Belmont 40 Arch Bridge Superstructure Reconstruction

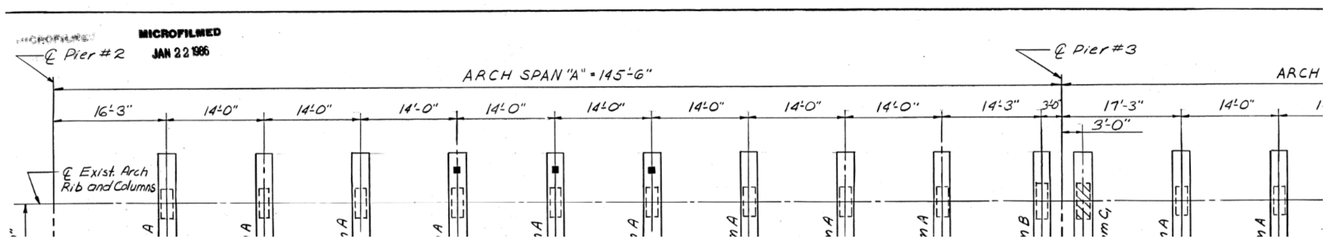
Calculated: ETB 2/7/25
Checked: DBW 2/20/25

APPLY CONSTRUCTION DEAD LOAD (CDL) OF 15 psf x 50' WIDE = 750PLF TO ACCOUNT FOR PROTECTIVE DECKING / DEBRIS CONTAINMENT.

APPLY CONSTRUCTION DEAD LOAD (CDL) OF 50psf x 19' WIDE TO ACCOUNT FOR CRANE MATS ON CENTER 5 SLAB BEAMS + 375 PLF FOR H-PILES ON SLAB BEAMS. TOTAL CONSTRUCTION DEAD LOAD IN CRANE MAT REGION = 70PSF

APPLY CONSTRUCTION LIVE LOAD (CLL) OF 25 psf x 50' WIDE = 1,250 PLF TO ACCOUNT FOR PERSONNEL AND MISC. EQUIPMENT.

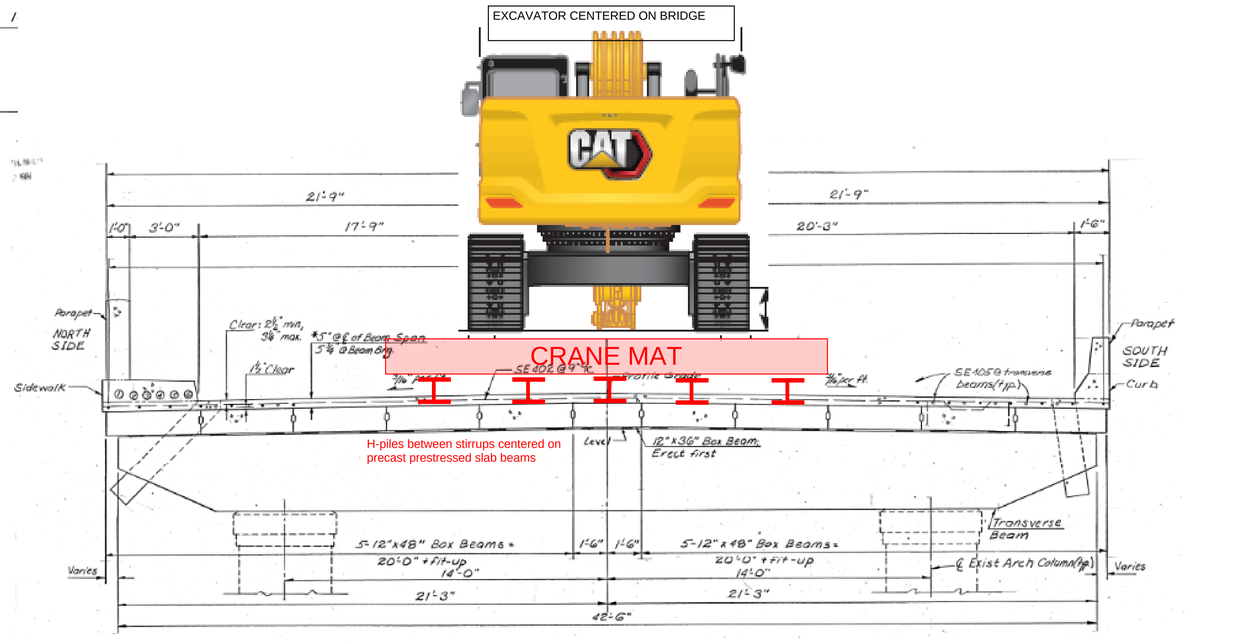
APPLY CONSTRUCTION LIVE LOAD (CR) OF CAT 336 EXCAVATOR: 81,000 lb (ON 2 TRACKS APPROX. 13' LONG) AND SU4 TRUCK (54,000lb)



ETB: I will apply the construction dead load to the cap beams as element beam loads and the construction live load as pressure loads to the deck elements. There are 5 different cap beam load magnitudes for each construction live load and dead load based upon tributary spacing of cap beams. Grouped in the model using the groups shown below. They are:

Group A Caps, 15.125' say 11.34k/42.5' = 0.267klf for construction dead load
Group B Caps, 14' say 10.5k/42.5' = 0.247klf for construction dead load
Group C Caps, 14.125' say 10.59k/42.5' = 0.249klf for construction dead load
Group D Caps, 15.75' say 11.81k/42.5' = 0.278klf for construction dead load
Group E Caps, 15.625' say 11.72k/42.5' = 0.275klf for construction dead load

-Models created for various stages of construction, with both columns and arches investigated.
-Assume excavator weight is 81k + slab beam pick (20'x4'x1' = 12k) and has an axle spacing of 13.25'. Total axle load is 46.5k. SU4 truck is 54k (including slab beam loads) and follows the traditional AASHTO axle weights and spacings. Keep a minimum distance of 10' between excavator and wheel loader.
-Assume the excavator/truck is primarily confined to the CL of the bridge. The truck will transport each slab beam to the excavator, which will pick the slab beam and move it into place. No other heavy construction vehicle will be on the bridge with the excavator and wheel loader.
-Braking force, BR, will be 10% of the weight of the excavator + truck: 0.1*(46.5k*2+54k)/42.5' = 0.35klf applied to the cap elements. Assume this load is distributed to only one cap for conservatism. All stages of construction were analyzed for column loads without braking force, and then the two cases with the highest D/C ratios were re-run with the braking force included.
-Previous demo iterations have shown that the arch is sensitive to unbalanced load conditions. The first attempt to rebuild the deck will consist of starting at the west end of Arch A and building out each slab beam span in full width before moving east into the next slab beam span. If this approach does not work, I will try building Arch Span A in full width slab beam spans evenly from both the east and west simultaneously.
-For Arches A and B, the demolition steps have been furthest discretized. Since Arches C and D bridge decks will be deconstructed most similarly to Arch B, only a couple Arch C and D stages will be modeled to save time. These stages will be chosen based upon those governing Arch B stages.



TRANSVERSE DECK SECTION
THRU ARCH SPANS

Transverse Section Showing Bridge Demolition Initial Sequence and Excavator Placement

CONSTRUCTION STAGE LOAD COMBINATIONS:

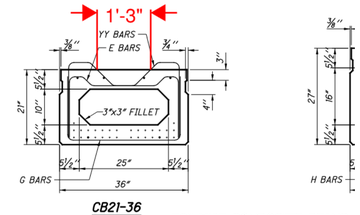
STR-I: 1.25x(DC) + 1.5x(CDL + CLL) + 1.5x(CR + IM + BR) + 0.50 x(TU)
~~STR-III: 1.25x(DC) + 1.25x(CDL+CLL)+0.50 x(TU) + 1.0x(WS)~~ — IGNORE FOR INITIAL PROOF OF CONCEPT CHECKS
~~STR-VA: 1.25x(DC) + 1.25x(CDL) + 1.35x(CLL) + 1.35x(CR) x(1.1) + 1.0x(TU) + 1.0x(CW)~~
~~STR-X: 1.4x(DC) + 1.4x(CDL + CLL) + 1.4x(CR) x(1.1) + 1.0x(TU)~~
~~SVC-1: 1.0 x (DC) + 1.0 X (CDL +CLL) + 1.0 x (CR + IM + BR) + 1.0 CW + 1.0 (TU)~~

NOTE:

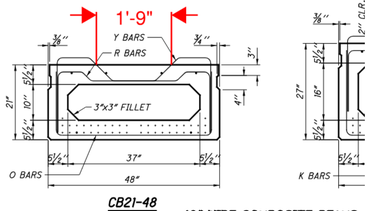
DC = PERMANENT DEAD LOAD
CDL = CONSTRUCTION DEAD LOAD
CLL = CONSTRUCTION LIVE LOAD
CR = ~~CRANE~~ & EQUIVALENT ML80 LOAD
EXCAVATOR Cat 336 + SU4

IM = DYNAMIC ALLOWANCE (10%)
TU = UNIFORM TEMPERATURE FORCE EFFECT
WS = WIND LOAD ON STRUCTURE — DURING CONSTRUCTION ("INACTIVE" WIND)
CW = CONSTRUCTION WIND LOAD — ("ACTIVE" WIND OF 20 MPH)
IGNORE THERMAL AND WIND FOR INITIAL PROOF OF CONCEPT CHECKS

BR = 10% OF CR IN THE LONGITUDINAL DIRECTION



36" WIDE COMPOSITE BEAMS

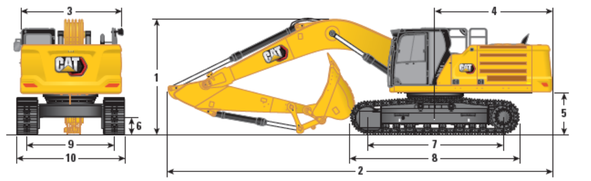


48" WIDE COMPOSITE BEAMS

336 Hydraulic Excavator Specifications

Dimensions

All dimensions are approximate and may vary depending on bucket selection.



