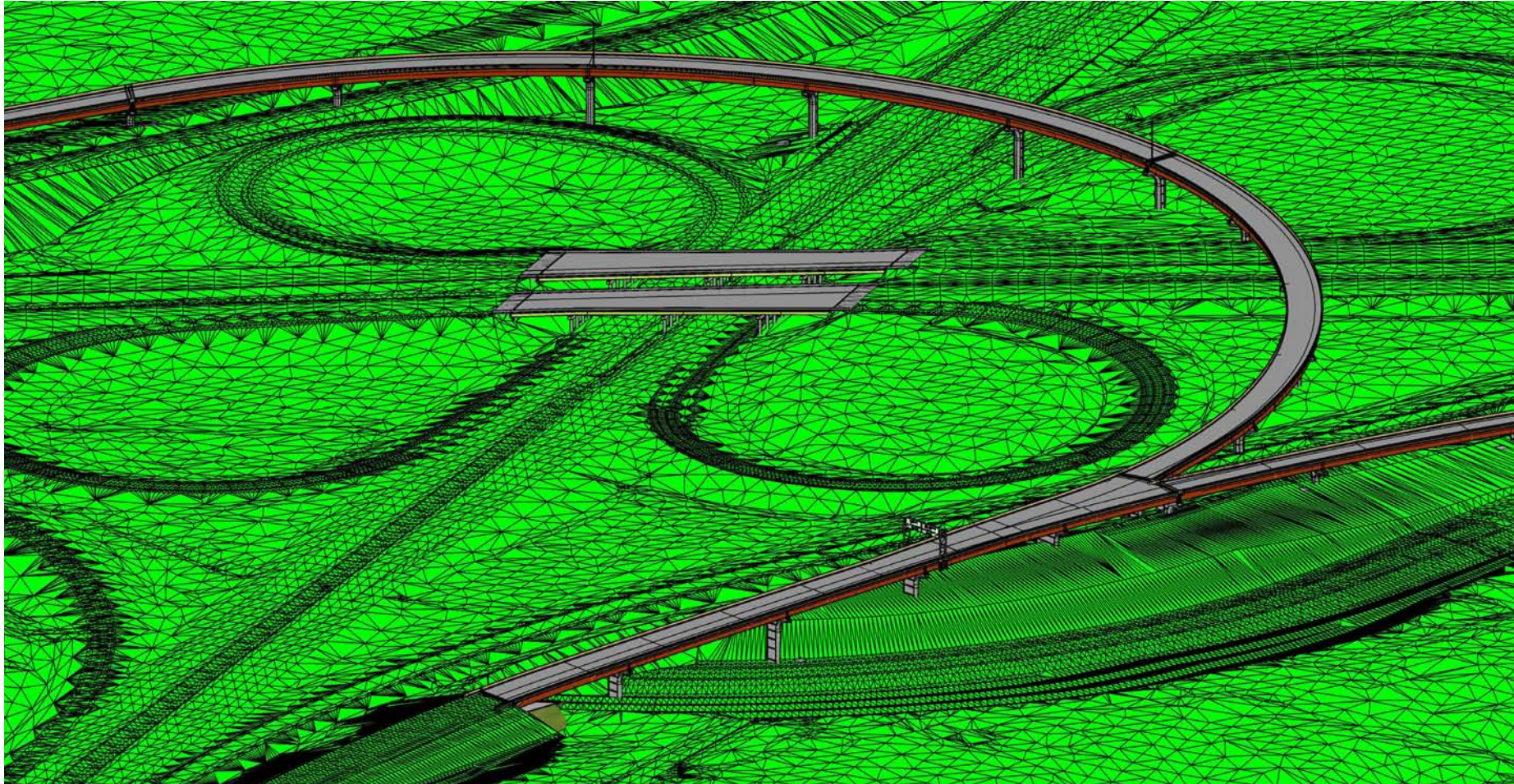
**COMPLEX
SUPERELEVATION AT GORE**

INSPECTION WALKWAYS

**AESTHETIC PIERS
& ABUTMENTS**

PROJECT OVERVIEW

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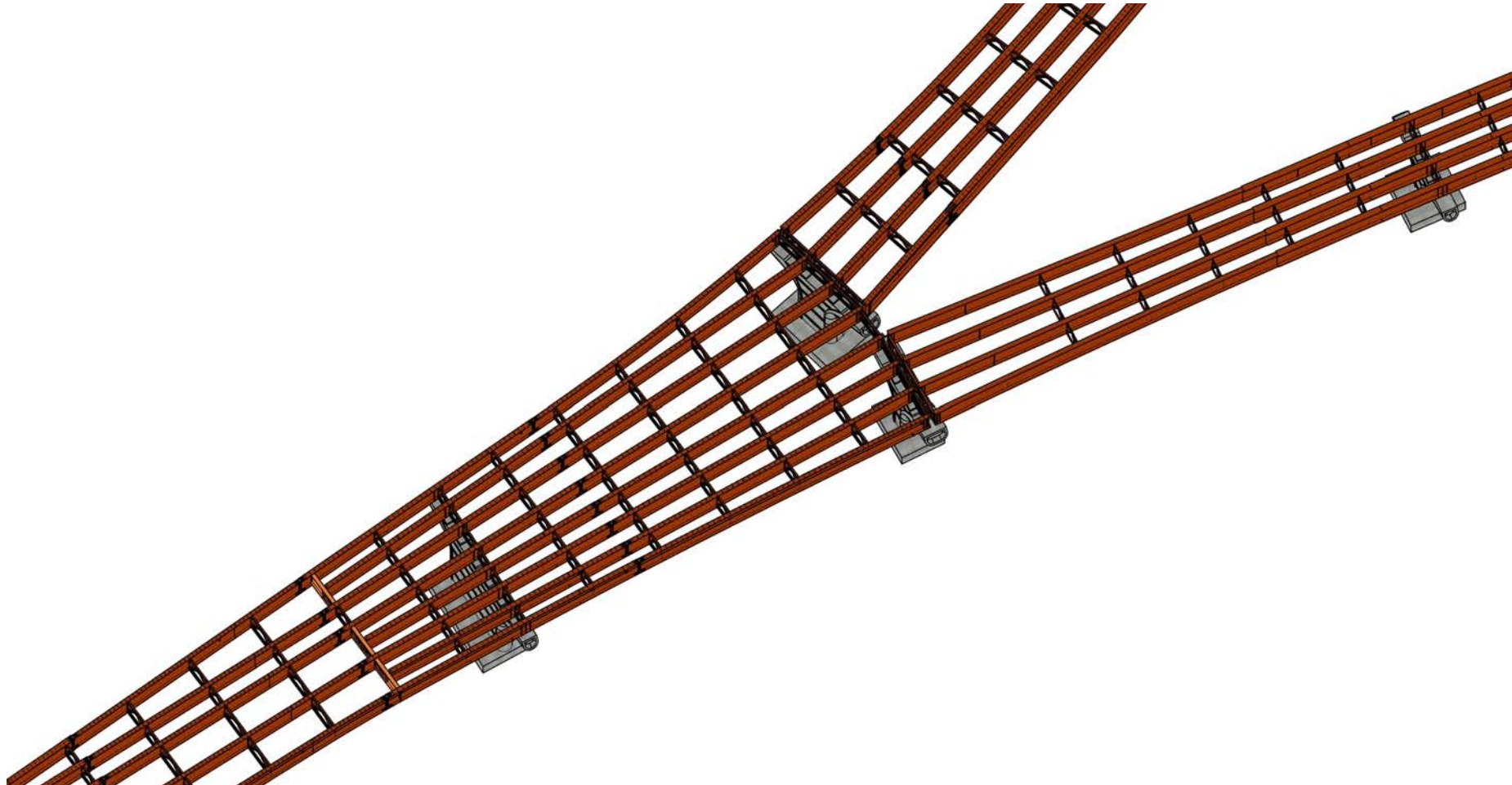
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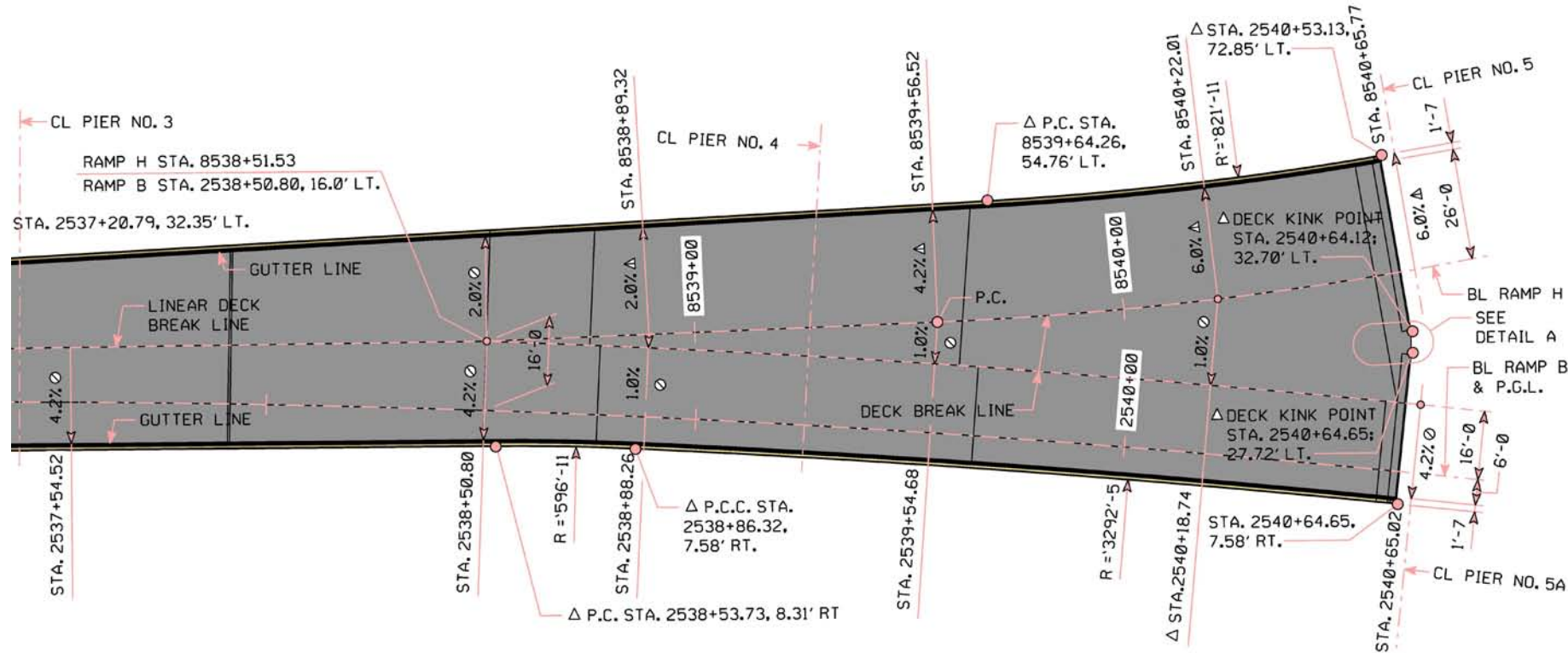
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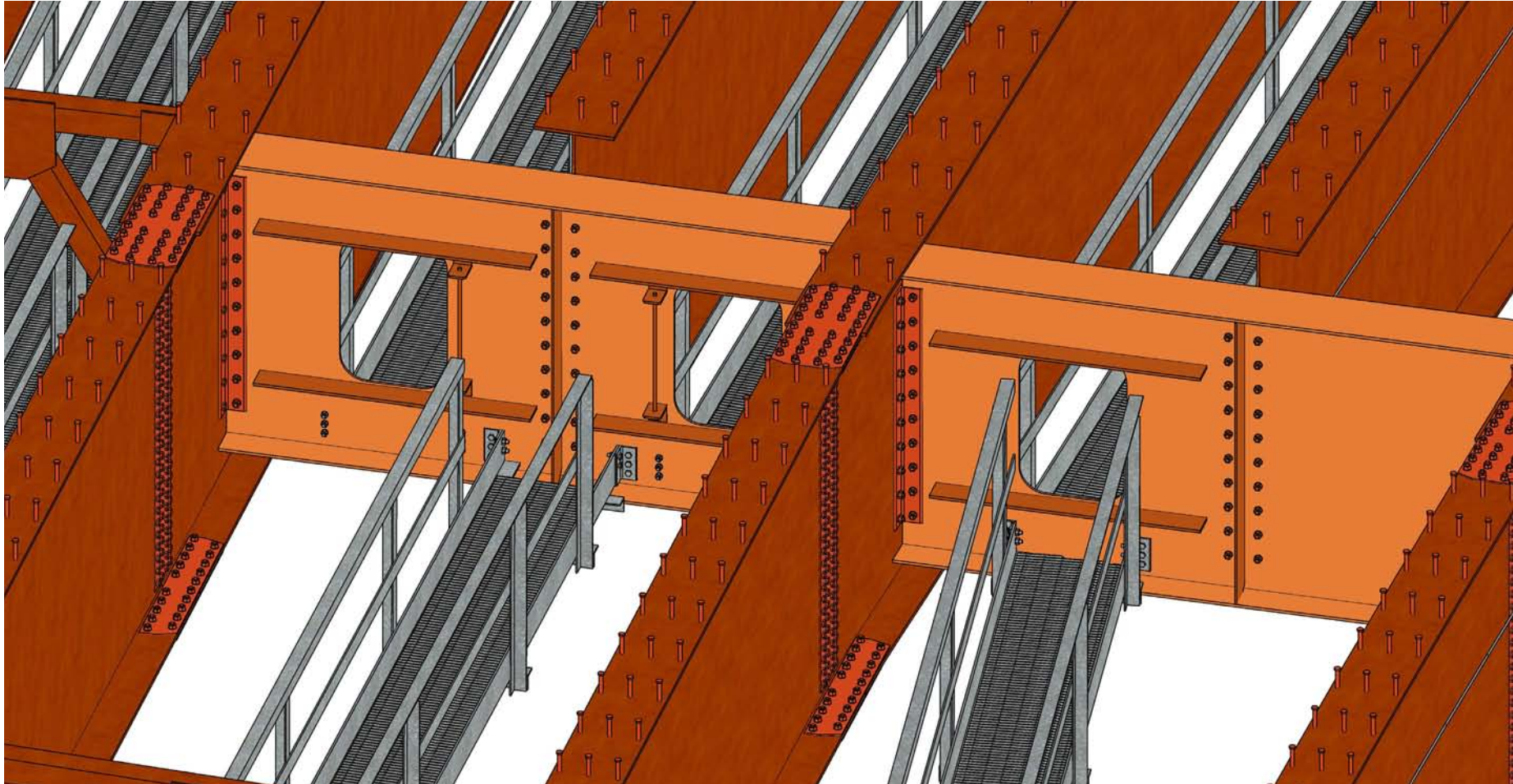
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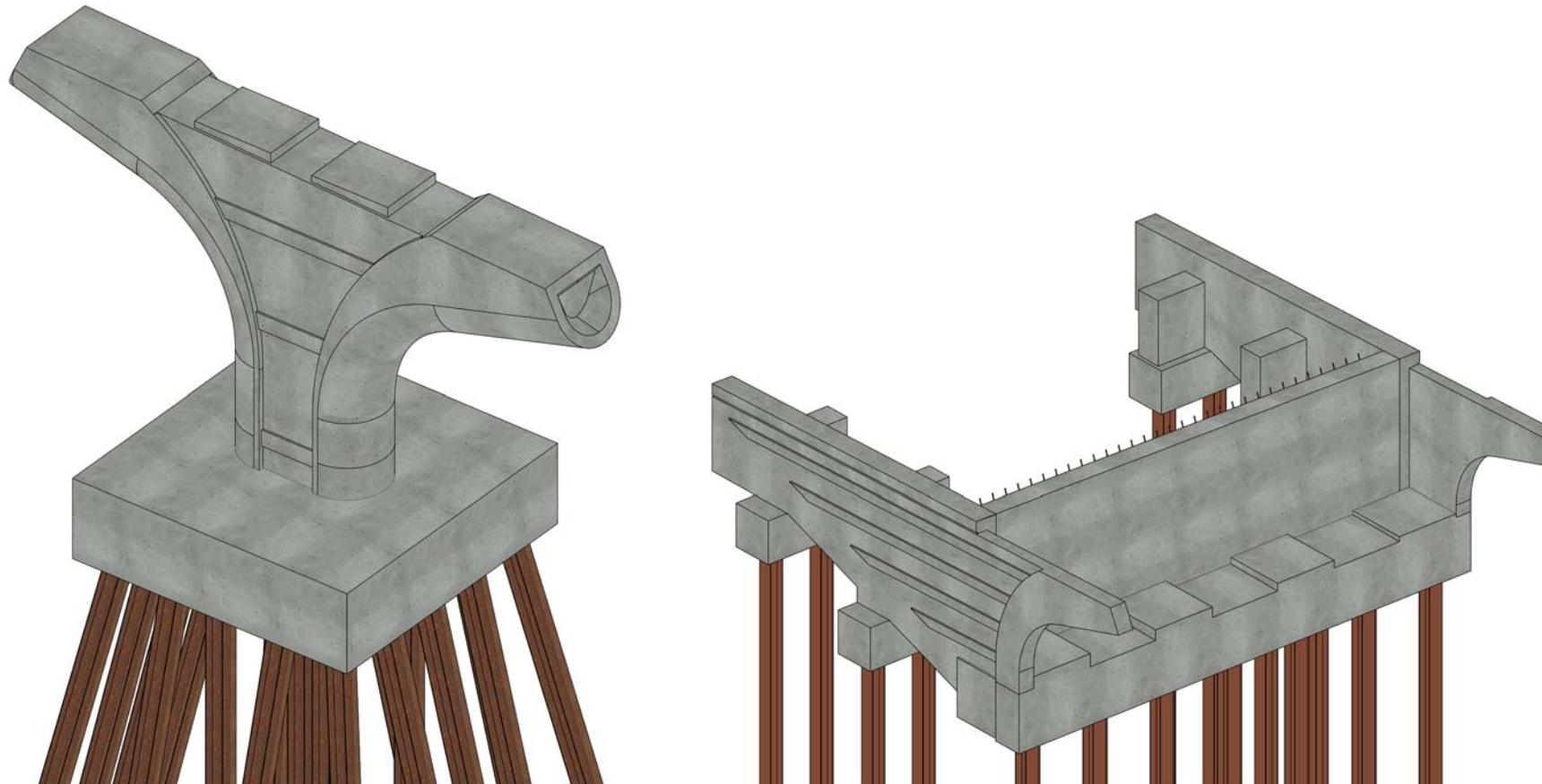
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PROJECT OVERVIEW