Undercarriage Option	Long Wide Undercarriage					
Boom Options	Reach Boom 6.5 m (21'4")				Mass Boom 6.18 m (20'3")	
Stick Options	Reach Stick				Mass Stick	
	R3.9DB (12'10")		R3.2DB (10'6")		M2.55TB (8'4")	
1 Machine Height:						
Cab height	3180 mm	10'5"	3180 mm	10'5"	3180 mm	10'5"
OPG height	3330 mm	10'11"	3330 mm	10'11"	3330 mm	10'11"
Guardrails/Handrails Height	3180 mm	10'5"	3180 mm	10'5"	3180 mm	10'5"
With Boom/Stick/Bucket Installed	3660 mm	12'0"	3480 mm	11'5"	3610 mm	11'10"
With Boom/Stick Installed	3560 mm	11'8"	3330 mm	10'11"	3410 mm	11'2"
With Boom Installed	2880 mm	9'5"	2880 mm	9'5"	2830 mm	9'3"
With Boom/Stick/Bucket Installed (with auxiliary lines)	3670 mm	12'0"	3530 mm	11'7"	3620 mm	11'11"
With Boom/Stick Installed (with auxiliary lines)	3620 mm	11'11"	3410 mm	11'2"	3420 mm	11'3"
With Boom Installed (with auxiliary lines)	2970 mm	9'9"	2970 mm	9'9"	2900 mm	9'6"
2 Machine Length:						
With Boom/Stick/Bucket Installed	11 180 mm	36'8"	11 160 mm	36'7"	10 870 mm	35'8"
With Boom/Stick Installed	11 170 mm	36'8"	11 120 mm	36'6"	10 830 mm	35'6"
With Boom Installed	9960 mm	32'8"	9960 mm	32'8"	9640 mm	31'8"
With Boom/Stick/Bucket Installed (with auxiliary lines)	11 180 mm	36'8"	11 160 mm	36'7"	10 870 mm	35'8"
With Boom/Stick Installed (with auxiliary lines)	11 170 mm	36'8"	11 120 mm	36'6"	10 830 mm	35'6"
With Boom Installed (with auxiliary lines)	10 010 mm	32'10"	10 010 mm	32'10"	9640 mm	31'8"
3 Upperframe Width without Walkways	2970 mm	9'9"	2970 mm	9'9"	2970 mm	9'9"
4 Tail Swing Radius	3530 mm	11'7"	3530 mm	11'7"	3530 mm	11'7"
5 Counterweight Clearance	1260 mm	4'2"	1260 mm	4'2"	1260 mm	4'2"
6 Ground Clearance	510 mm	1'8"	510 mm	1'8"	510 mm	1'8"
7 Track Length – Length to Center of Rollers	4040 mm	13'3"	4040 mm	13'3"	4040 mm	13'3"
8 Track Length	5030 mm	16'6"	5030 mm	16'6"	5030 mm	16'6"
9 Track Gauge – Extended	2740 mm	9'0"	2740 mm	9'0"	2740 mm	9'0"
10 Track Width/Undercarriage Width (with steps):						
700 mm (28") Shoes	3440 mm	11'3"	3440 mm	11'3"	3440 mm	11'3"
800 mm (31") Shoes	3540 mm	11'7"	3540 mm	11'7"	3540 mm	11'7"
850 mm (33") Shoes	3590 mm	11'9"	3590 mm	11'9"	3590 mm	11'9"
Bucket Type	HD		HD		SDV	
Bucket Capacity	2.00 m³	2.61 yd³	2.00 m³	2.61 yd³	2.41 m³	3.15 yd³
Bucket Tip Radius	1790 mm	5'9"	1790 mm	5'9"	1910 mm	6.3 ft

336 Hydraulic Excavator Specifications

Engine

Engine Model	Cat® C7.1 TTA	
Net Power		
ISO 9249	223.5 kW	300 hp
ISO 9249 (DIN)	304 hp (metric)	
Engine Power		
ISO 14396	225 kW	302 hp
ISO 14396 (DIN)	306 hp (metric)	
Bore	105 mm	4 in
Stroke	135 mm	5 in
Displacement	7.01 L	428 in³

- Meets U.S. EPA Tier 4 Final, EU Stage V, and Japan 2014 emission standards.
- Recommended for use up to 4500 m (14,760 ft) altitude with engine power derate above 3000 m (9,840 ft).
- Advertised power is tested per the specified standard in effect at the time of manufacture.
- Net power is the power available at the flywheel when the engine is equipped with fan, air intake system, exhaust system, and alternator with engine speed at 2,000 rpm.
- All Cat nonroad U.S. EPA Tier 4 Final, EU Stage V, Japan 2014, Korea Stage V, India CEV Stage V, and China Nonroad Stage IV diesel engines are required to use ULSD (ultra-low sulfur diesel with 15 ppm of sulfur or less) or ULSD blended with the following lower-carbon intensity fuels** up to:
  - ✓ 20% biodiesel FAME (fatty acid methyl ester)*
  - ✓ 100% renewable diesel, HVO (hydrotreated vegetable oil) and GTL (gas-to-liquid) fuels

  Refer to guidelines for successful application. Please consult your Cat dealer or "Caterpillar Machine Fluids Recommendations" (SEBU6250) for details.

  **Engines with no aftertreatment devices can use higher blends, up to 100% biodiesel.*

  ***Tailpipe greenhouse gas emissions from lower-carbon intensity fuels are essentially the same as traditional fuels.*

Swing Mechanism

Swing Speed	8.84 rpm	
Maximum Swing Torque	143 kN-m	105,250 lbf-ft

Weights

Operating Weight	36 800 kg	81,100 lb

- Long Wide Undercarriage, Reach Boom, R3.9DB (12'10") Stick, HD 2.12 m³ (2.77 yd³) Bucket, 850 mm (33") Triple Grouser Shoes, 6.8 mt (15,000 lb) Counterweight.

Track

Optional Track Shoes Width	850 mm	33 in
Optional Track Shoes Width	800 mm	31 in
Optional Track Shoes Width	700 mm	28 in
Number of Shoes (each side)	49	
Number of Track Rollers (each side)	8	
Number of Carrier Rollers (each side)	2	

Drive

Maximum Gradeability	35°/70%	
Maximum Travel Speed	4.7 km/h	2.9 mph
Maximum Drawbar Pull	302.5 kN	68,005 lbf

Hydraulic System

Main System – Maximum Flow (Implement)	560 L/min (280 × 2 pumps)	148 gal/min (74 × 2 pumps)
Maximum Pressure – Equipment – Implement	35 000 kPa	5,076 psi
Maximum Pressure – Equipment – Lift Mode	38 000 kPa	5,511 psi
Maximum Pressure – Travel	35 000 kPa	5,076 psi
Maximum Pressure – Swing	29 400 kPa	4,264 psi
Boom Cylinder – Bore	150 mm	6 in
Boom Cylinder – Stroke	1440 mm	57 in
Stick Cylinder – Bore	170 mm	7 in
Stick Cylinder – Stroke	1738 mm	68 in
DB Bucket Cylinder – Bore	150 mm	6 in
DB Bucket Cylinder – Stroke	1151 mm	45 in
TB Bucket Cylinder – Bore	160 mm	6 in
TB Bucket Cylinder – Stroke	1356 mm	53 in

Service Refill Capacities

Fuel Tank Capacity	600 L	158.5 gal
Cooling System	39 L	10.2 gal
Engine Oil (with filter)	25 L	6.6 gal
Swing Drive	18 L	4.8 gal
Final Drive (each)	8 L	2.1 gal
Hydraulic System (including tank)	373 L	98.5 gal
Hydraulic Tank (including suction pipe)	161 L	42.5 gal
Diesel Exhaust Fluid (DEF) Tank	50 L	13.2 gal

Standards

Brakes	ISO 10265:2008
Cab/Operator Protective Guards (OPG) (optional)	ISO 10262:1998 Level II
Cab/Rollover Protective Structure (ROPS)	ISO 12117-2:2008

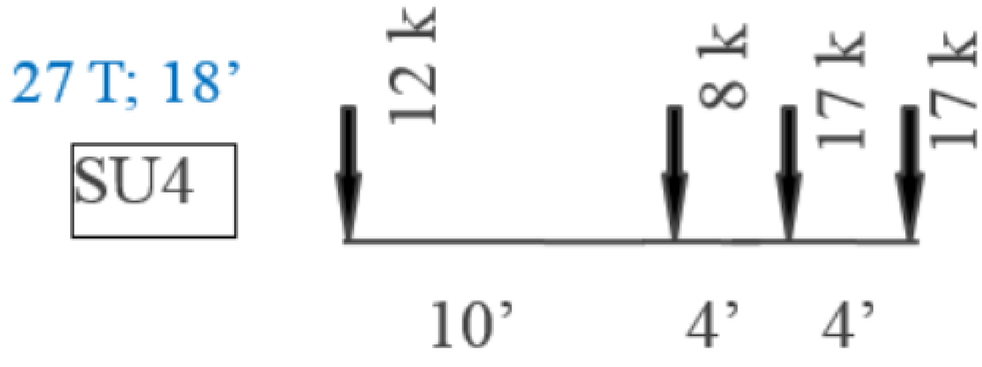
Sound Performance

ISO 6395:2008 (external)	105 dB(A)
ISO 6396:2008 (inside cab)	72 dB(A)

- Hearing protection may be needed when operating with an open operator station and cab (when not properly maintained or doors/windows open) for extended periods or in a noisy environment.

Air Conditioning System

The air conditioning system on this machine contains the fluorinated greenhouse gas refrigerant R134a (Global Warming Potential = 1430). The system contains 1.00 kg of refrigerant, which has a CO_2 equivalent of 1.430 metric tonnes.

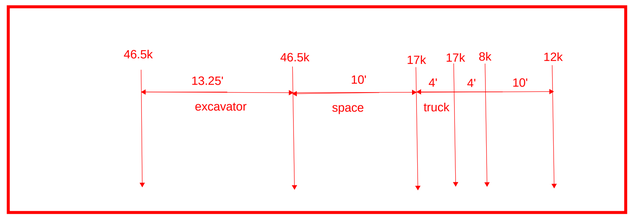


ASSUME EXCAVATOR IS CENTERED IN 14' SPAN AND REACHES TO ADJACENT 14' SPAN
PICK RADIUS = 7' + 7' = 14' (SAY 15')

ASSUME EXCAVATOR IS CENTERED IN 14' SPAN AND REACHES TO ADJACENT 20'-3" SPAN
PICK RADIUS = 7' + 10'-1.5" = 17'-1.5" (SAY 20')

LIFT CAPACITY IS GREATER THAN 20,000 lb.

REPRESENTATIVE TRUCK DEFINED IN MIDAS
FOR EXCAVATOR PLUS SU4 TRUCK

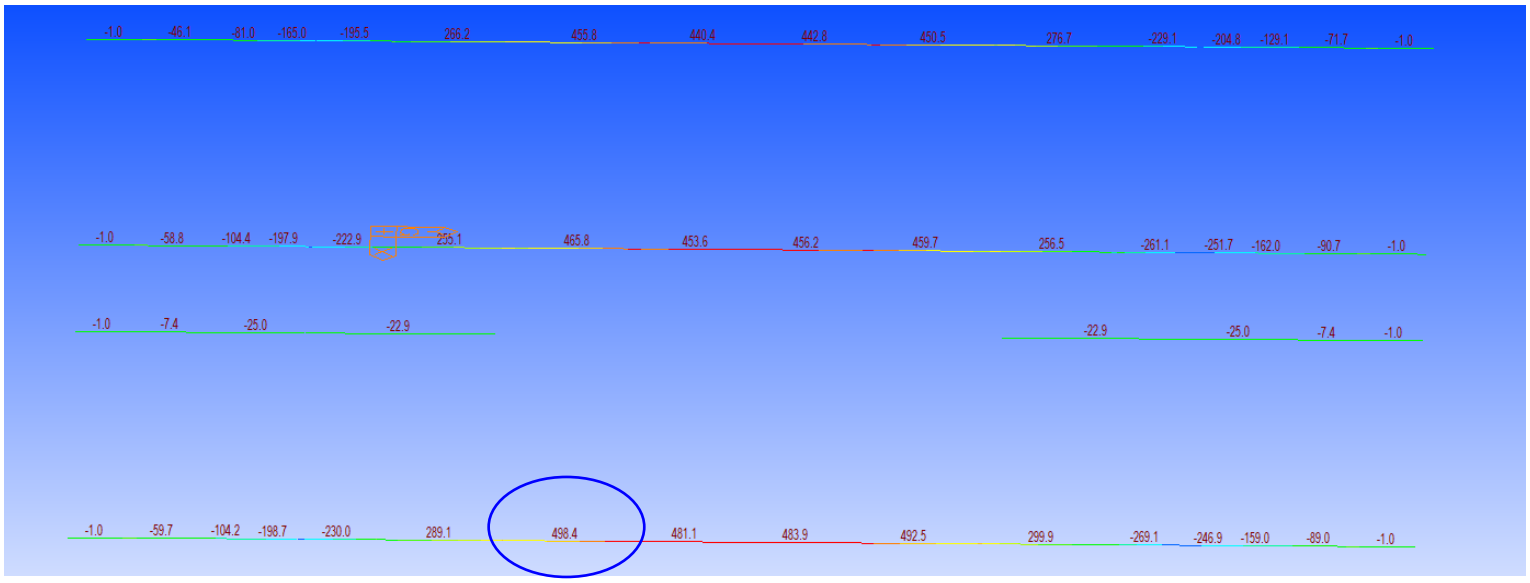


Comparison of Floorbeam Maximum Positive Moments in Final Condition vs. During Construction

Compare the original/final condition dead and live load to the construction conditions. Up to three lanes of SU7 can load the floorbeam during the original/final condition. During construction, one lane of loader/excavator can be on the bridge, in addition to crane mats and protective decking.

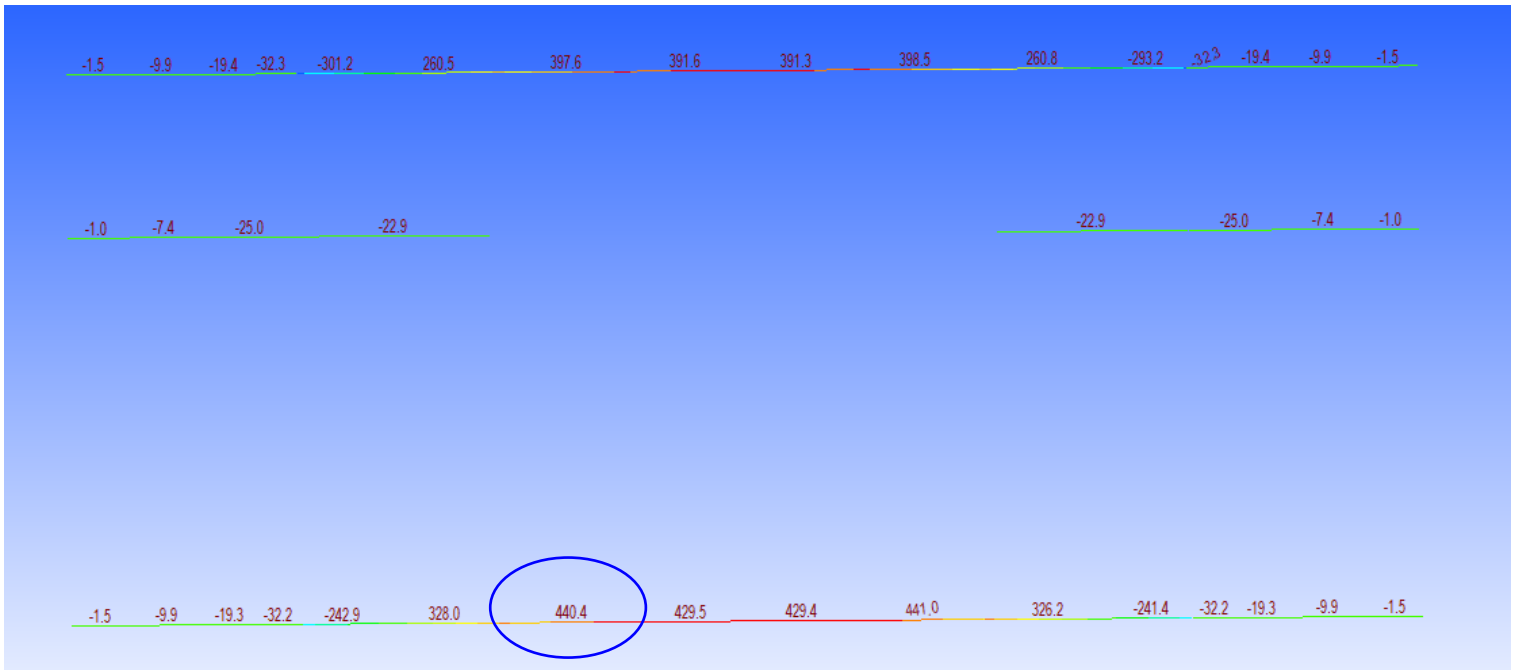
Final Condition, Unfactored DL+LL+IM (SU7)

BEL 40 Iteration 3 Rehabilitation Model.mcb

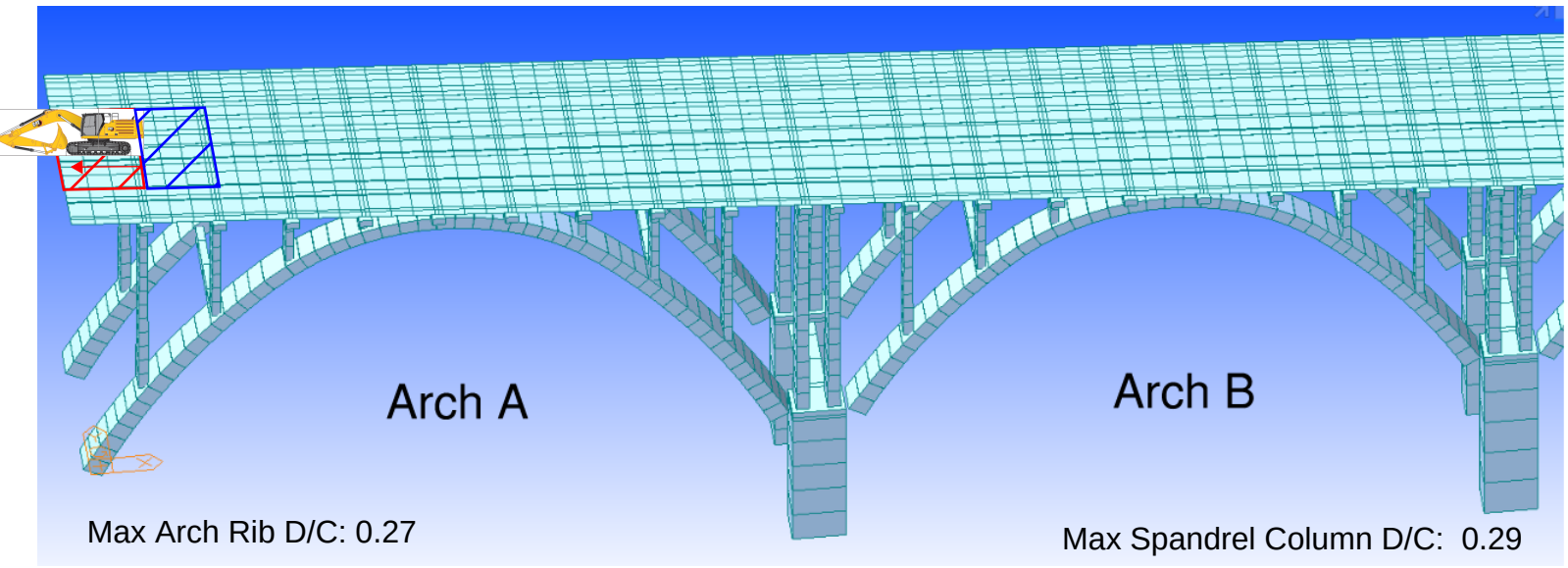


Demo Condition, Unfactored DL+LL+IM (Excavator + Loader)