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**BENTLEY BIM
DEVELOPMENT SOFTWARE**

BENTLEY SOFTWARE

Bentley's BIM Bridge Solution



OPEN BRIDGE MODELER

Defines primary
bridge elements using
horizontal & vertical
geometry



PROSTRUCTURES

Used to add elements
not created by OBM

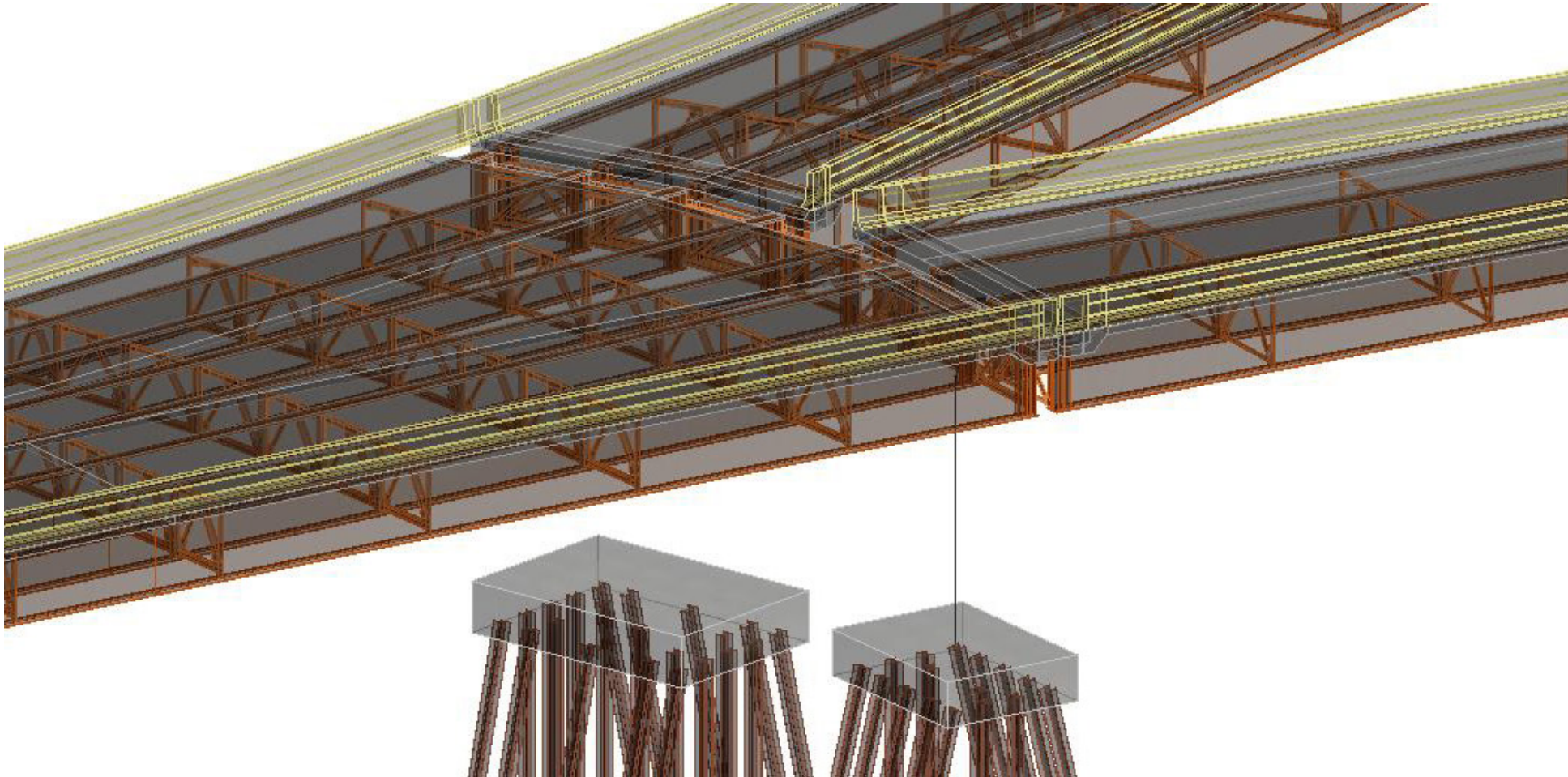


NAVIGATOR CONNECTS

For multi-platform
viewing with limited
element information

MODEL DEVELOPMENT

OpenBridge Modeler



OBM ELEMENTS

BRIDGE DECK, HAUNCH

BARRIERS

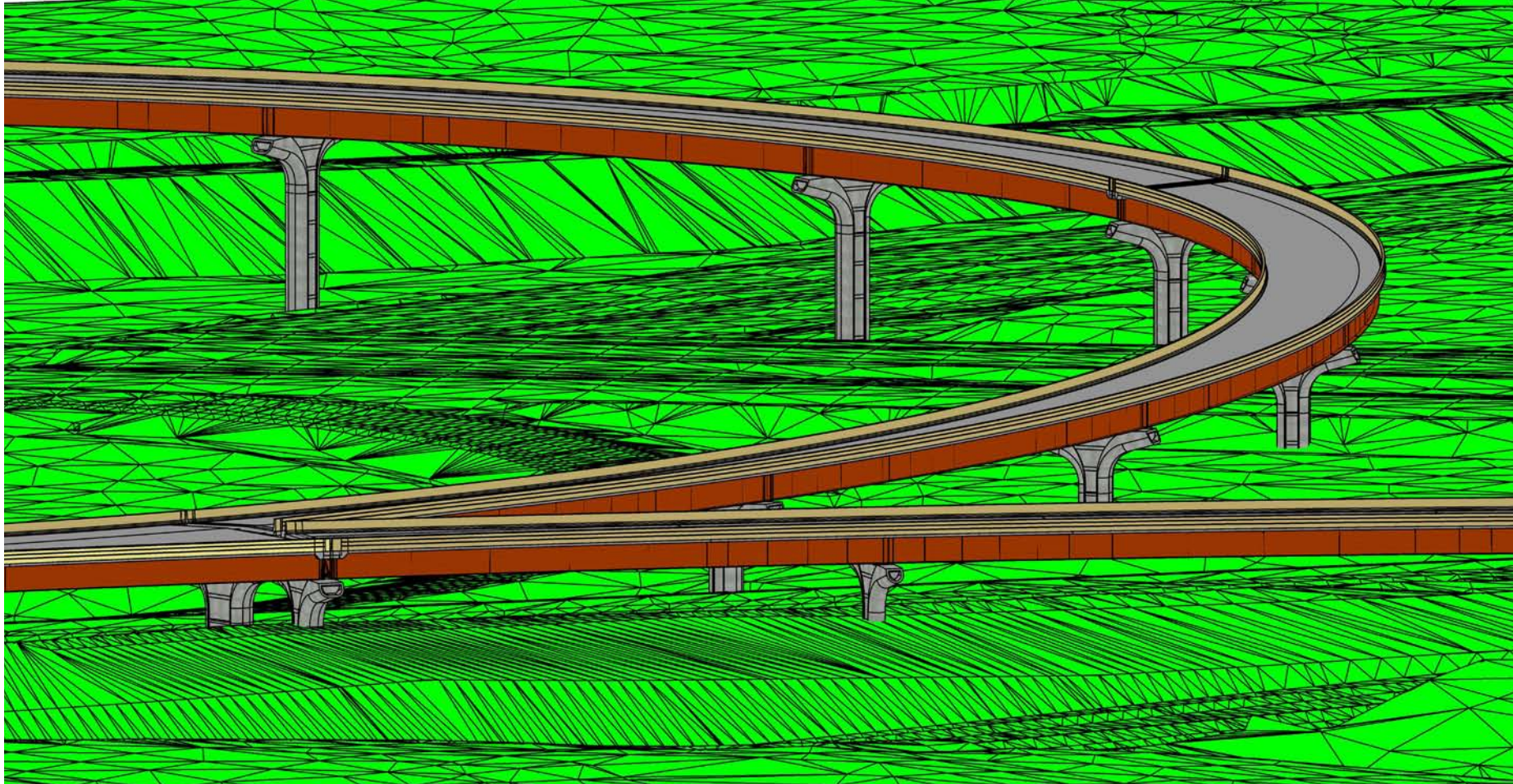
GIRDERS, PLATES &
STIFFENERS

CROSS-FRAMES

FOOTINGS & PILES

MODEL DEVELOPMENT

OpenBridge Modeler



ADVANTAGES

CREATING ELEMENTS
BASED ON HORIZONTAL &
VERTICAL GEOMETRY

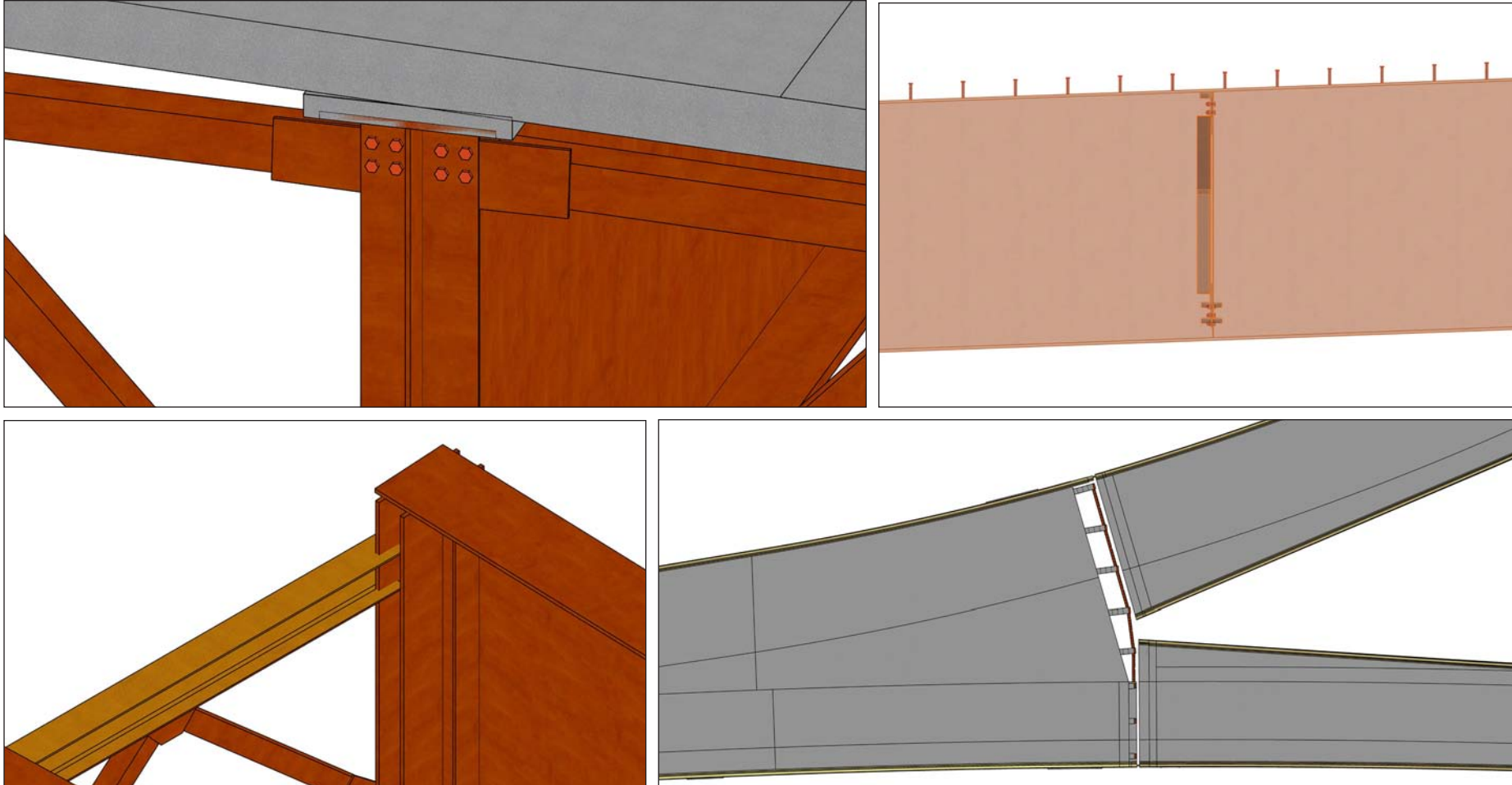
COMPLEX STEEL FRAMING

PLACE NON-NATIVE CELLS
AT STATION & OFFSETS

NATIVE ELEMENT
INFORMATION POPULATION

MODEL DEVELOPMENT

OpenBridge Modeler