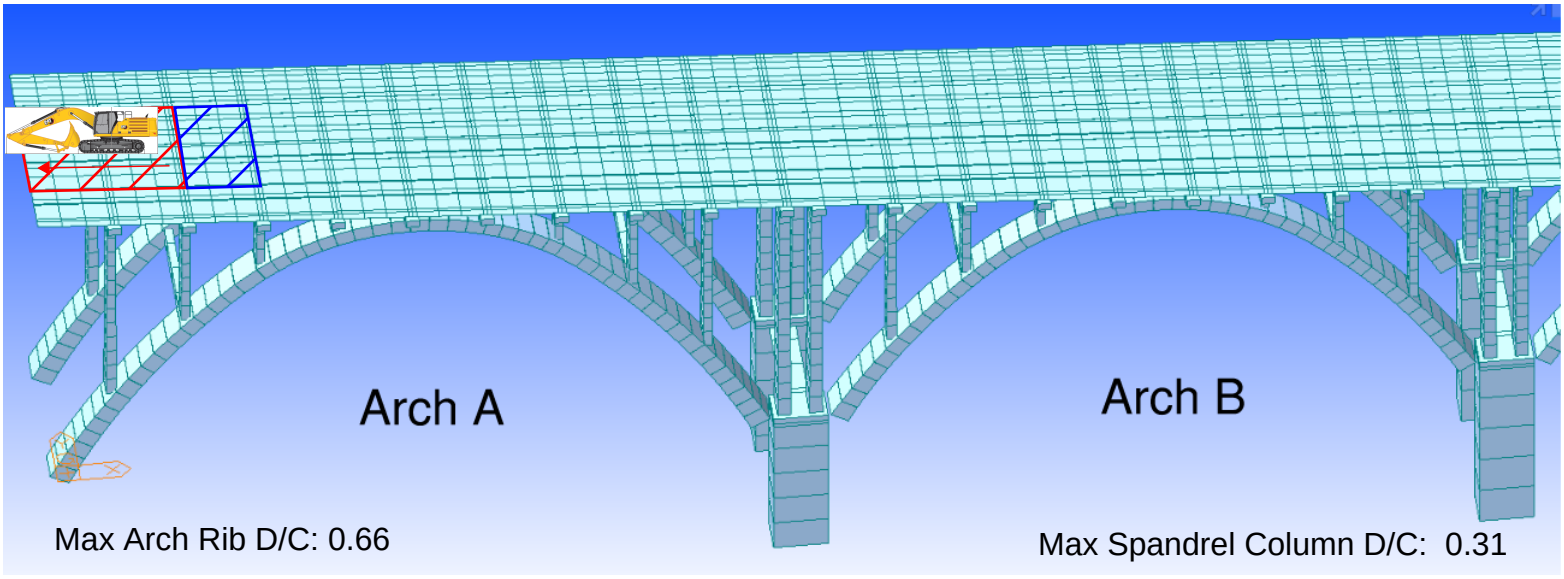
BEL 40 Iteration 3 Demo Analysis Arch Model Construction Loading.mcb



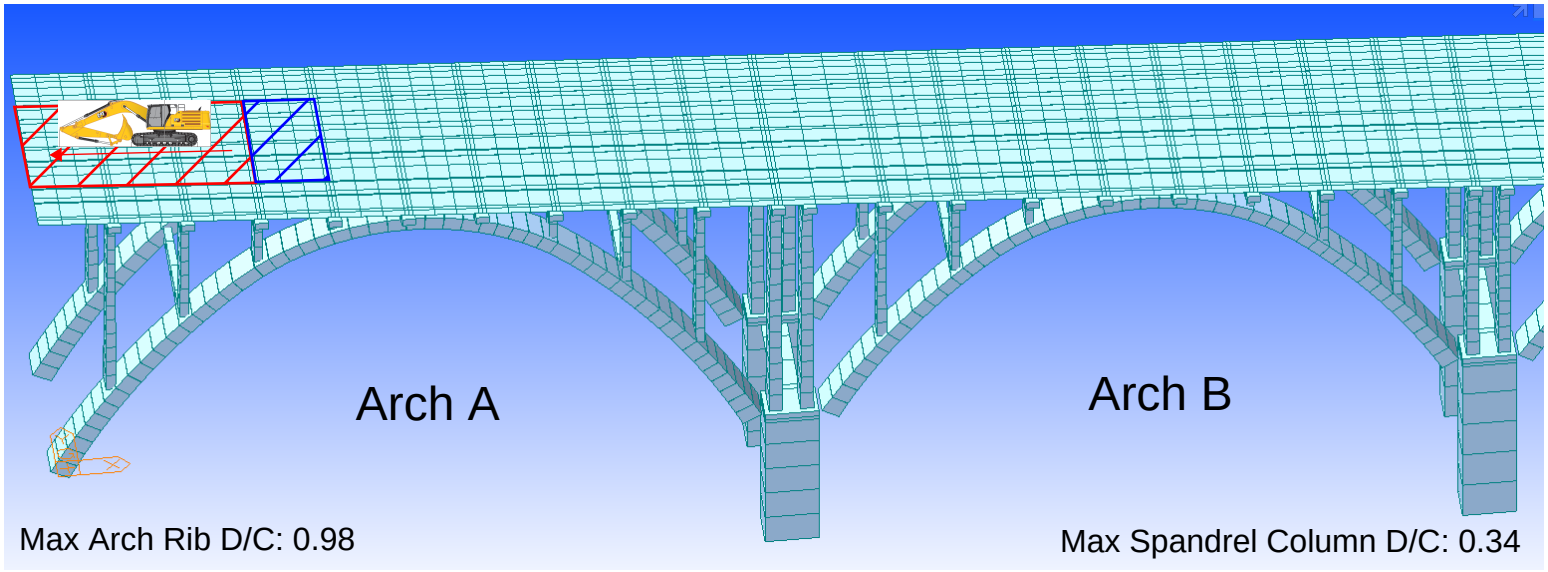
Conclusion: The demo condition, which adds the dead loads of crane mats and protective decking to the bridge, has lower unfactored floorbeam moments than the original/final condition bridge. The change in dead load is smaller than the change in live loading (SU7's versus a single excavator).



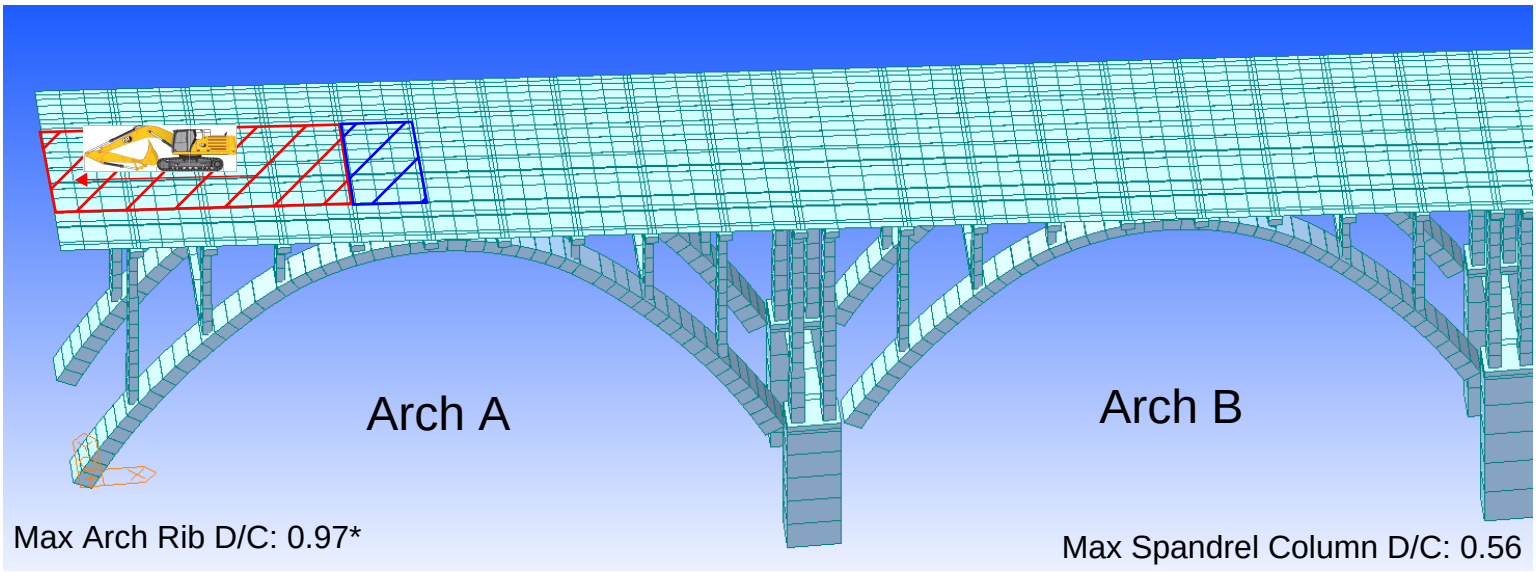
BEL 40 Iteration 3 Deck Reconstruction Analysis Stage 1.mcb



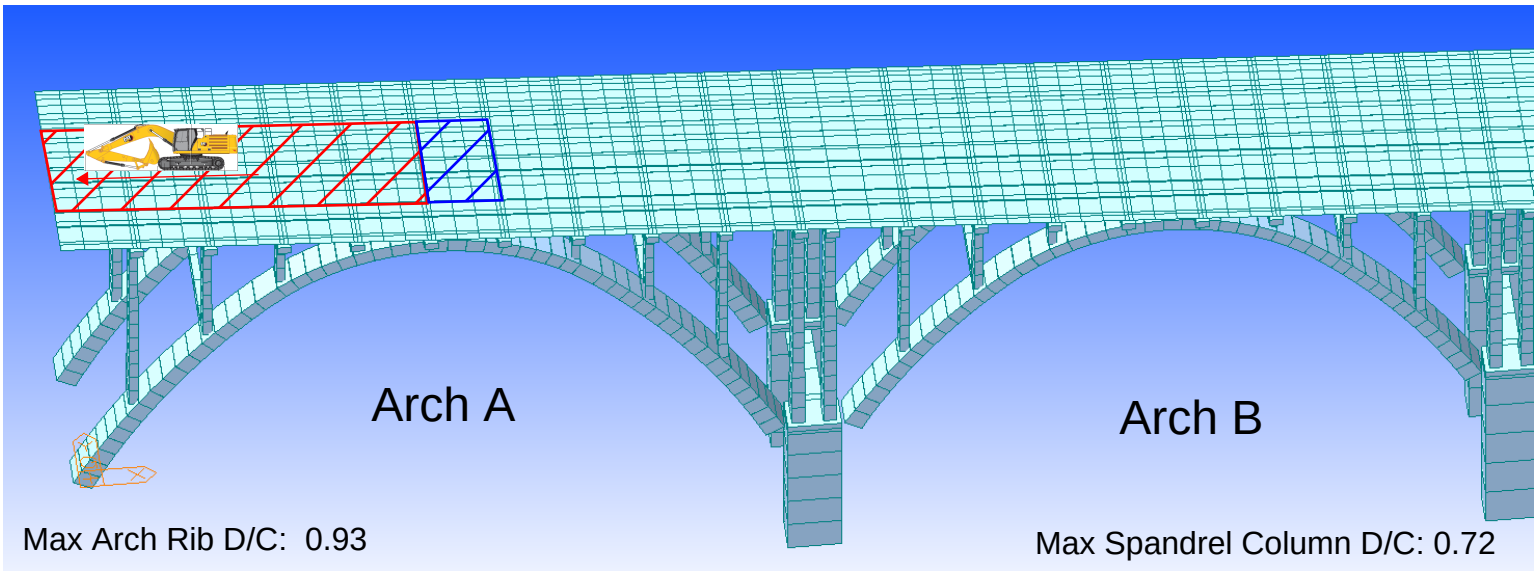
BEL 40 Iteration 3 Deck Reconstruction Analysis Stage 2.mcb



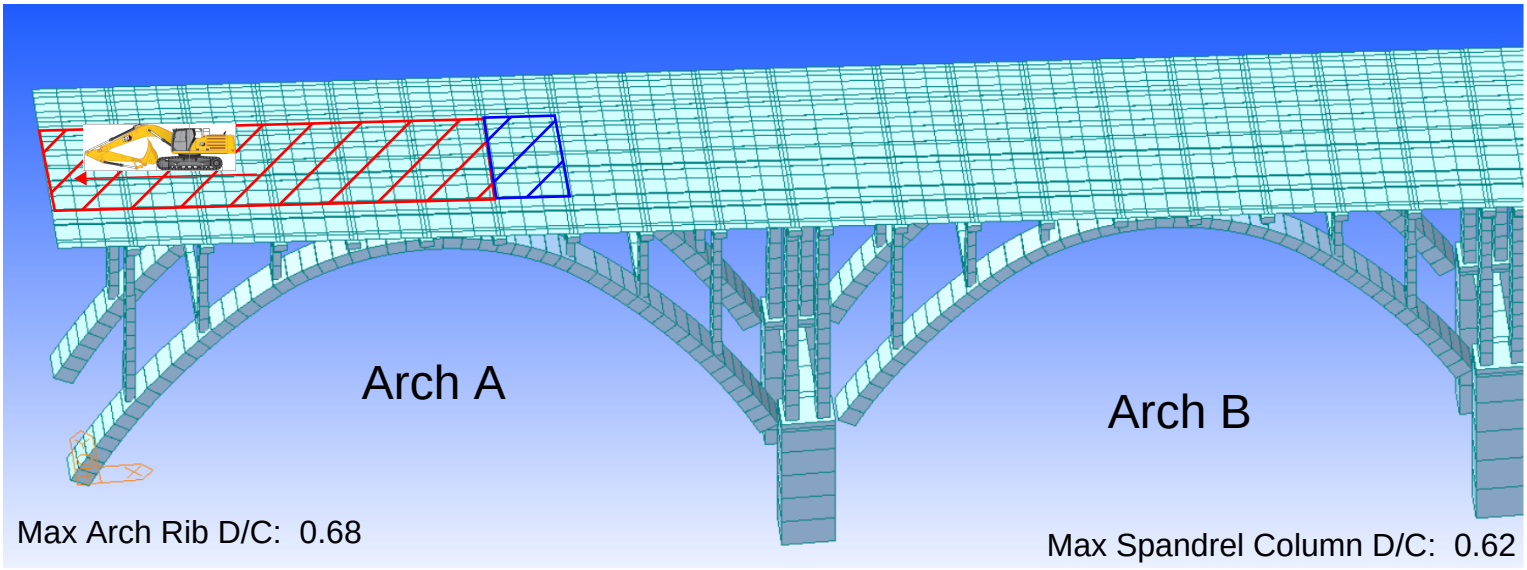
BEL 40 Iteration 3 Deck Reconstruction Analysis Stage 3.mcb



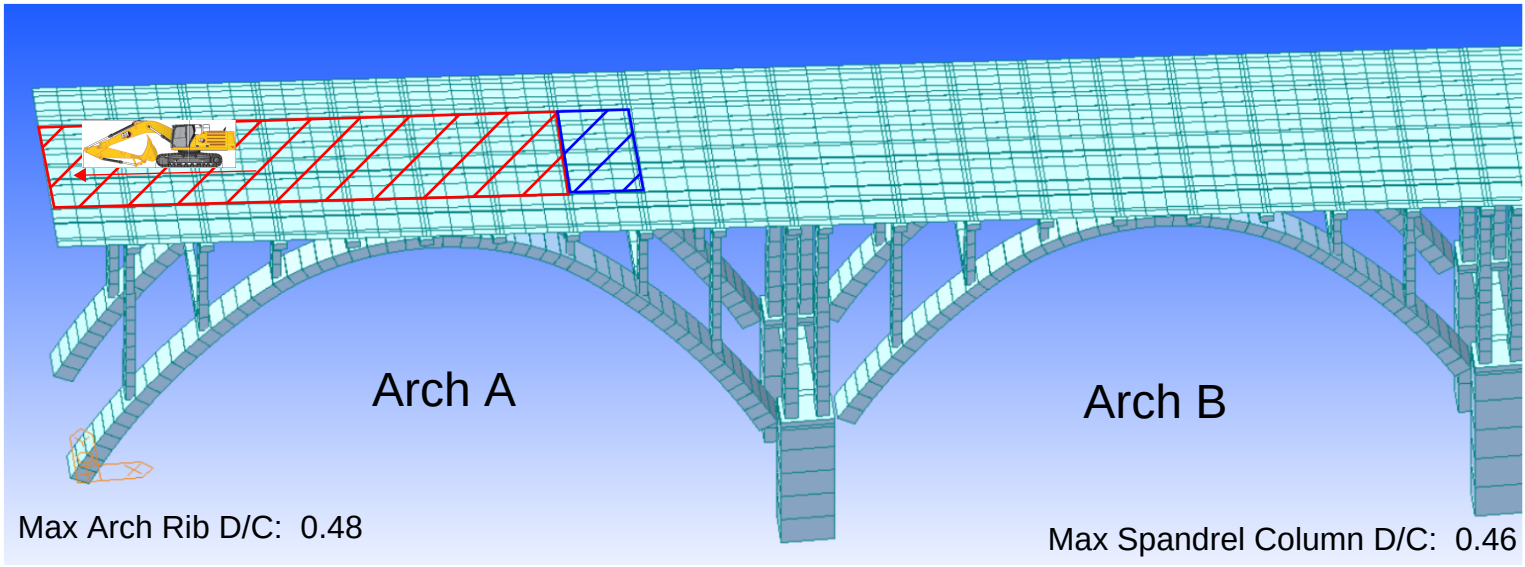
BEL 40 Iteration 3 Deck Reconstruction Analysis Stage 4.mcb
*No construction Live load included in this case



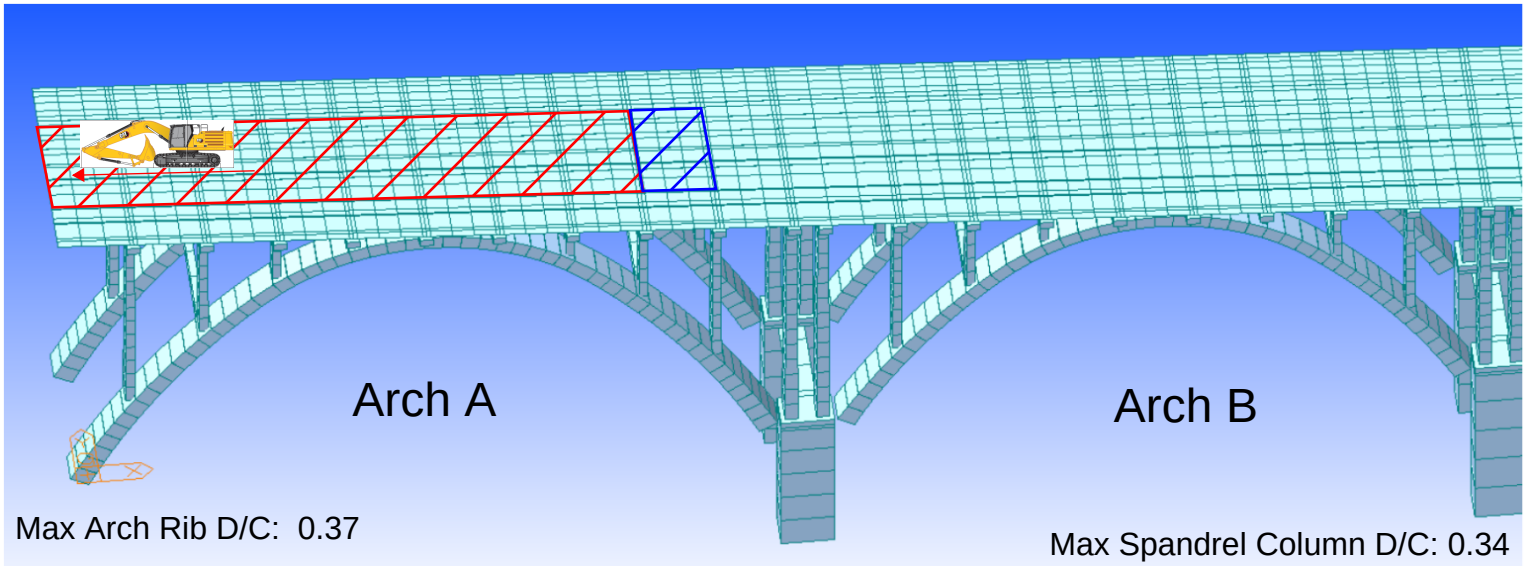
BEL 40 Iteration 3 Deck Reconstruction Analysis Stage 5.mcb