ISSUES

OBM ELEMENTS CANNOT BE CUSTOMIZED

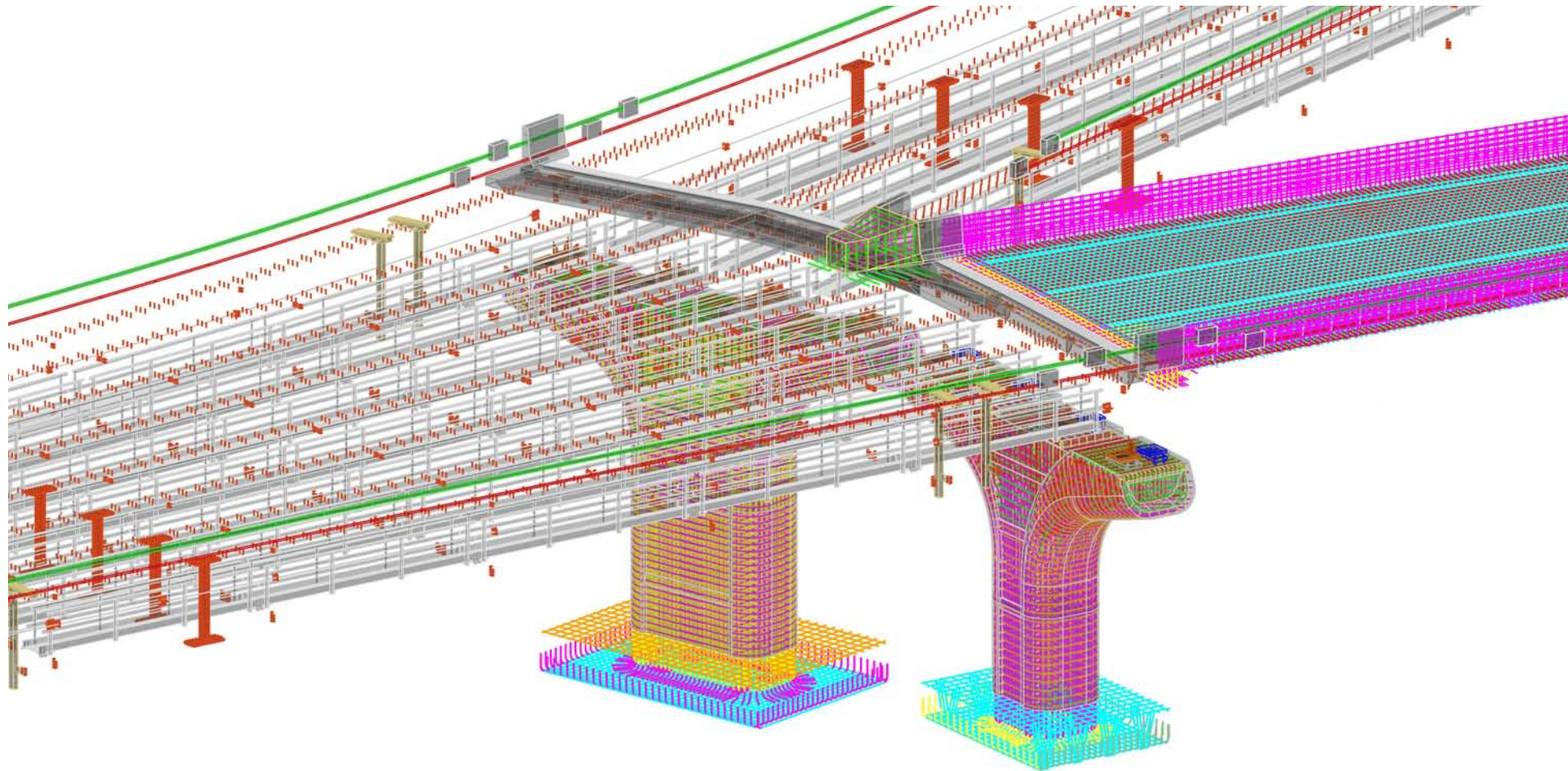
CROSSFRAMES & STIFFENERS PLUMB TO WORLD

SIMPLE NATIVE ELEMENTS (I.E. PIERS & ABUTMENTS)

LIMITED QUANTITIES & NO PARTS LIST

MODEL DEVELOPMENT

ProStructures



PS ELEMENTS

REINFORCING STEEL

BOLTS & BOLT HOLES

DISC BEARINGS &
ANCHORAGE

FIELD SLICES & MISC. STEEL

ABUTMENT & PIERS

SIGN SUPPORT & I.T.S. POLES

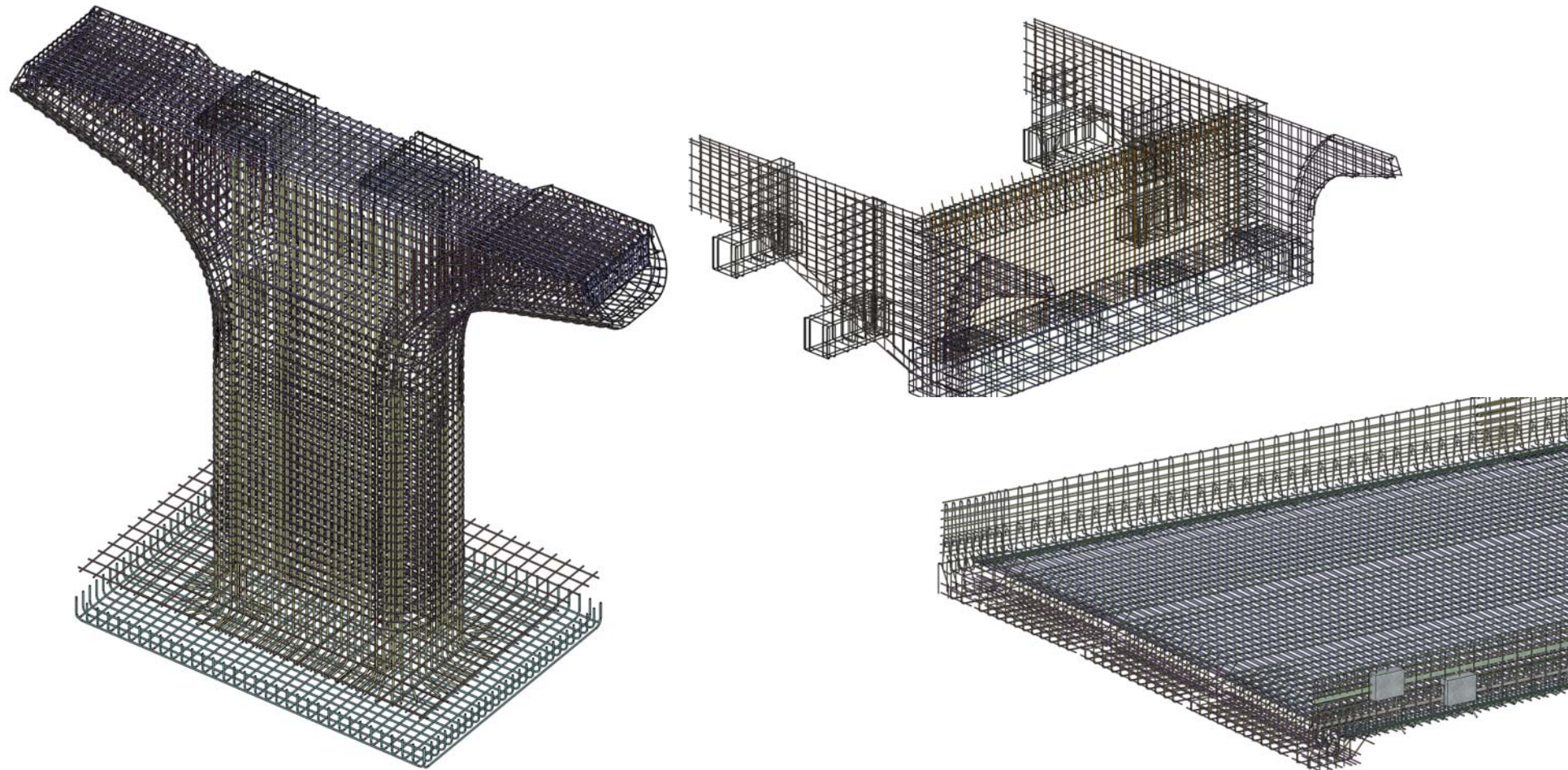
DIAPHRAGMS &
ACCESS DOORS

INSPECTION ACCESS SYSTEM

MISC. ELEMENTS

MODEL DEVELOPMENT

ProStructures



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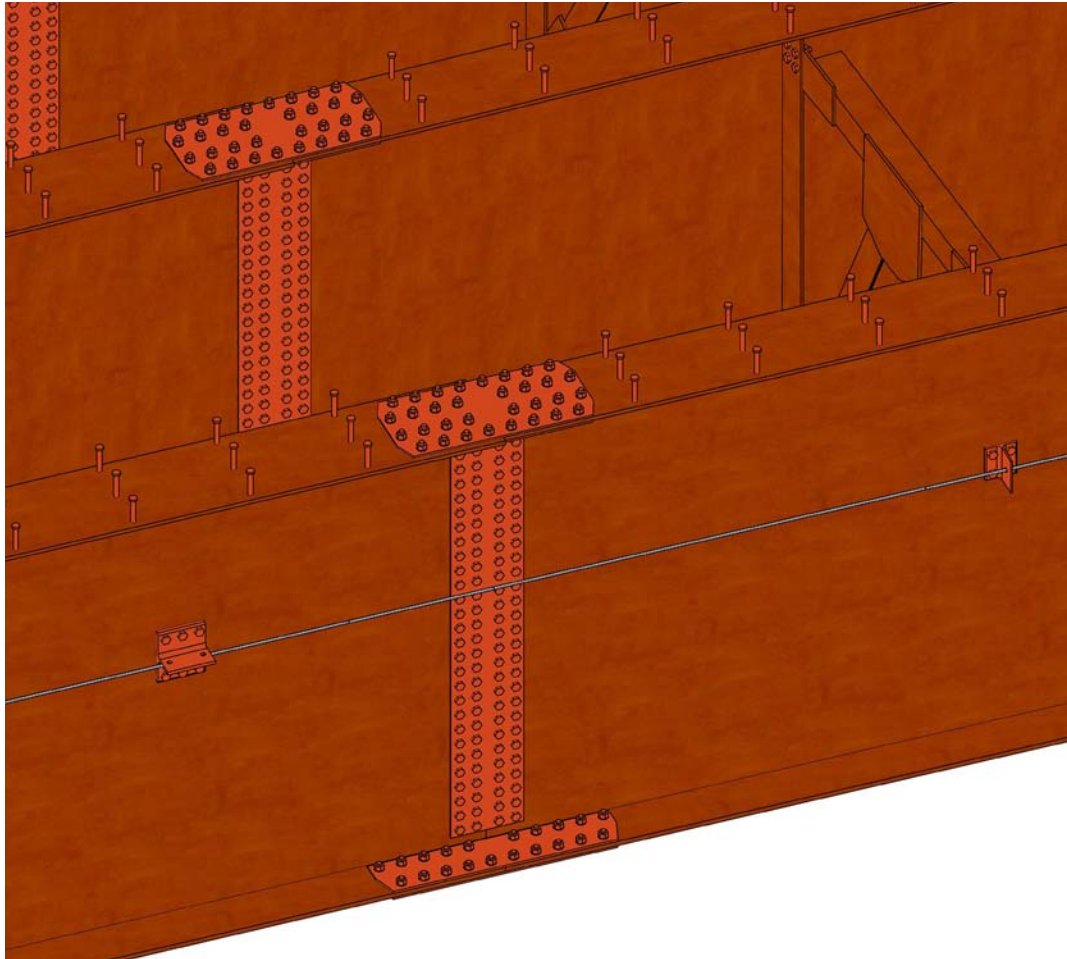
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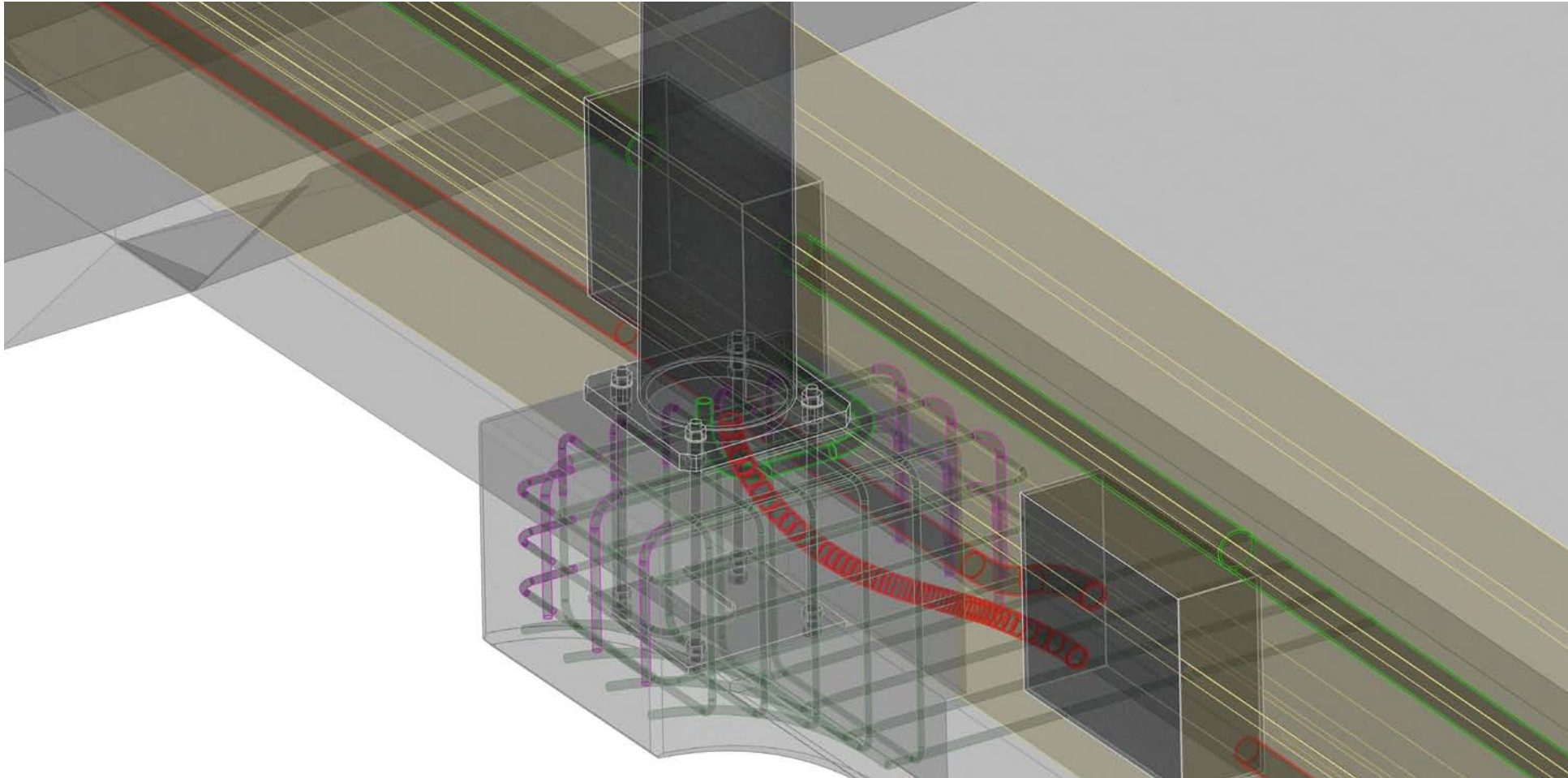
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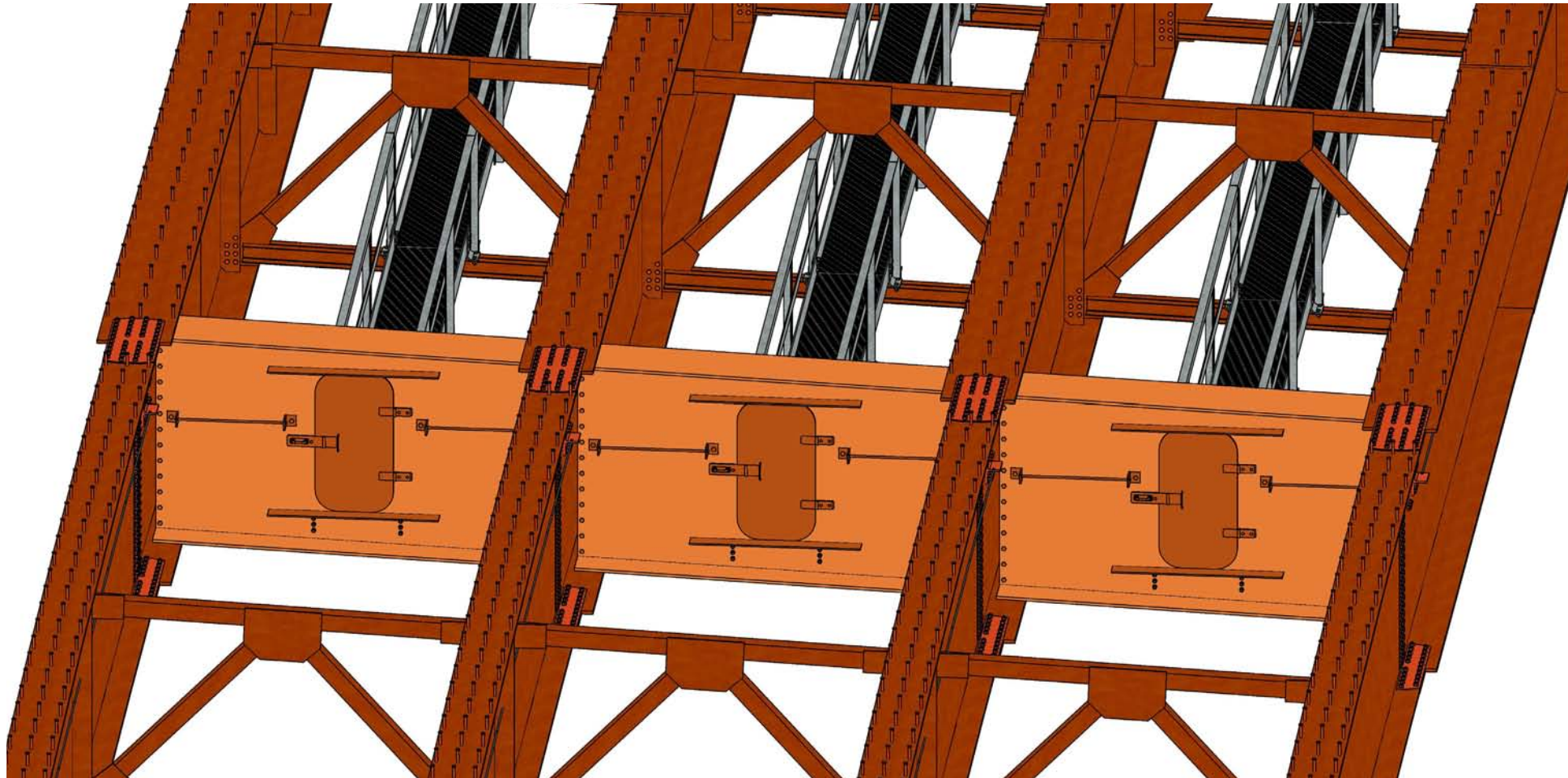
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ACCESS DOORS

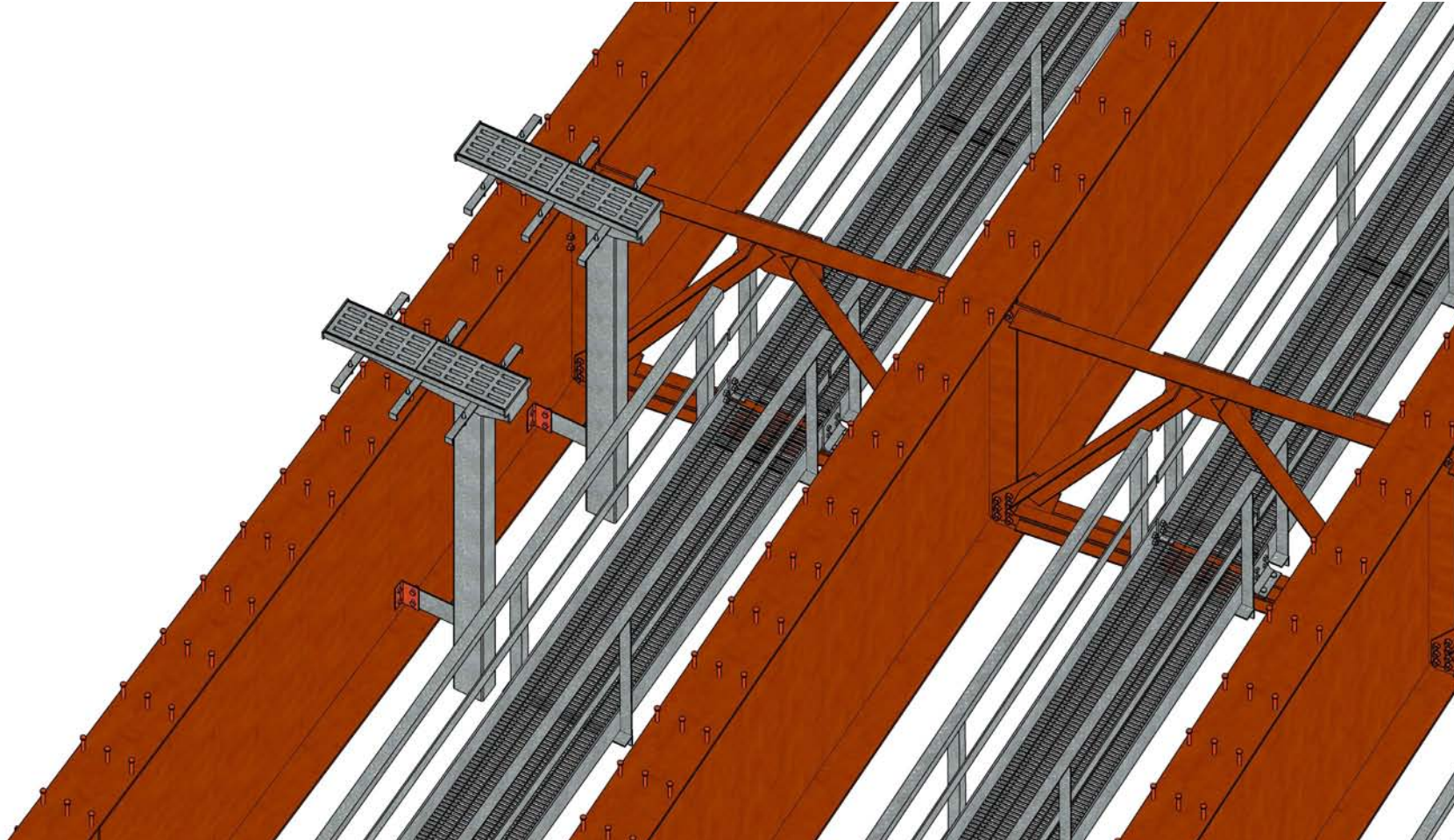
INSPECTION ACCESS SYSTEM

MISC. ELEMENTS



MODEL DEVELOPMENT

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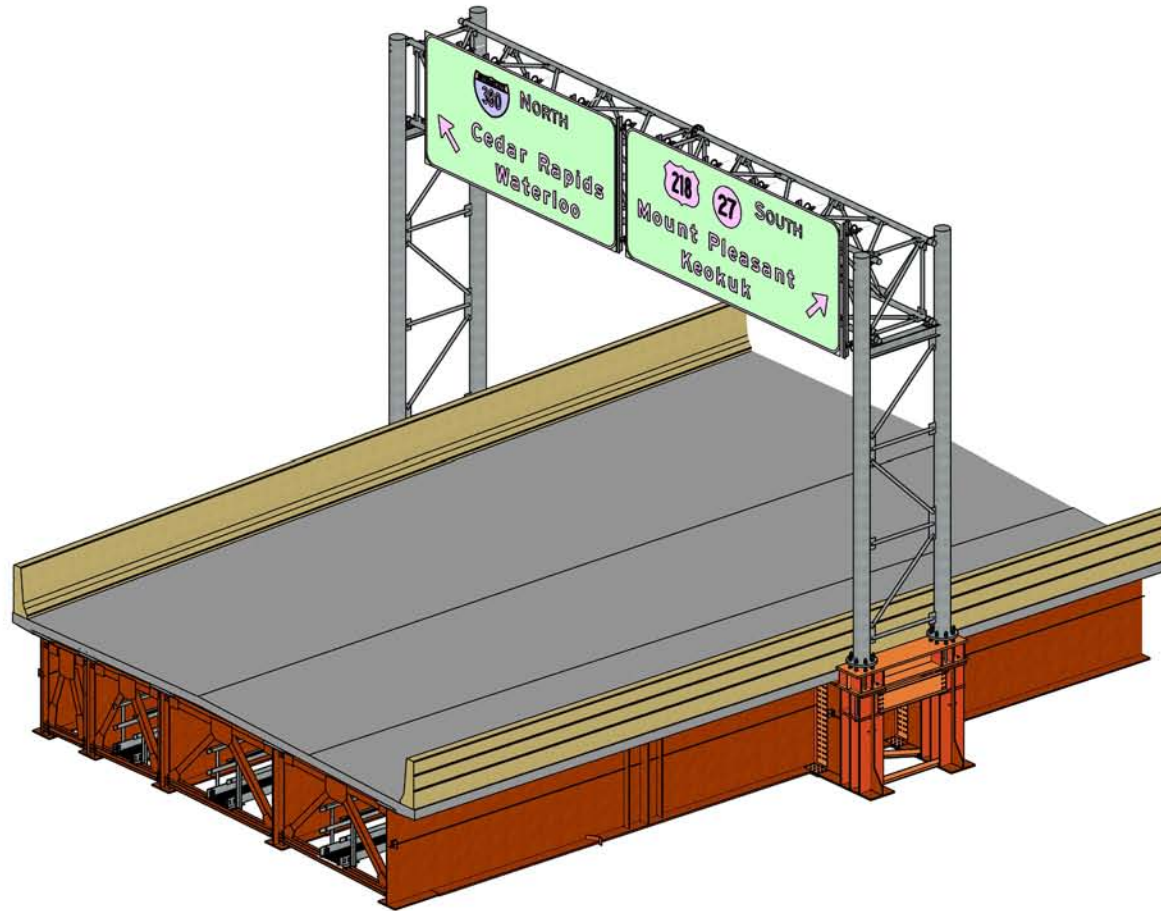
DIAPHRAGMS &
ACCESS DOORS