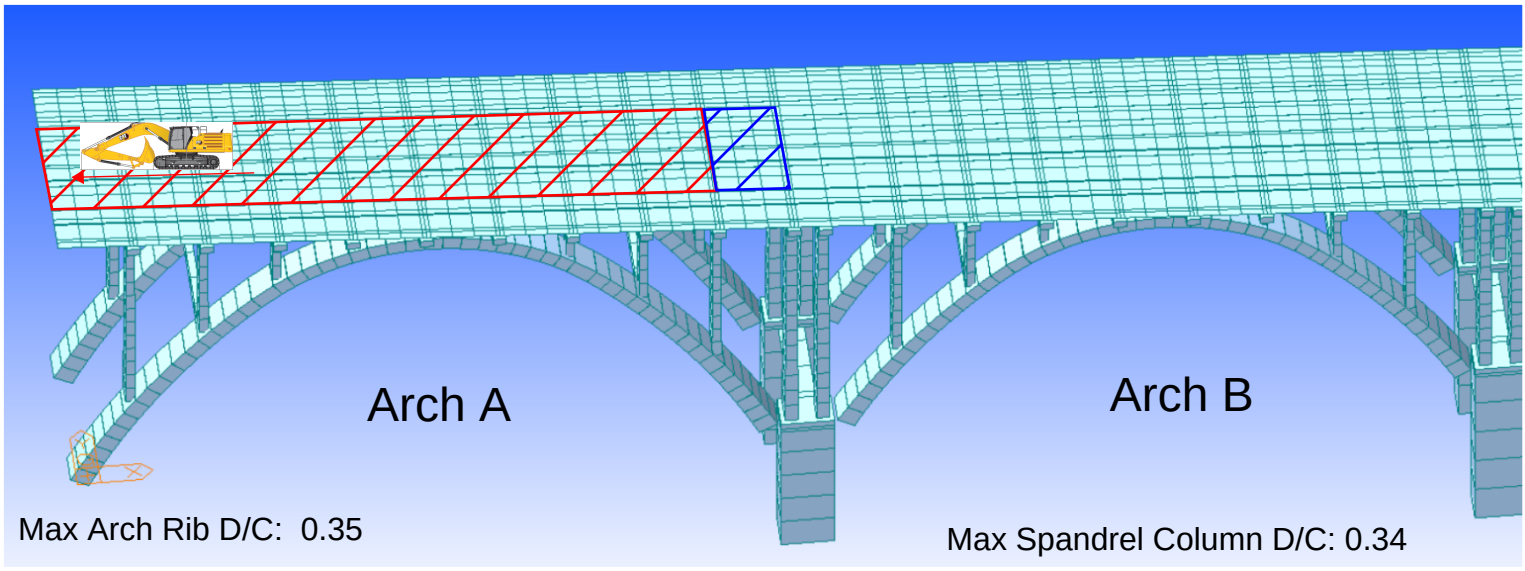
BEL 40 Iteration 3 Deck Reconstruction Analysis Stage 6.mcb



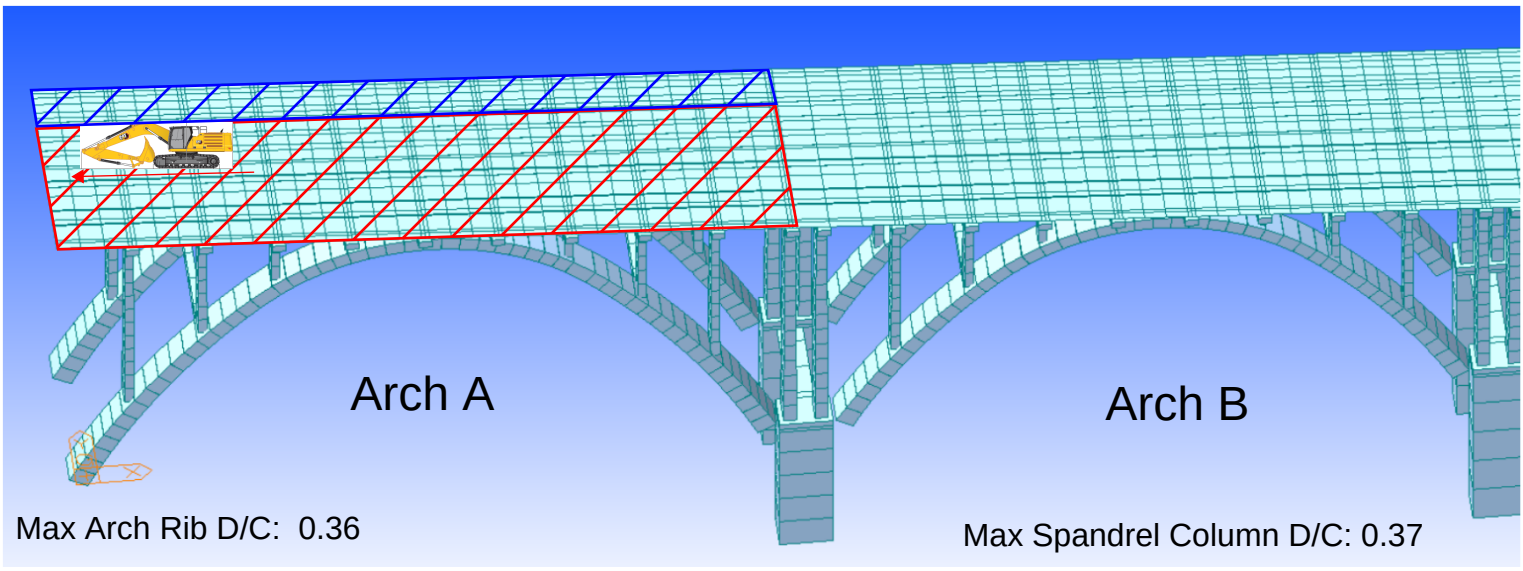
BEL 40 Iteration 3 Deck Reconstruction Analysis Stage 7.mcb



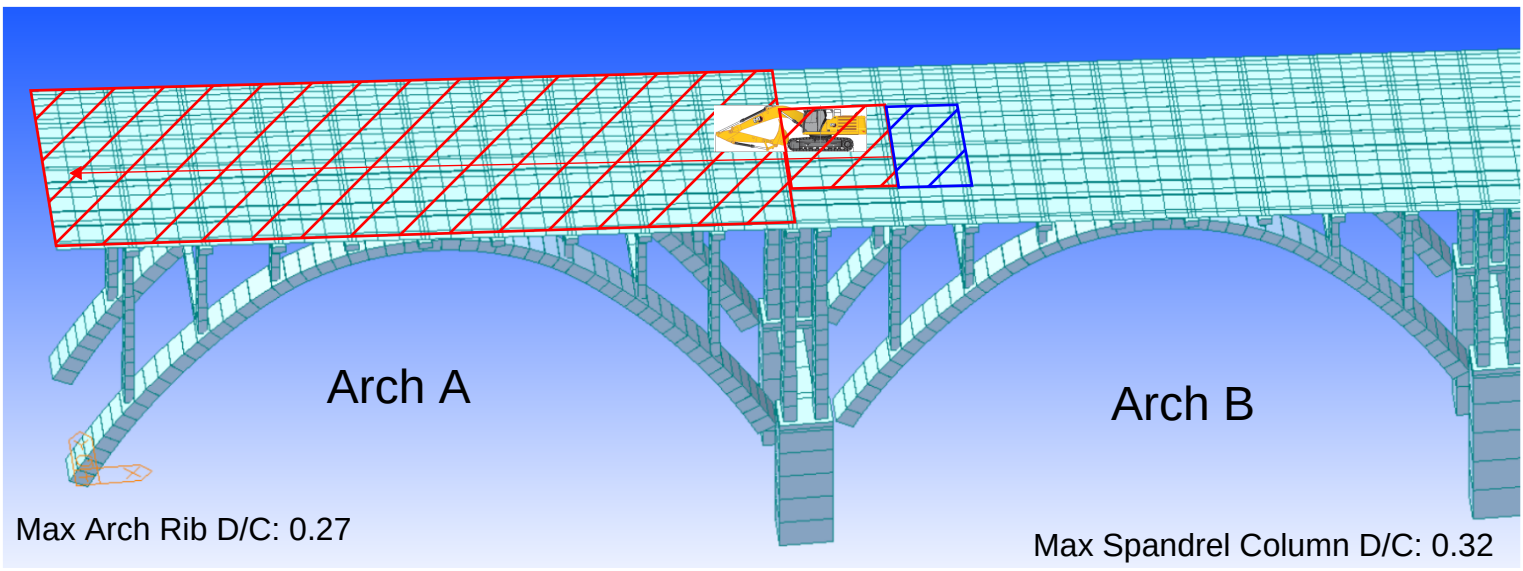
BEL 40 Iteration 3 Deck Reconstruction Analysis Stage 8.mcb



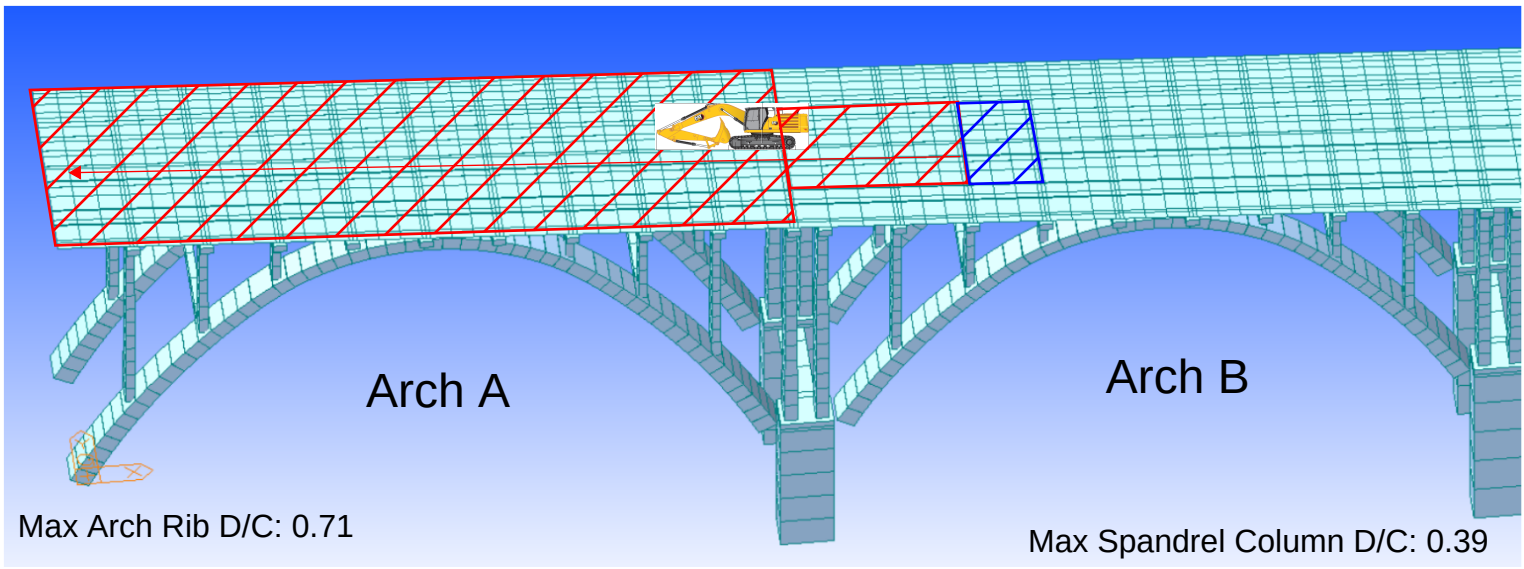
BEL 40 Iteration 3 Deck Reconstruction Analysis Stage 9.mcb