INSPECTION ACCESS SYSTEM

MISC. ELEMENTS

MODEL DEVELOPMENT

ProStructures



ADVANTAGES

REBAR LAYOUT IS FLEXIBLE & IMPROVING

HIGHER LEVEL OF DEVELOPMENT

CAN ADD ANY USER-CREATED ELEMENT

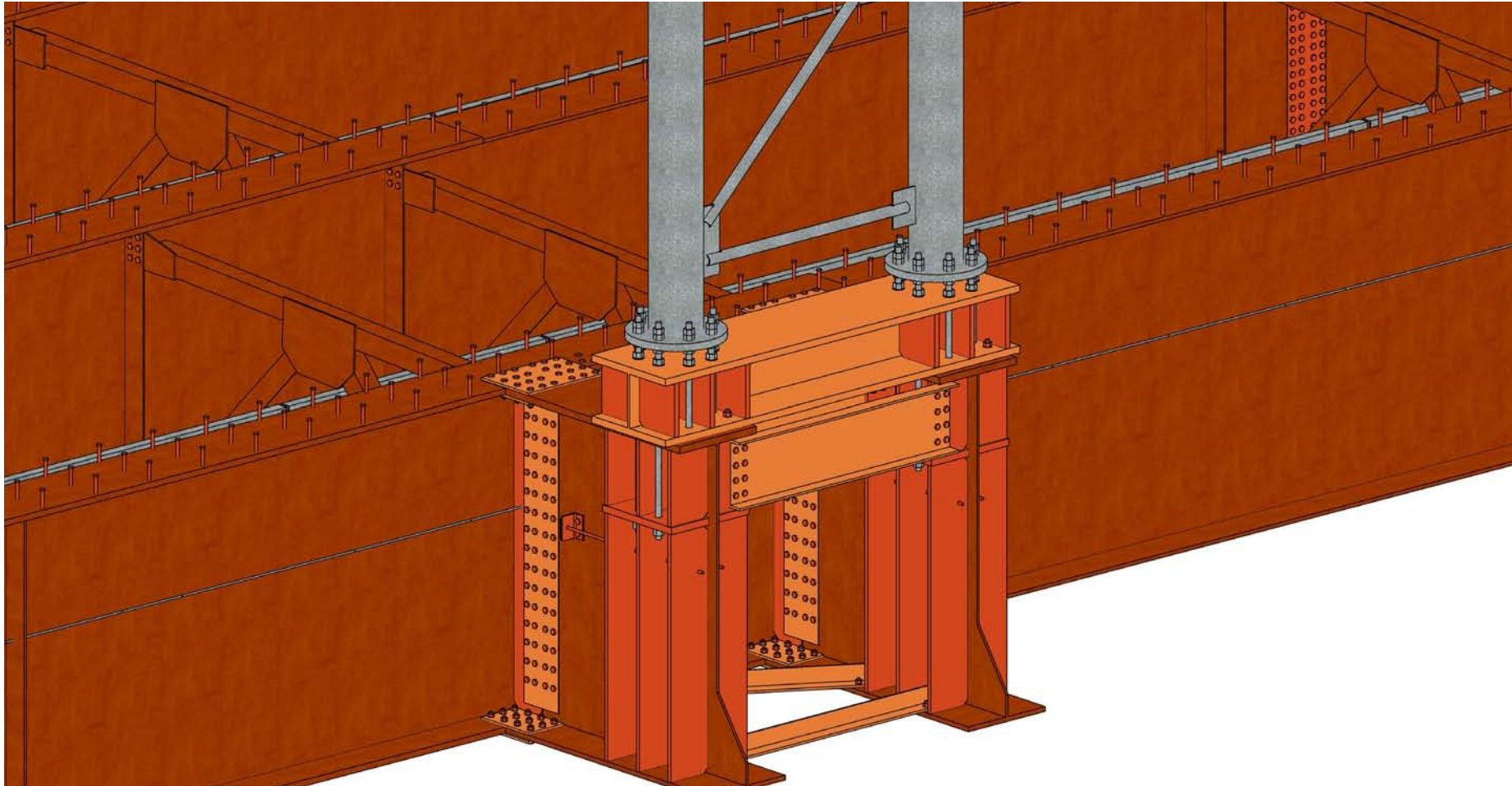
QUANTITY & PART LIST CAPABILITIES

BILL OF BARS

CUT SECTIONS & CLIP VOLUMES

MODEL DEVELOPMENT

ProStructures



ISSUES

NO HORIZONTAL
& VERTICAL CONTROL

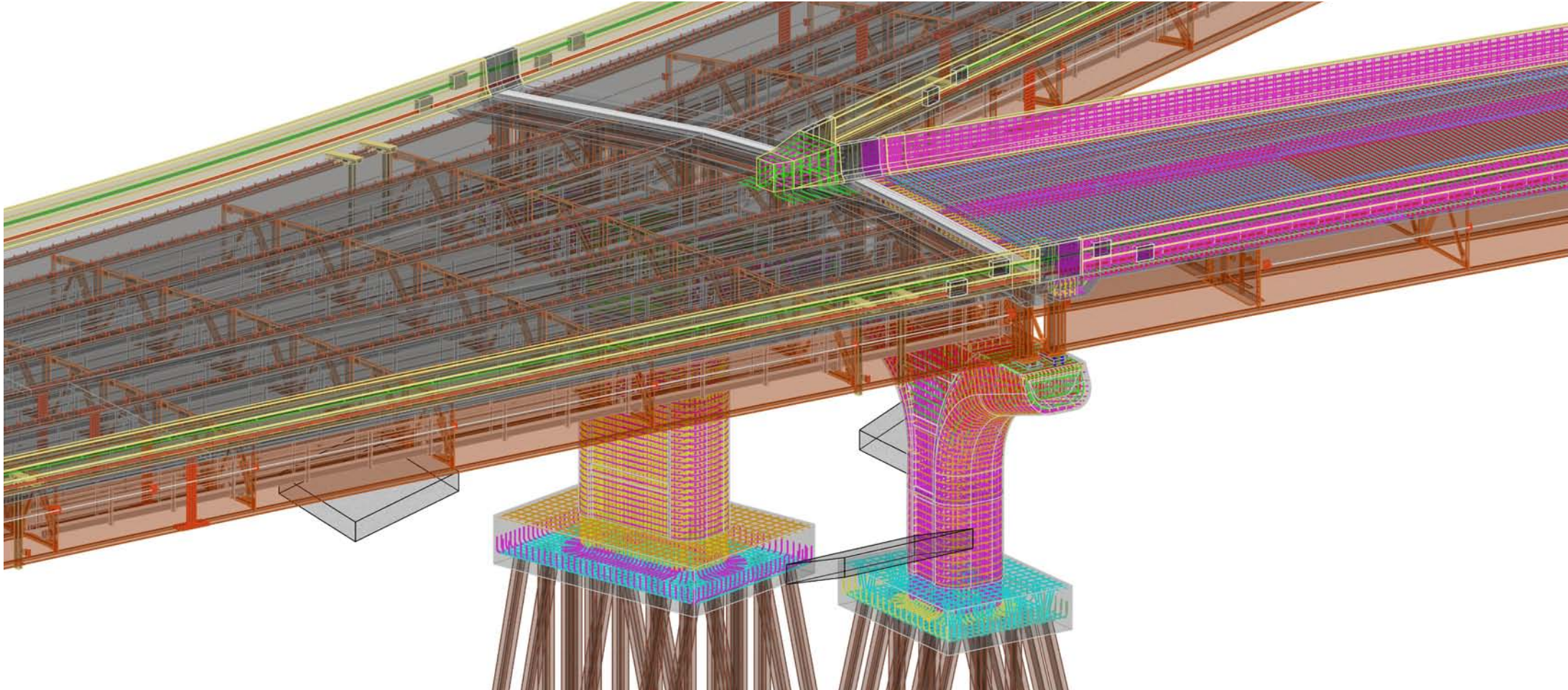
BUILDINGS-BASED
PROGRAM

NEEDS MORE
BRIDGE-SPECIFIC
NATIVE ELEMENTS

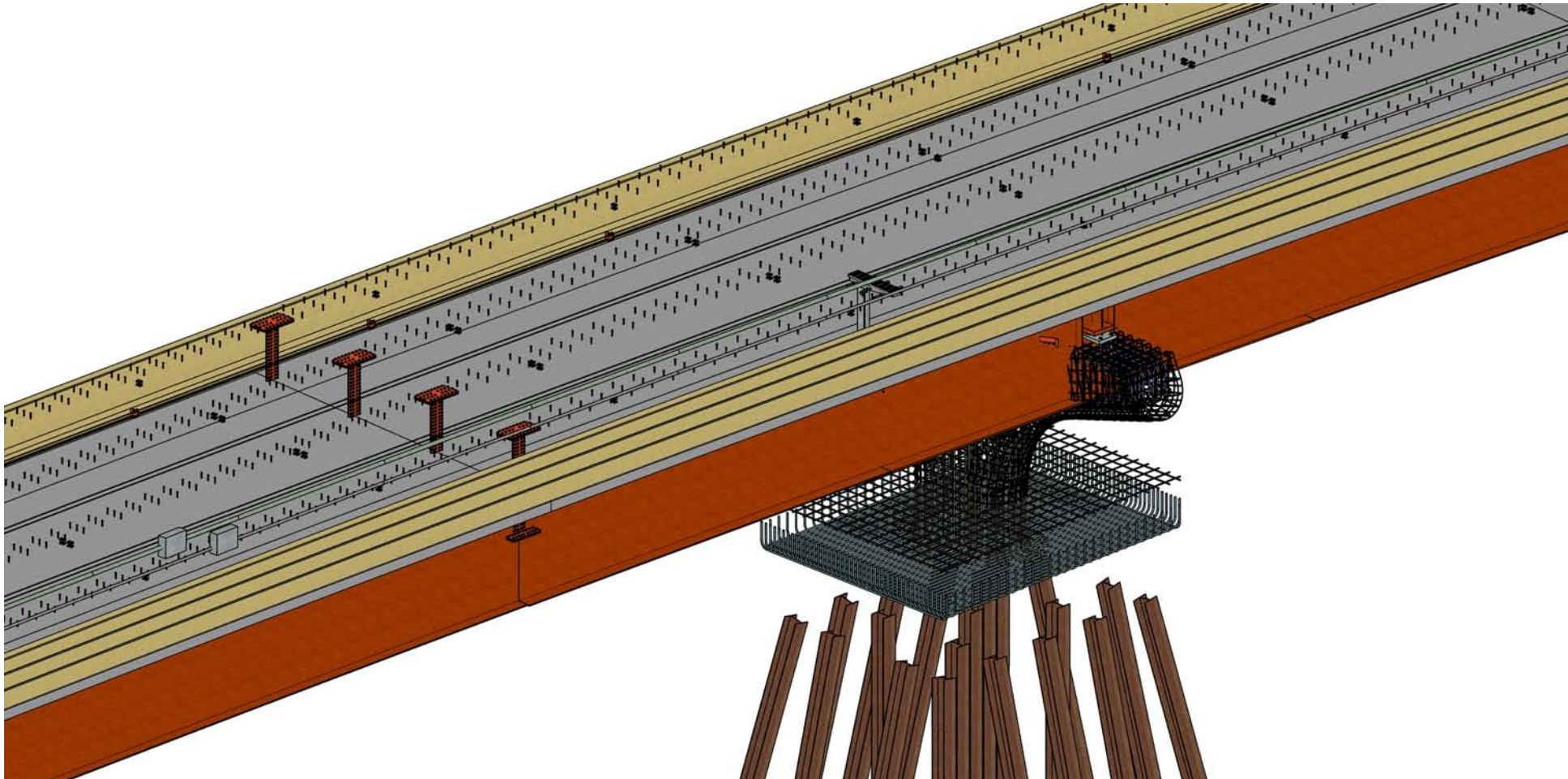
TIME CONSUMING

MODEL DEVELOPMENT

Combined OBM & ProStructures



INTEROPERABILITY



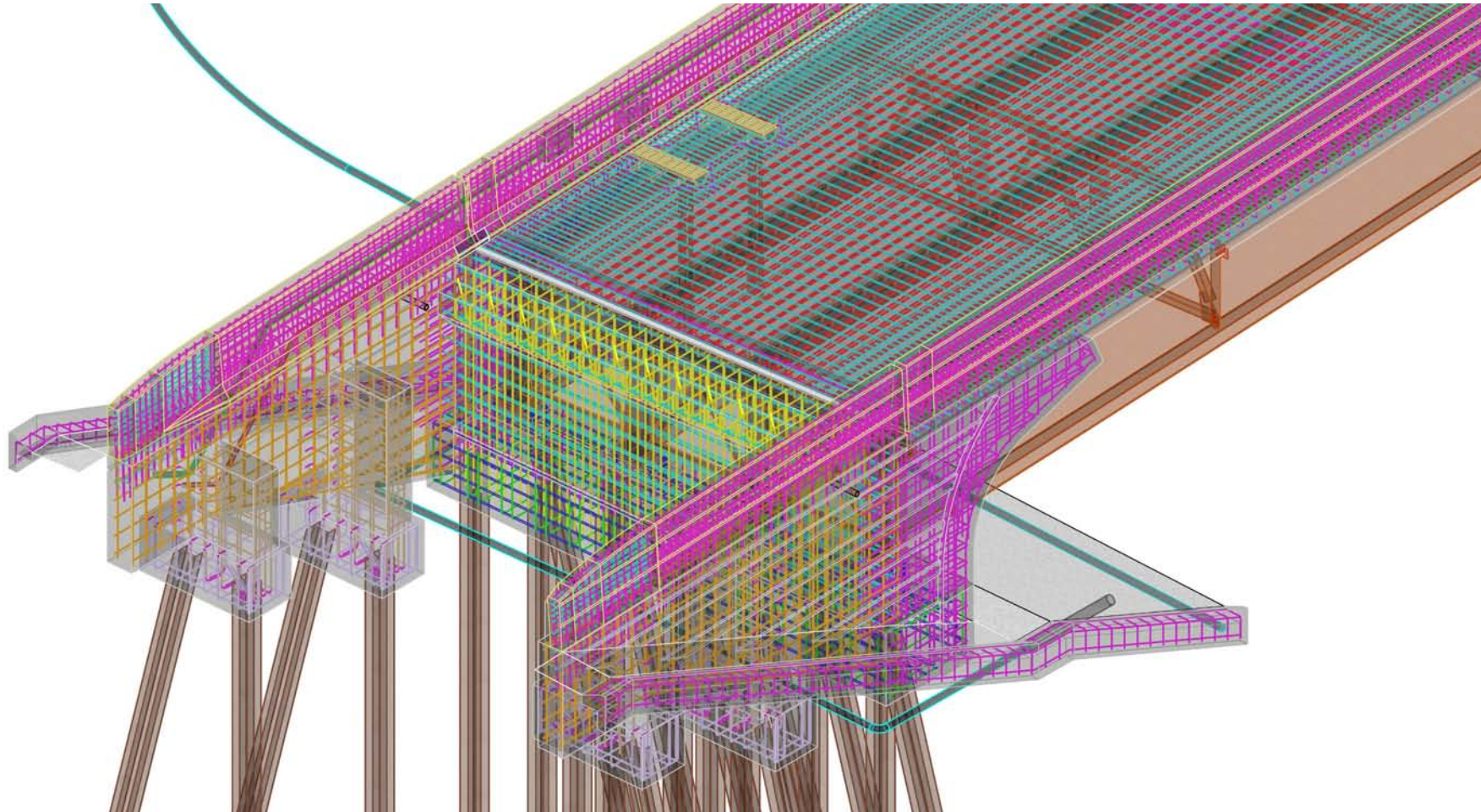
Not Parametric

- Changes in alignment or positioning in OBM does not move PS elements
- Rebar will be lost with changes to OBM model elements

Quantities for OBM elements can only be obtained within OBM
(*Vice-versa*)