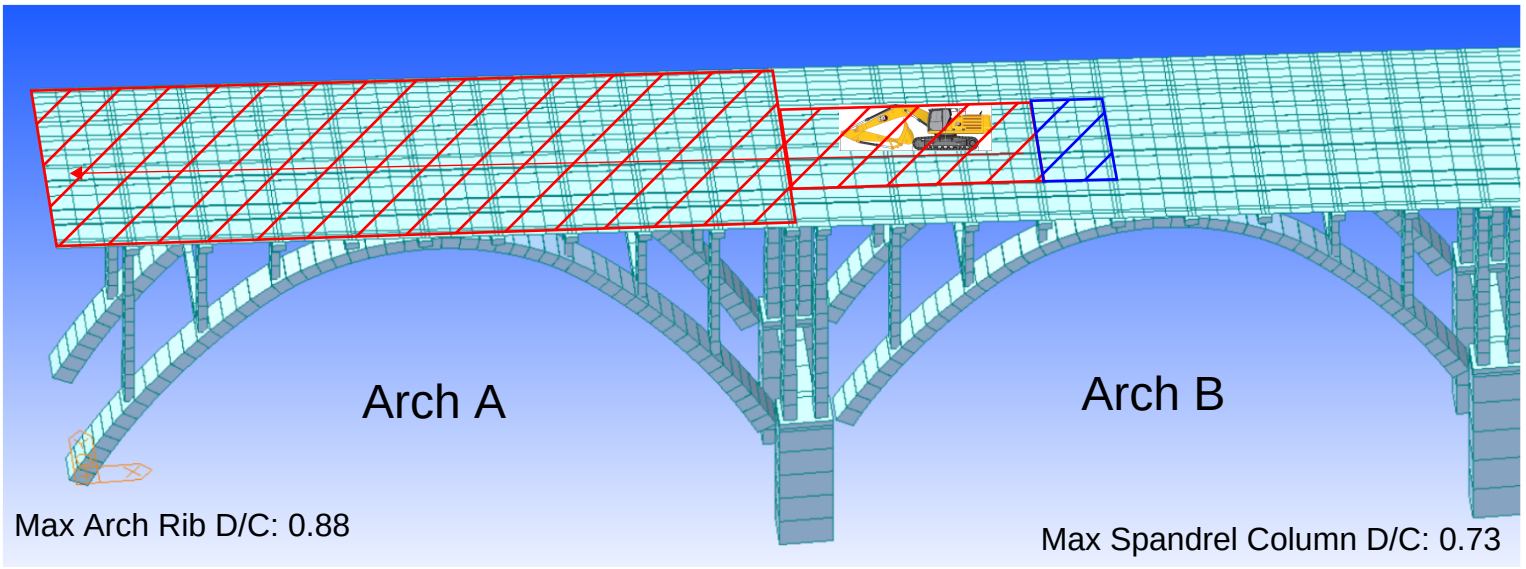
BEL 40 Iteration 3 Deck Reconstruction Analysis Stage 10.mcb



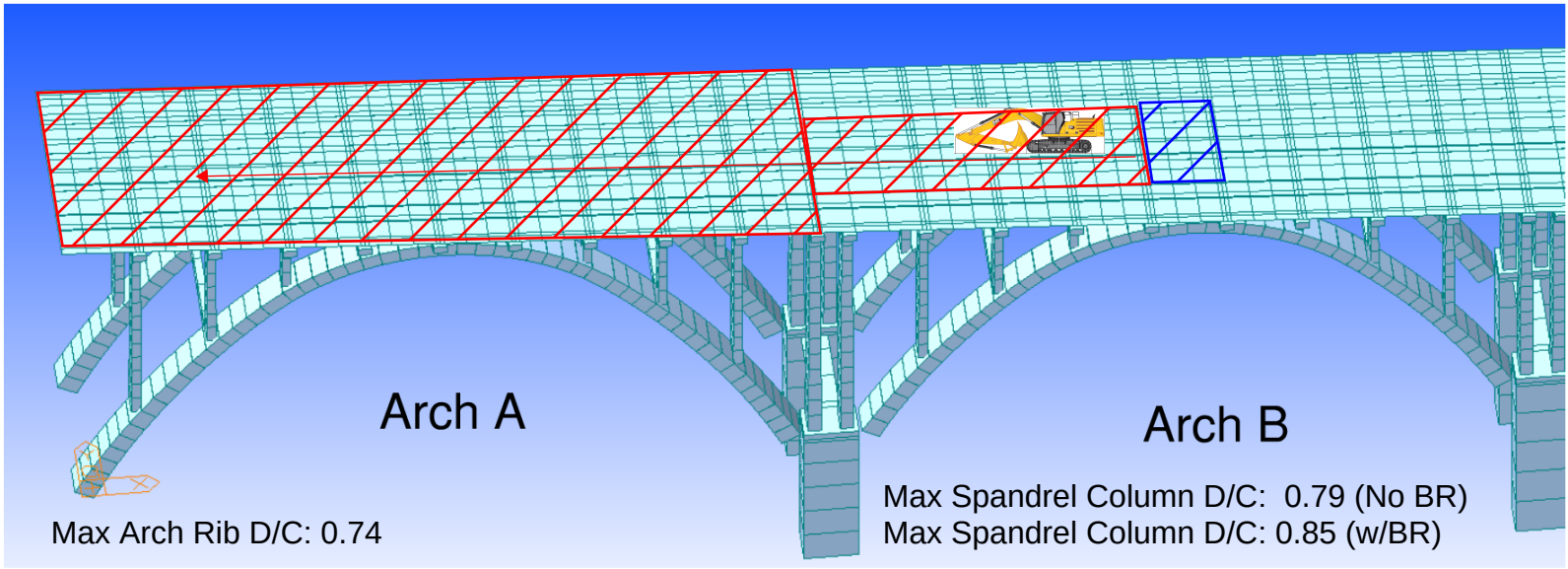
BEL 40 Iteration 3 Deck Reconstruction Analysis Stage 11.mcb



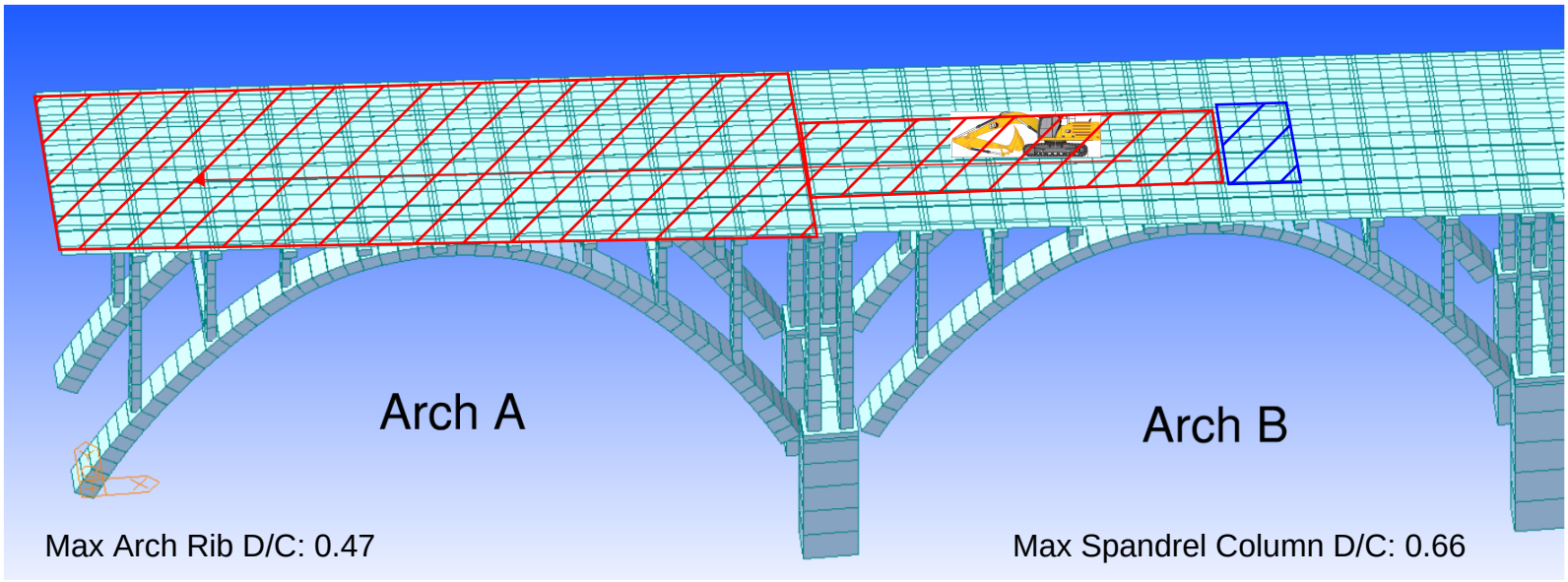
BEL 40 Iteration 3 Deck Reconstruction Analysis Stage 12.mcb