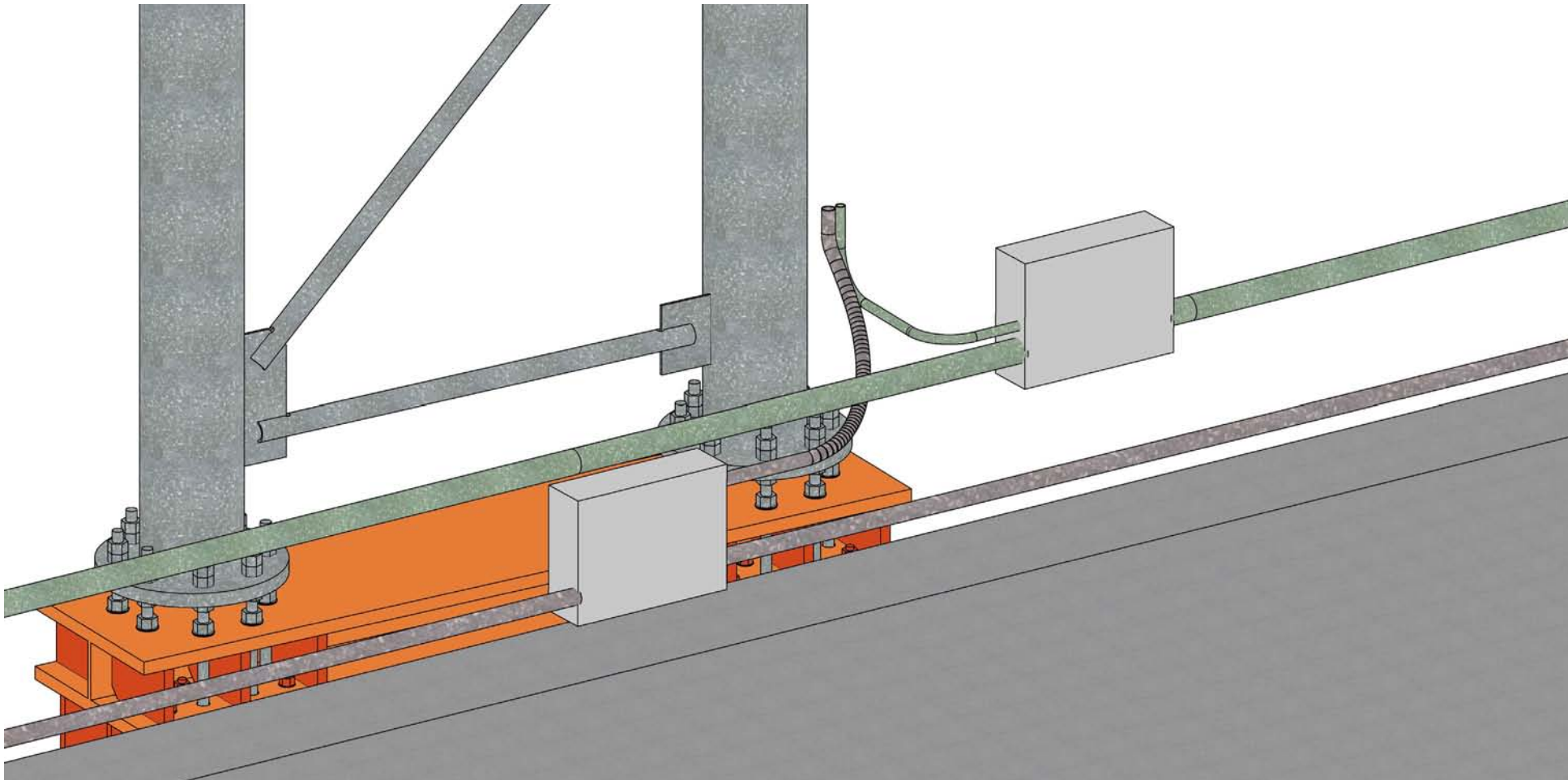
BIM MODEL USE DURING DESIGN

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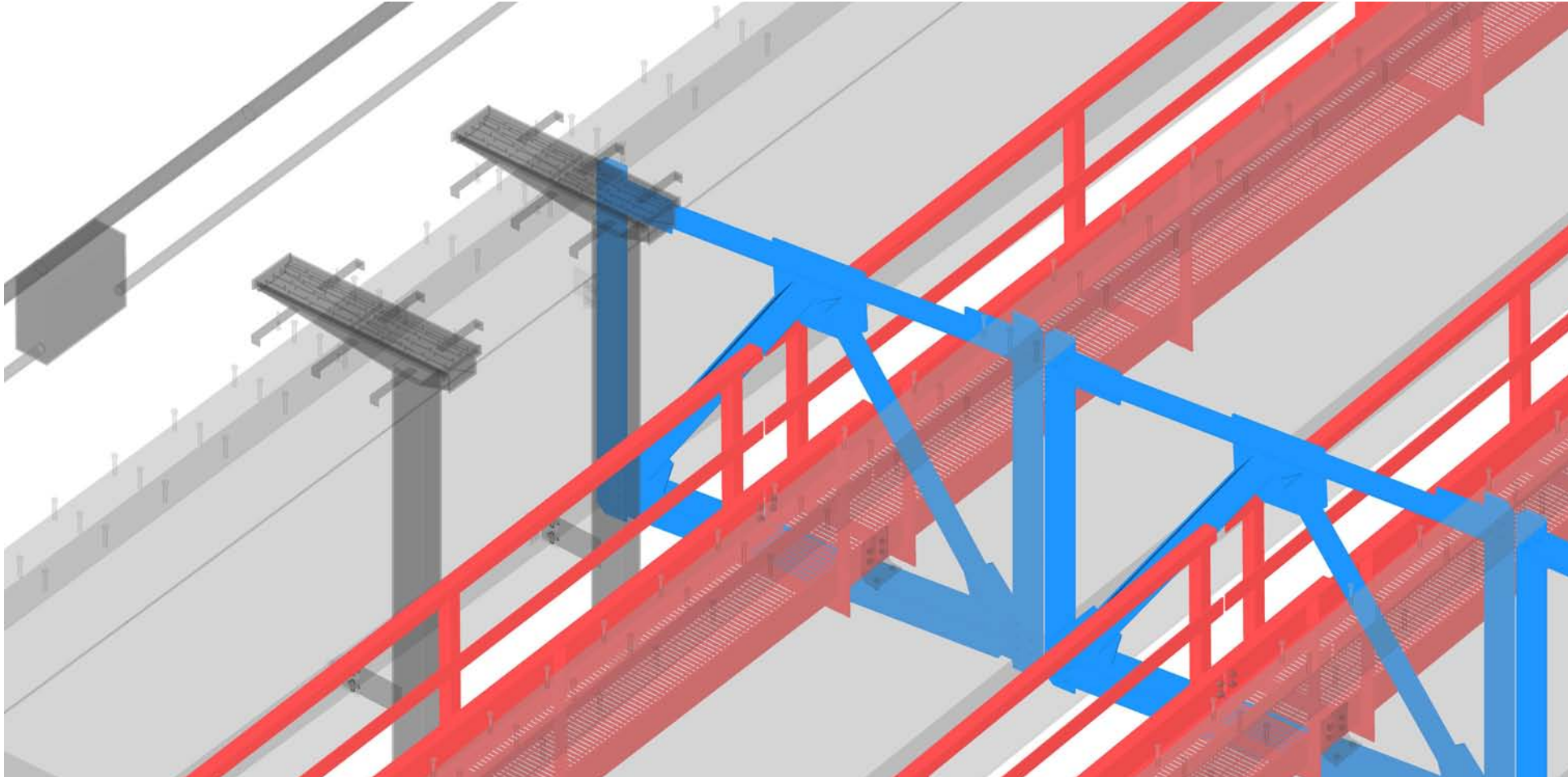
- Complex detail visualization
- Bill of bars & quantities
- Parts list
- Clash detection
- Measurements
- Section cuts
- Barrier conduit layout
- 2D plan detail development
- Interdisciplinary coordination

BIM MODEL USE DURING DESIGN



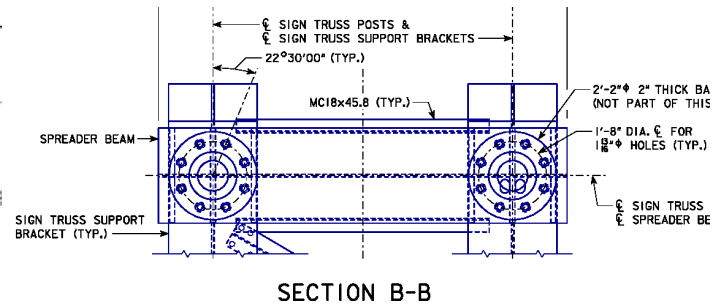
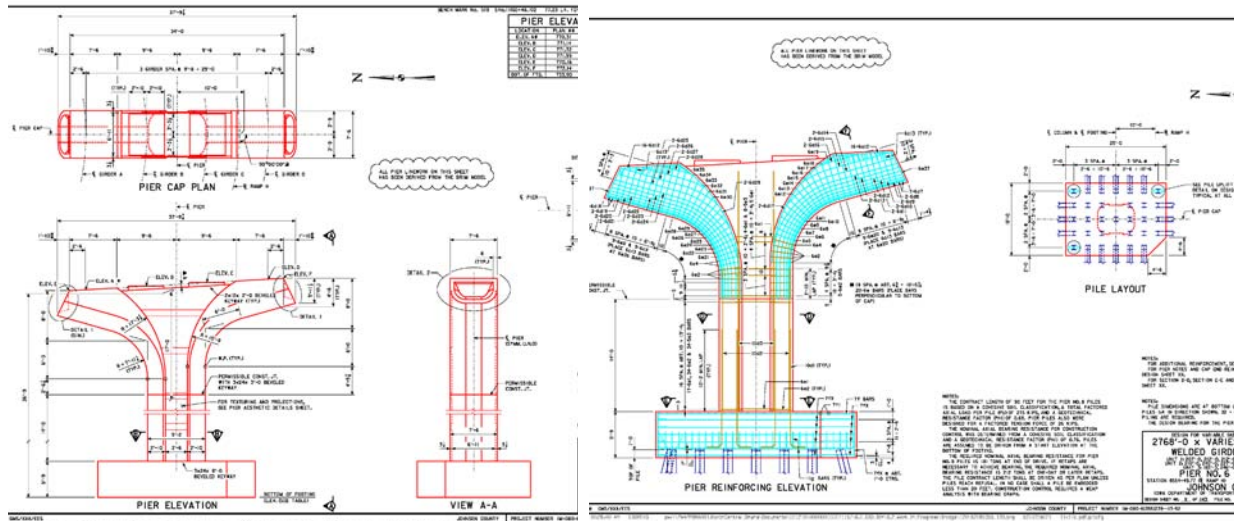
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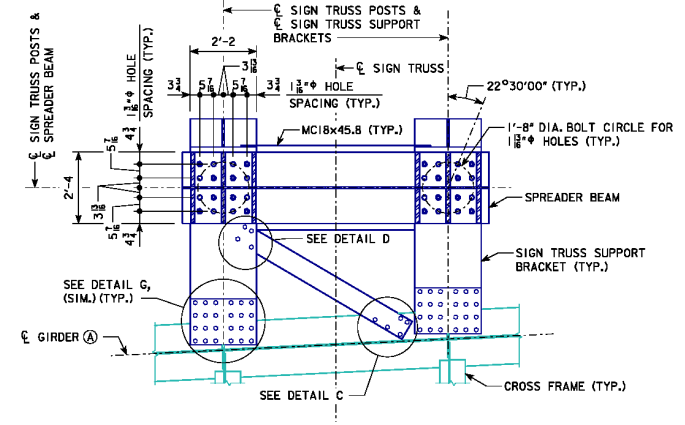
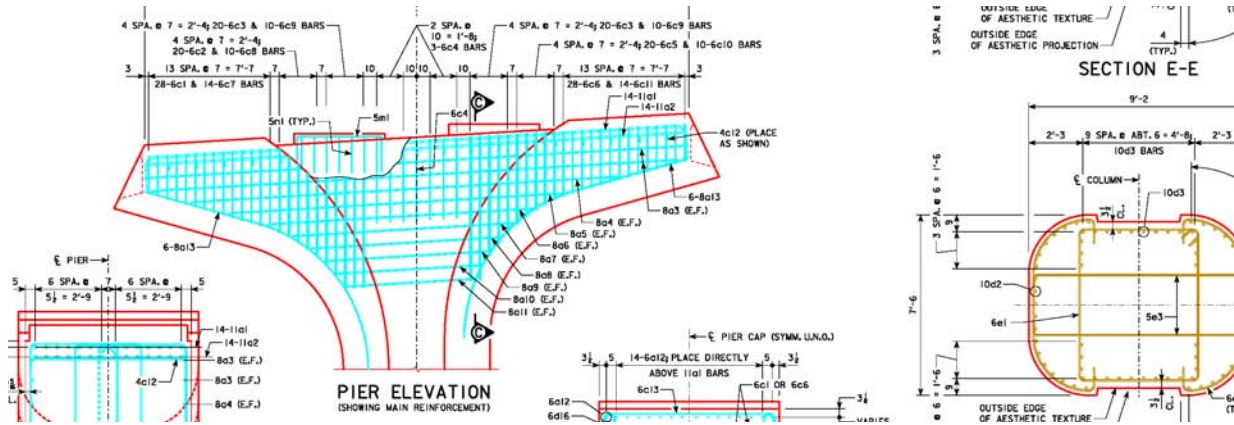


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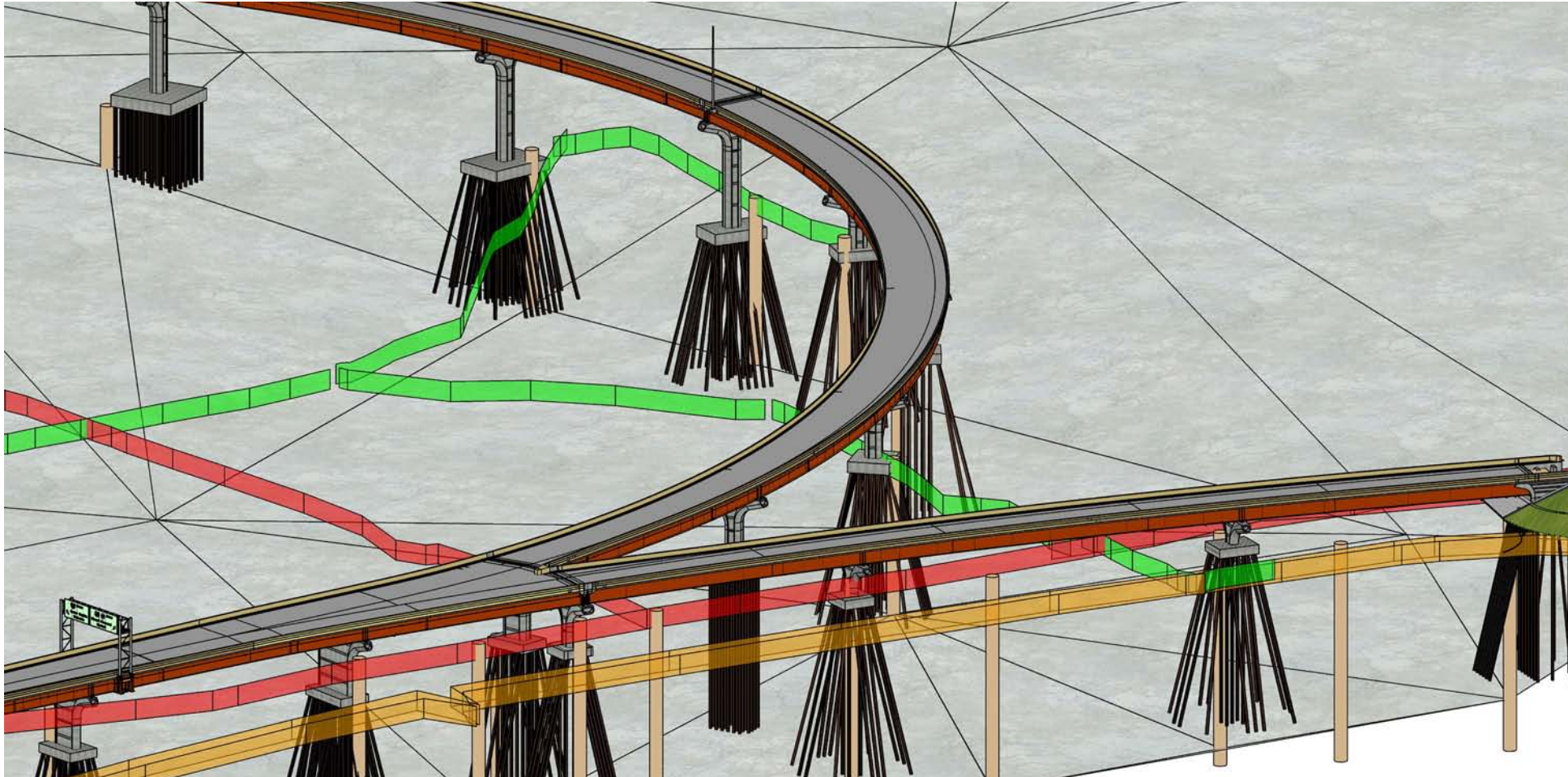
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- Complex detail visualization
- Bill of bars & quantities
- Parts list
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- Measurements
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- Barrier conduit layout
- 2D plan detail development
- Interdisciplinary coordination



BIM MODEL USE DURING DESIGN



Interdisciplinary Coordination

- Geotechnical
- Roadway
- Drainage
- Utilities
- Lighting
- Mechanical

BIM MODEL USE DURING CONSTRUCTION

CONSTRUCTION

Design, Bid, Build Contract

INITIAL APPROACH

Provide BIM Model
for Information

FINAL APPROACH

Hybrid Model

- Ramp BH & H Bridges - 2D
Plan Deliverable
BIM Model for information
- Ramp B Bridge - BIM
Model Deliverable
*BIM Model deliverable with
links augmenting model*

DESIRED RESULTS

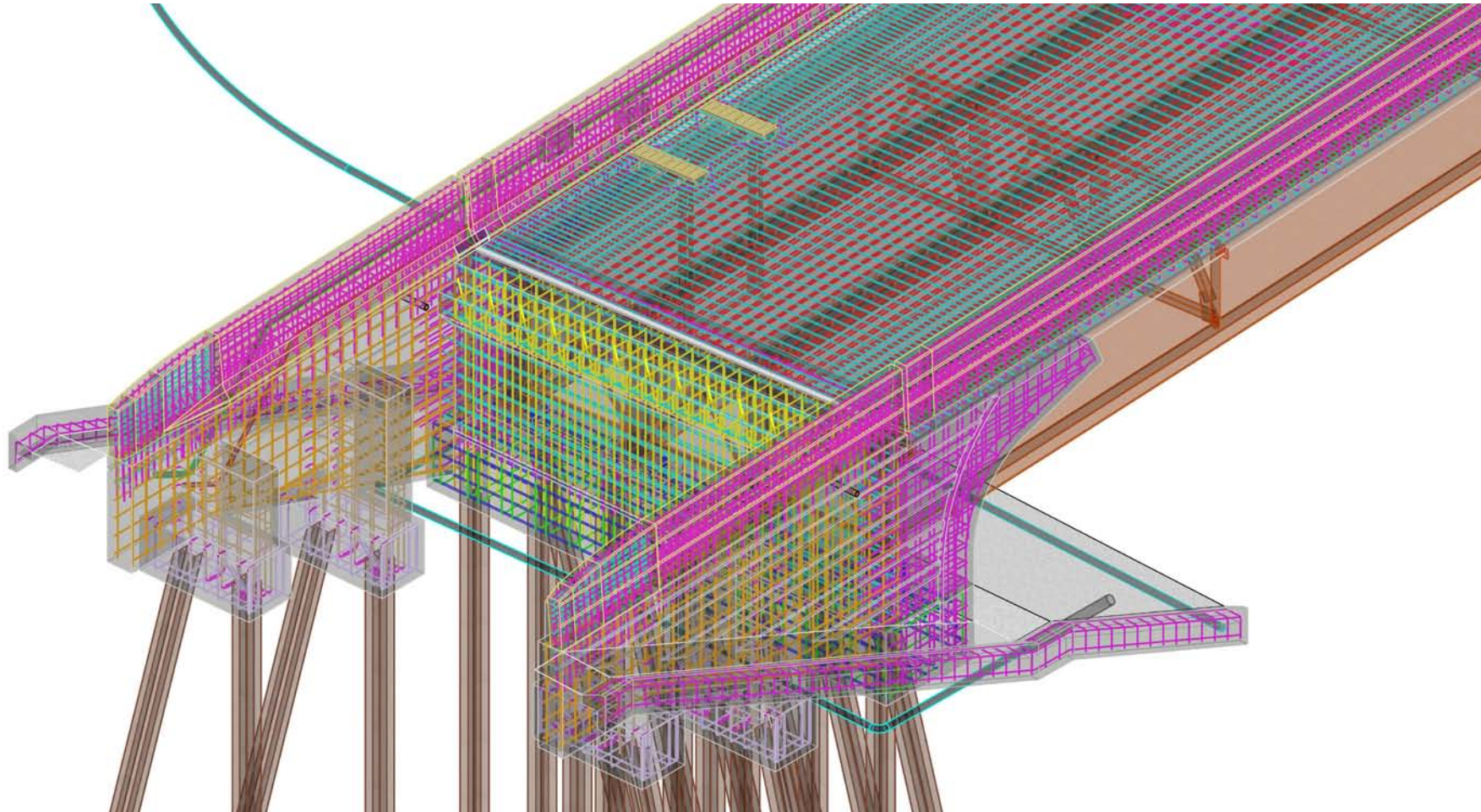
- **Reduce Contractor Risk**
- **Promote BIM usage**
- **Gather Information on
BIM Usage**
(During construction)

BIM DELIVERABLE



BIM DELIVERABLE

Ramp B

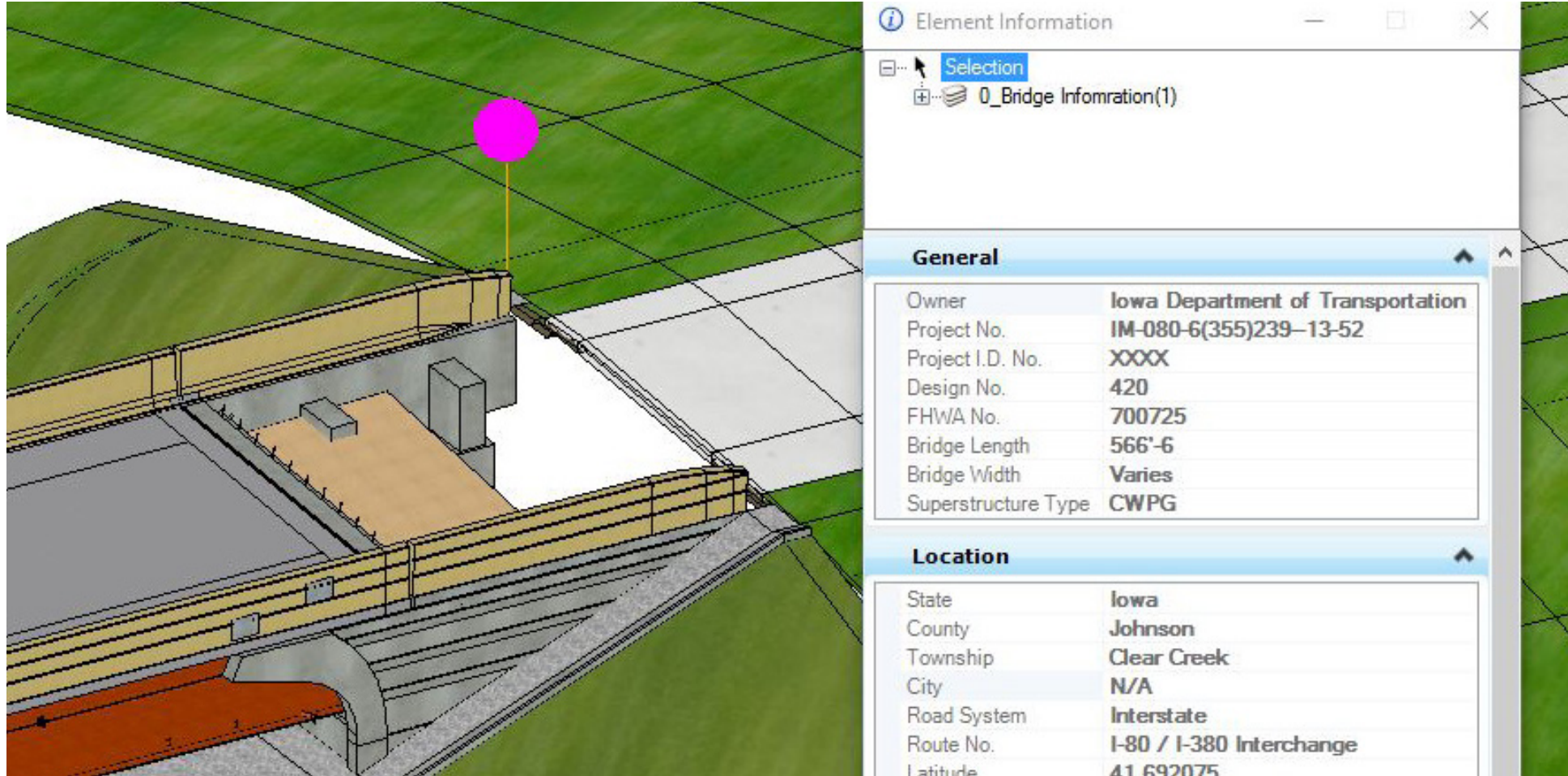


CHALLENGES

- Contractors and subs unfamiliar with software & process
- Software lacks full functionality
 - Can't summarize complete quantities
 - Some dimensions are not easily accessible in model
 - Not all elements modeled correctly
- Additional information needed

BIM DELIVERABLE

Linked Information

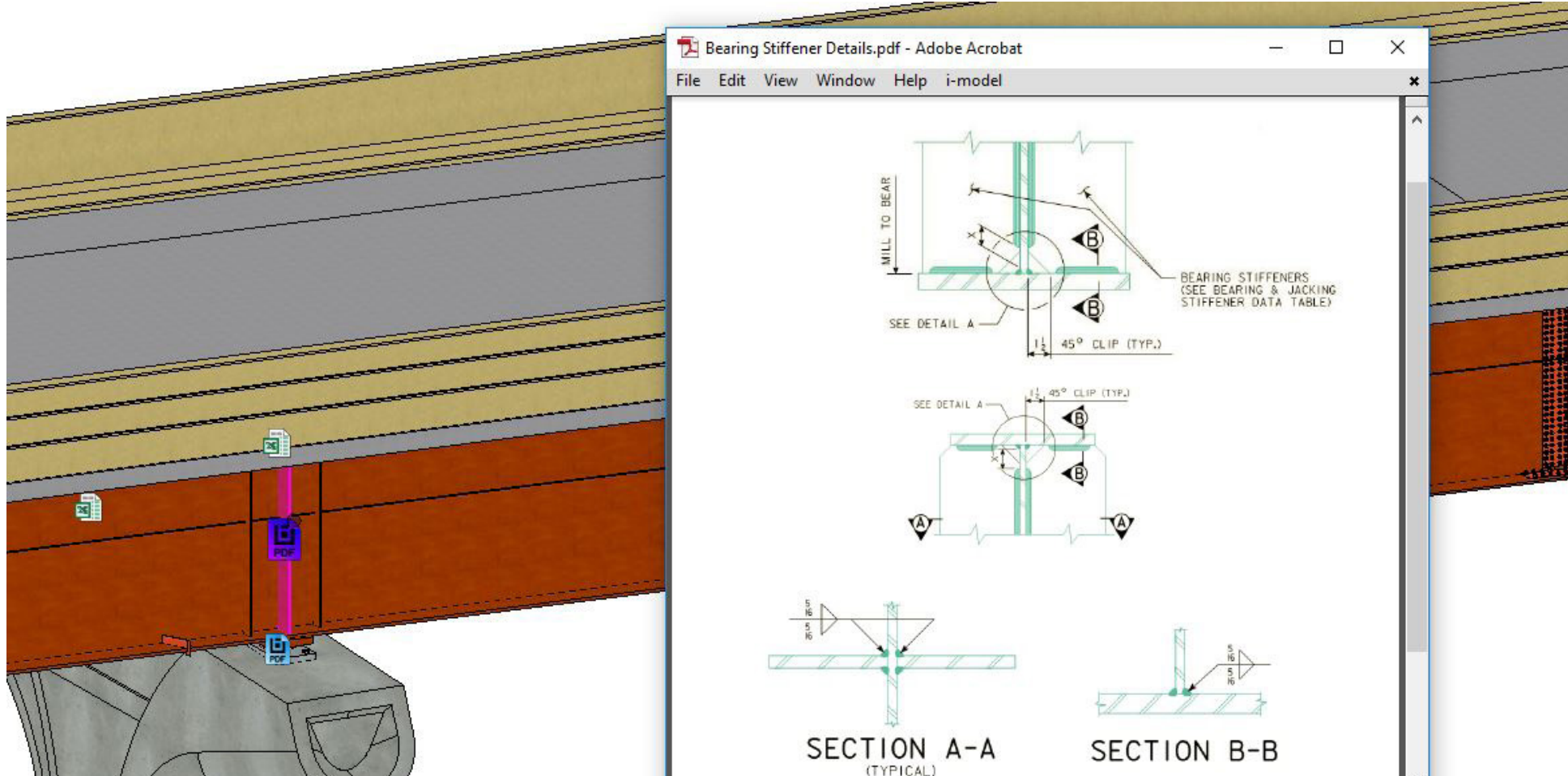


- Current software capabilities do not allow all information to be obtained from the model.
- Software lacks features to allow easy access to available information.
- Purpose of the links is to augment the models shortcomings.
- Detail Links needed to help define:
 - Welding Details
 - Vendor supplied items (i.e. bearings, expansion joints)
- Notes & quantities
- Items difficult to pull from the model (shear connector spacing)
- Additional Information Needed
 - Specifications
 - Horizontal dimensions
 - » Span Lengths
 - » Girder layout

BIM DELIVERABLE

Ramp B

LINKED INFO



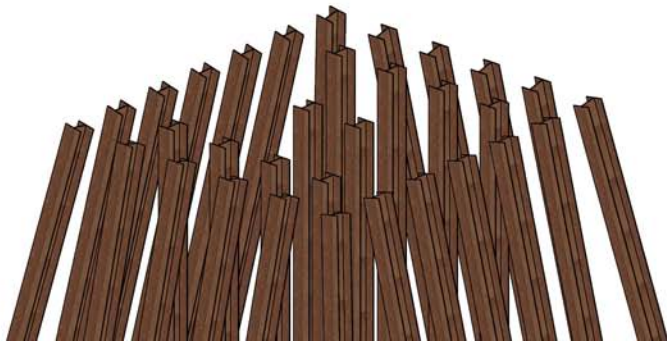
SPECIFICATIONS

DETAILS OVERRIDING BIM

NUMERIC DATA

BIM DELIVERABLE

Use By Contractor



CONTRACTOR USE

VISUALIZATION

SECTION CUTS &
MEASUREMENTS

ELEMENT INFORMATION

BILL OF BARS &
PARTS LIST

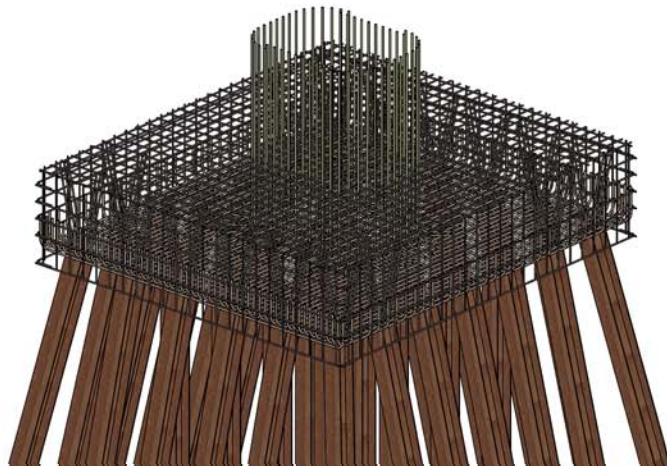
STAGING

SAFETY...ETC.



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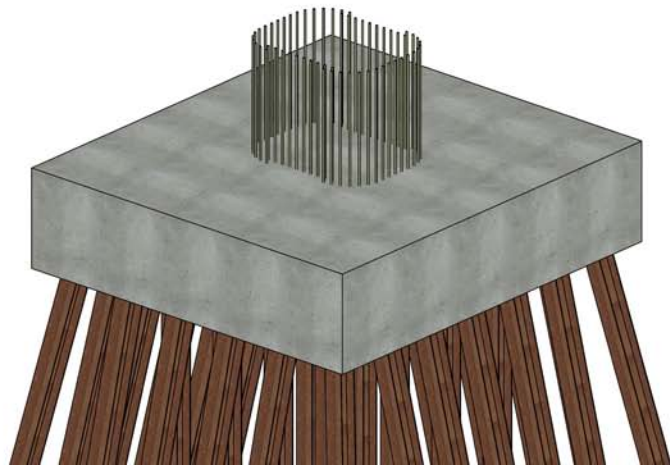
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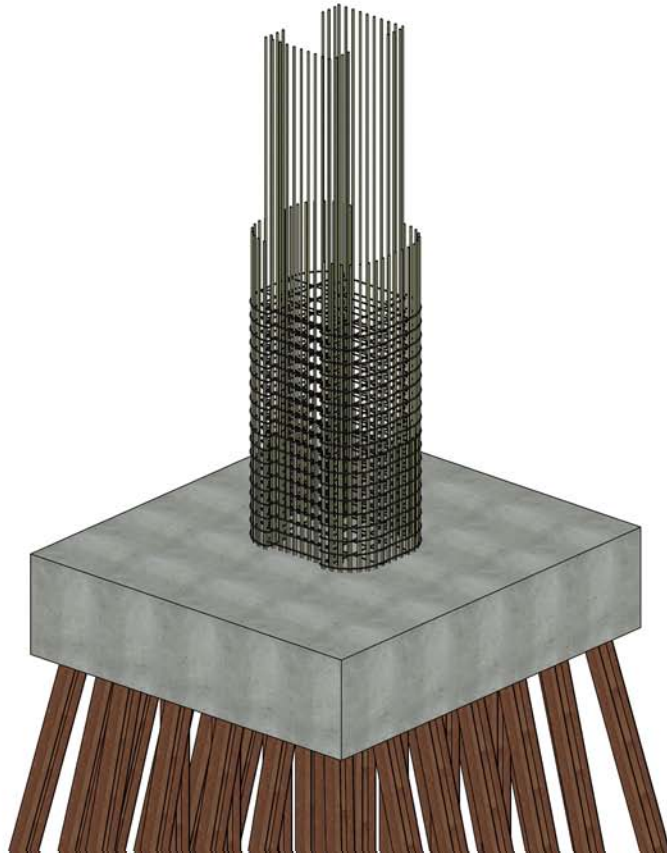
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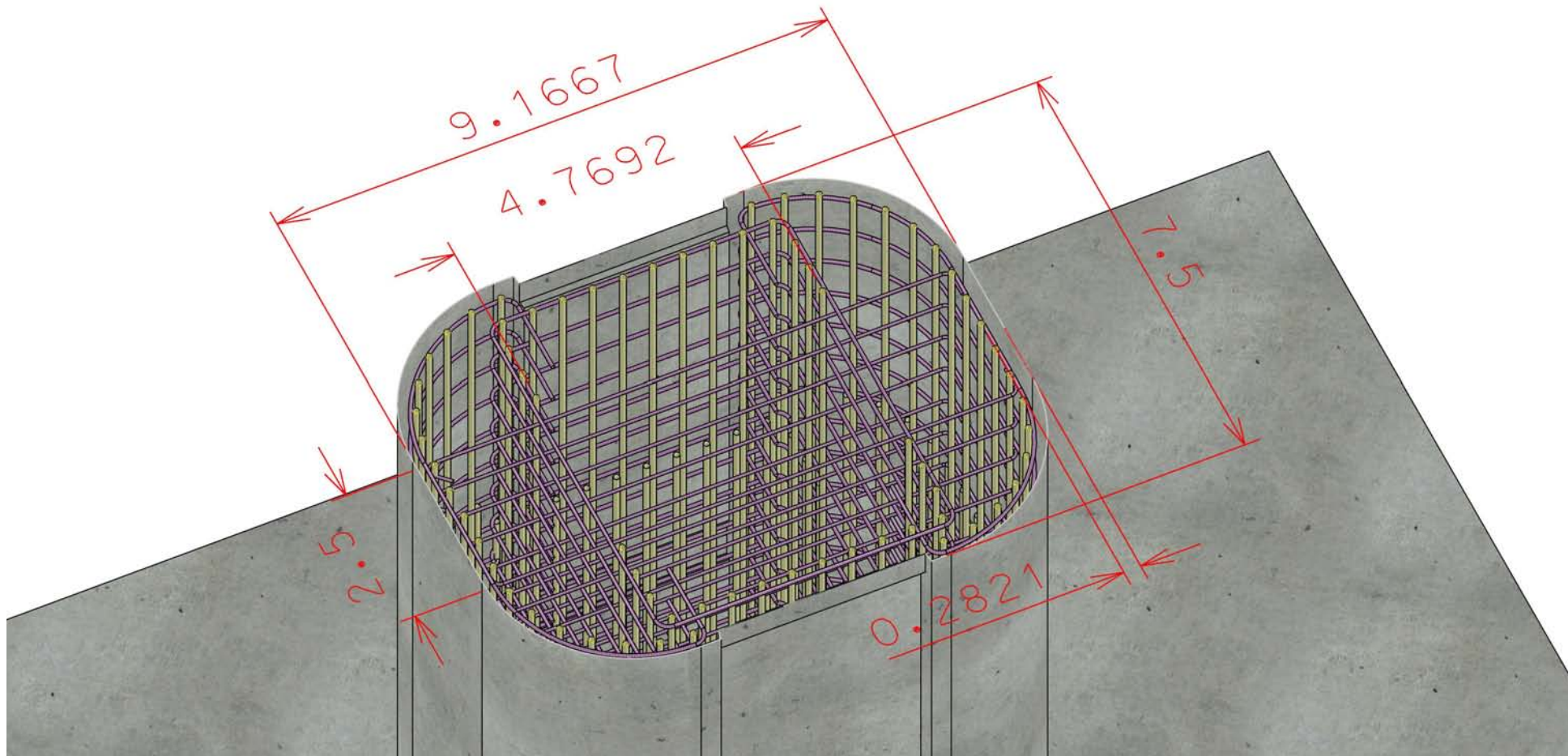
STAGING

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BIM DELIVERABLE

During Construction



CONTRACTOR USE

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BIM MODEL

During Construction

Element Information

Selection
L3x3x5/16

General

Description: L3x3x5/16
 Level: Inspection Walkway
 Color: ByLevel (32)
 Line Style: ByLevel (0)
 Weight: ByLevel (0)
 Class: Primary
 Template: None
 Transparency: 0
 PsName: L3x3x5/16

Geometry

PsHeight: 0.2500
 PsWidth: 0.2500
 PsLength: 20.2900

Material

Extended

Raw Data


ProStructuresObject

Surface Area Formatted: 19.81 sf2
 Weight Formatted: 124.078 lbs
 Weight Gross [lbs]: 124.0872
 Surface Area [sf2]: 2853.3057
 Volume [sf3]: 437.5128
 Weight Net Formatted: 124.078 lbs
 Weight Gross Formatted: 124.087 lbs
 Weight Net [lbs]: 124.0782
 Shape Name: L3x3x5/16
 Weight_Ref_Formatted: 1485.235 lbs
 Weight_Ref: 1485.2345
 Shape Size: L3X3X5/16
 Volume Gross [sf3]: 437.5445
 Volume Net [sf3]: 437.5128
 Shape Class: AISC_IMPERIAL_AISC_I
 Height Formatted: 0.2500 sf
 Pos. No.
 Shipping No.

Complete list of single parts

page 1 of 1

projekt name:	I-80/I-380	customer:	GMS
project number:	IM-080-6(355)239--13-52	drawing made by/at:	
order name:	420_Field Splice	checked by/at:	TLP
order number:	001	released by/at:	
drawing name:	<u>comment:</u>		
drawing number:			



date: 11/22/2017

Position	Quantity	Component	Material	Length	Weight	Total Weight
1	4	Plate "B"	ASTM A709 Gr.50W	35	66.52	266.09
2	1	Plate "C"	ASTM A709 Gr.50W	35	34.46	34.46
10001	32	Plate "A"	ASTM A709 Gr.50W	84	96.76	3096.42
10002	4	Plate "E"	ASTM A709 Gr.50W	35	77.61	310.44
10003	12	Plate "B"	ASTM A709 Gr.50W	35	66.52	798.27
10004	4	Plate "D"	ASTM A709 Gr.50W	35	39.39	157.54
10005	4	Plate "D"	ASTM A709 Gr.50W	35	39.39	157.54
10006	16	Plate "C"	ASTM A709 Gr.50W	35	34.46	551.39
10007	15	Plate "C"	ASTM A709 Gr.50W	35	34.46	516.93
10008	12	Plate "E"	ASTM A709 Gr.50W	31	87.92	1055.00
10009	24	Plate "D"	ASTM A709 Gr.50W	31	44.51	1068.18
10010	16	Fill PL	ASTM A709 Gr.50W	18	11.09	177.39
10011	608	FIELD Bolt 0:0 7/8x0:3 1/2 A325-N	ASTM A325 TYP III	4	0.00	0.00
10012	512	FIELD Bolt 0:0 7/8x0:3 1/4 A325-N	ASTM A325 TYP III	3	0.00	0.00
10013	1792	FIELD Bolt 0:0 7/8x0:2 3/4 A325-N	ASTM A325 TYP III	3	0.00	0.00

CONTRACTOR USE

VISUALIZATION

SECTION CUTS & MEASUREMENTS

ELEMENT INFORMATION

BILL OF BARS & PARTS LIST

STAGING

SAFETY...ETC.



BIM DELIVERABLE

By Contractor

CONTRACTOR USE

Page 1

		Bar Bending Schedule			Status:	
					Drawing No:	
					Sheet :	
		Project:			Revision:	
Project:		Prepared by:			Date: Tuesday, July 11, 2017	
Model / Pour:		Checked by:			Last revised:	

Bar Mark	Quantity	Bar Size	Length of each bar	Shape	Sketch (dimensions)	Device at Bar Start	Device at Bar End	Total Weight
11A1	14	#11	37:10 3/4	2				2,819
11A3	14	#11	33:3					2,473
5A11	2	#5	11:1 1/4	E2Bar				23
5A16	2	#5	7:9 1/2	E Bar				16
5A17	8	#5	7:6	S15				63
5A18	20	#5	3:7	T5				75
6A13	22	#6	10:0 1/2	6				482

VISUALIZATION

SECTION CUTS & MEASUREMENTS

ELEMENT INFORMATION

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BIM DELIVERABLE

By Contractor

CONTRACTOR USE

VISUALIZATION

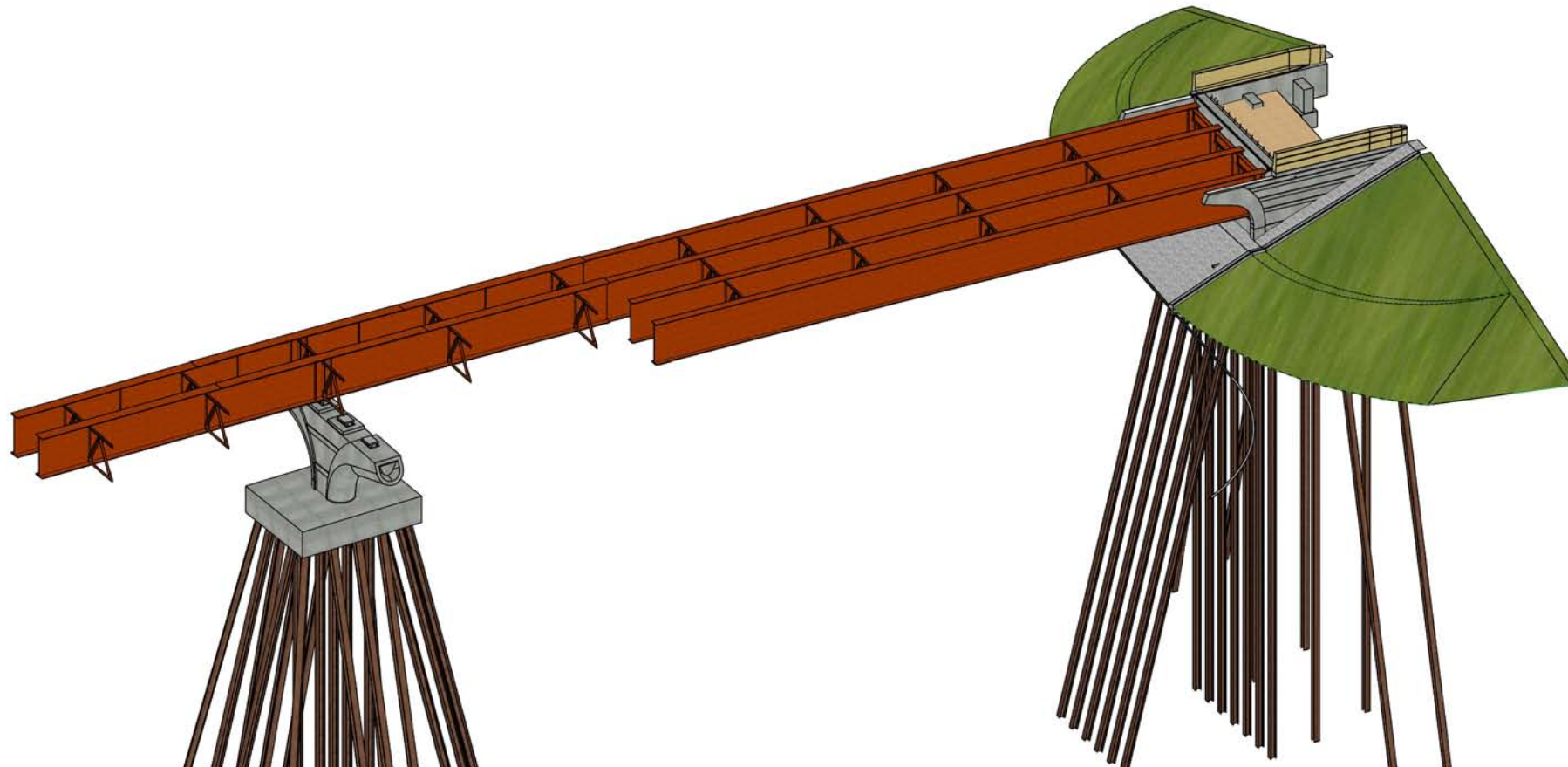
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FINAL THOUGHTS

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**DEVELOP BIM
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AS COMPLETE AS POSSIBLE

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**EVALUATE
BENTLEY
SOFTWARE**

OPENBRIDGE MODELER

PROSTRUCTURES

NAVIGATOR CONNECTS

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**ENCOURAGE
CONTRACTOR USE**

FINAL THOUGHTS

Future Use

**POST CONSTRUCTION
ASSET MANAGEMENT**

RATING

INSPECTION

MAINTENANCE

**DEPENDENT ON MVD
& IFC DEFINITIONS
*SPECIFIC TO BRIDGES***

QUESTIONS