BEL 40 Iteration 3 Deck Reconstruction Analysis Stage 13.mcb



BEL 40 Iteration 3 Deck Reconstruction Analysis Stage 14.mcb



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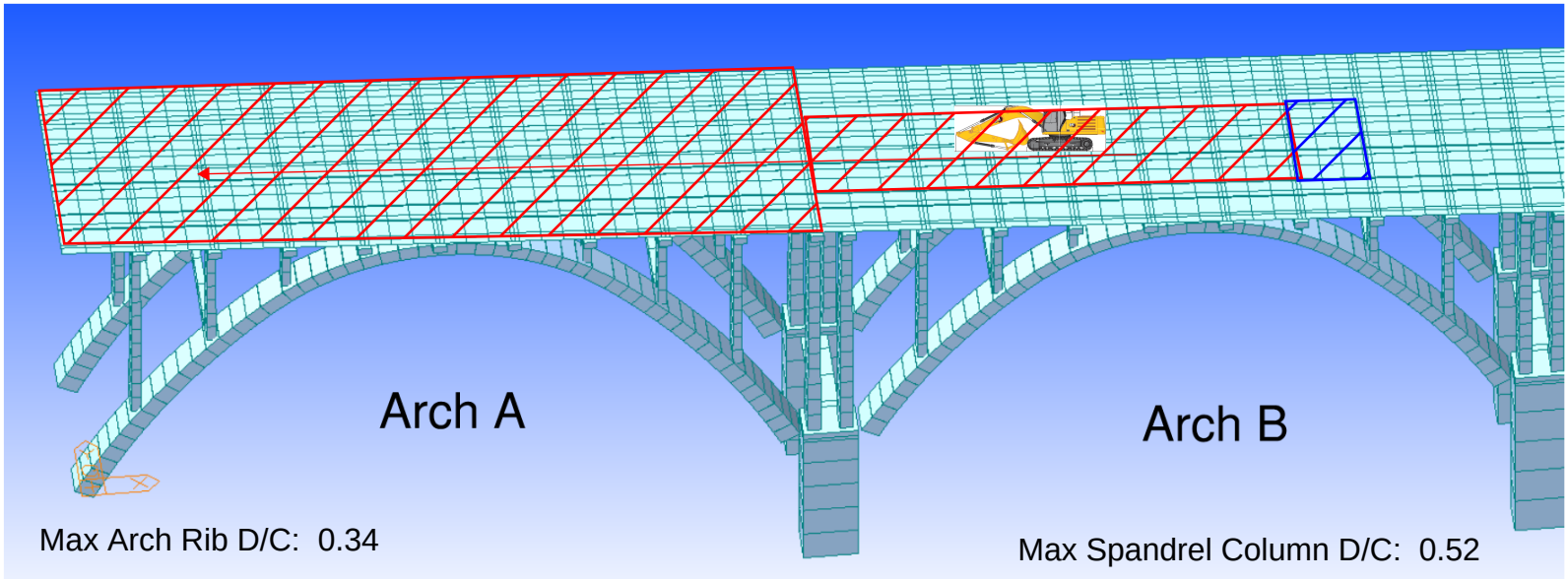
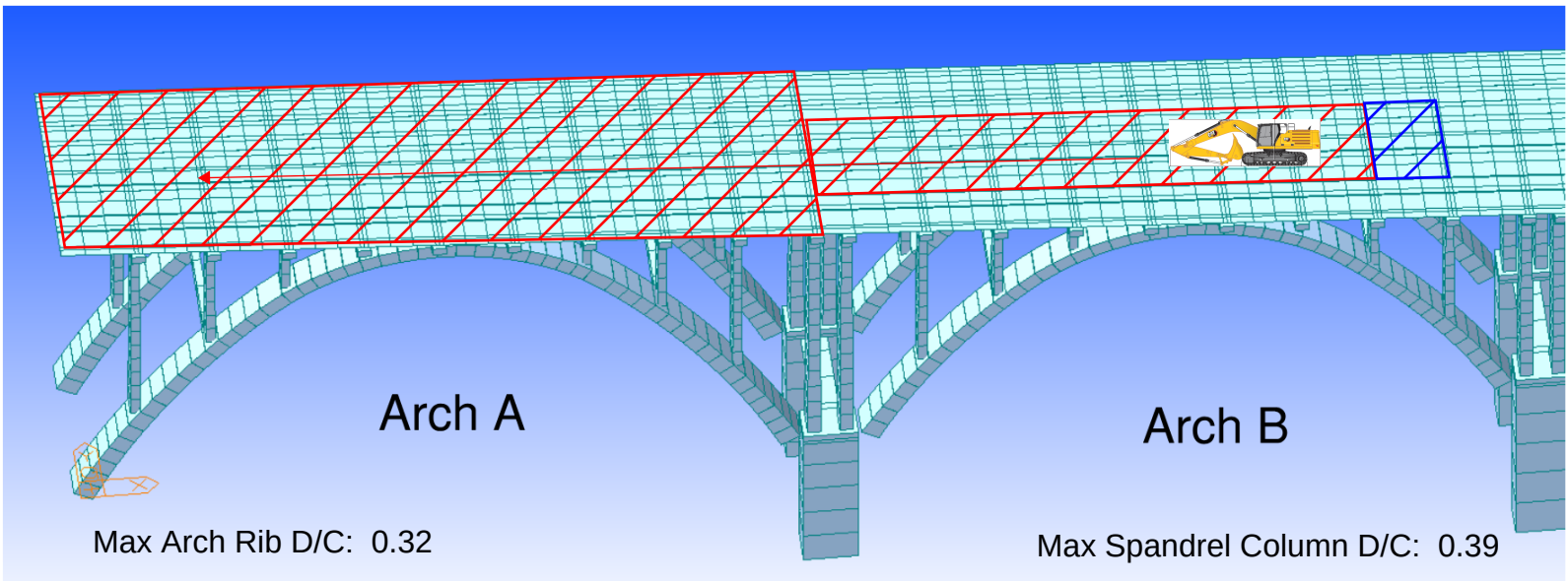
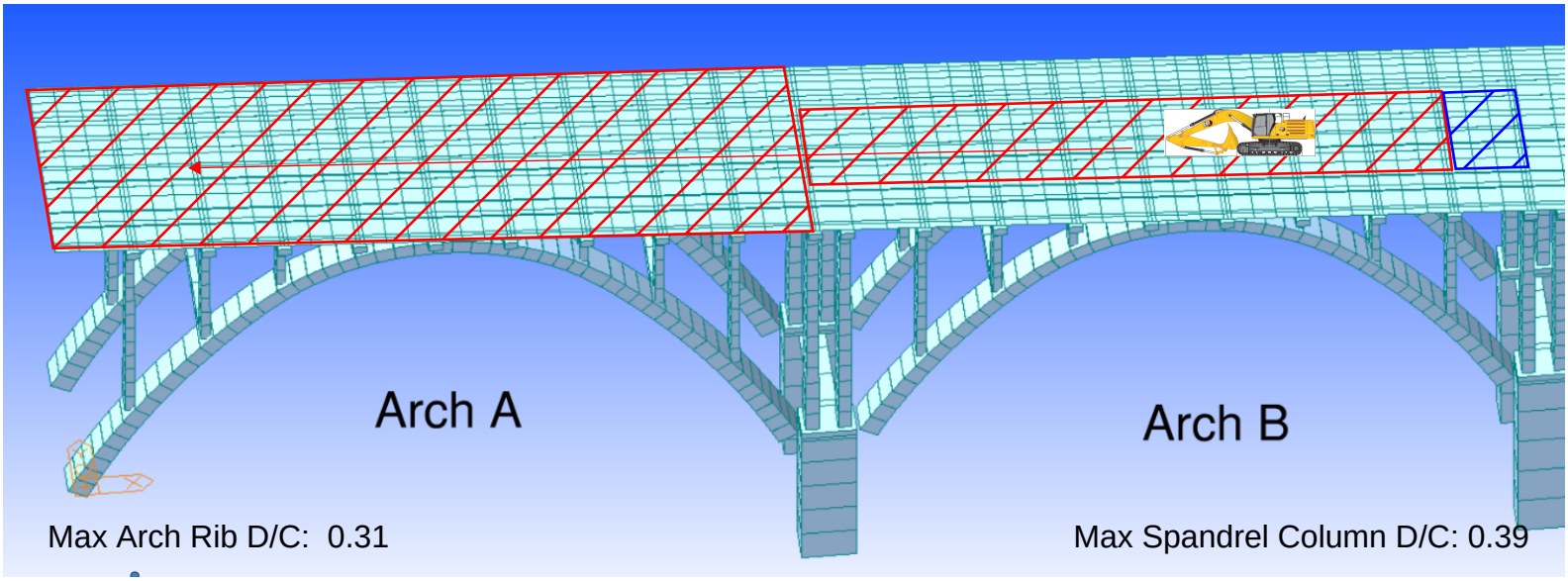


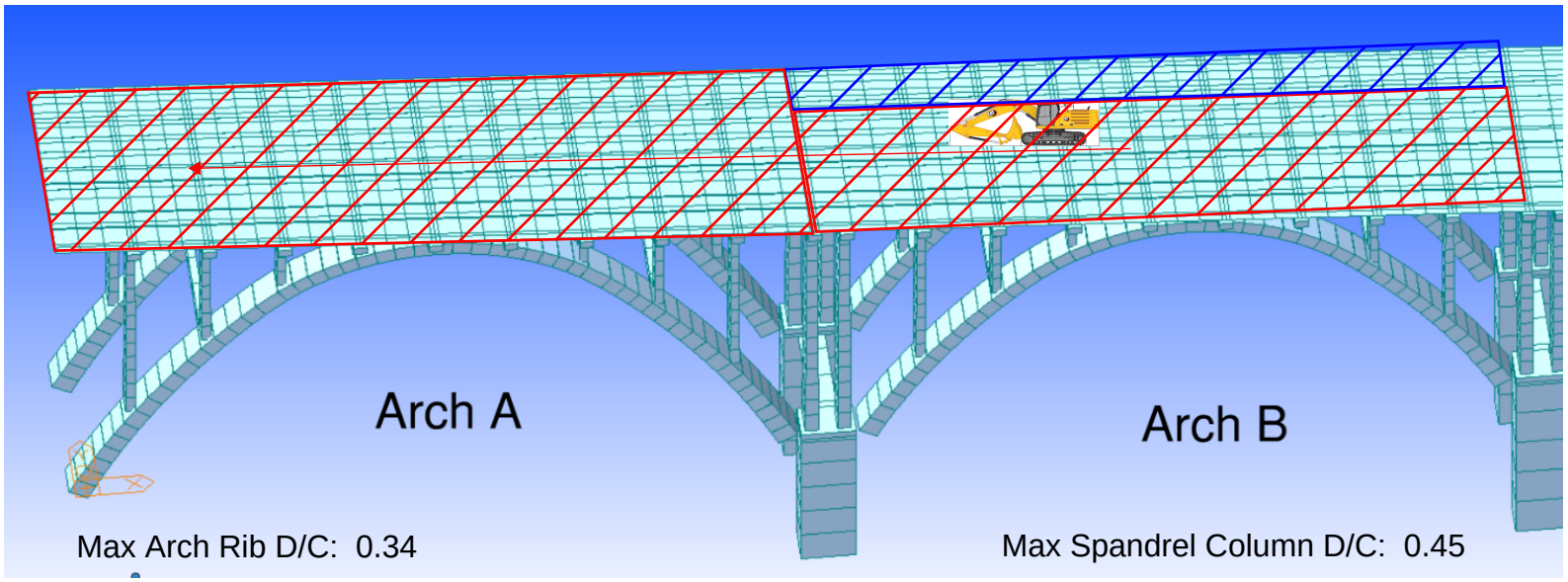
BEL 40 Iteration 3 Deck Reconstruction Analysis Stage 16.mcb



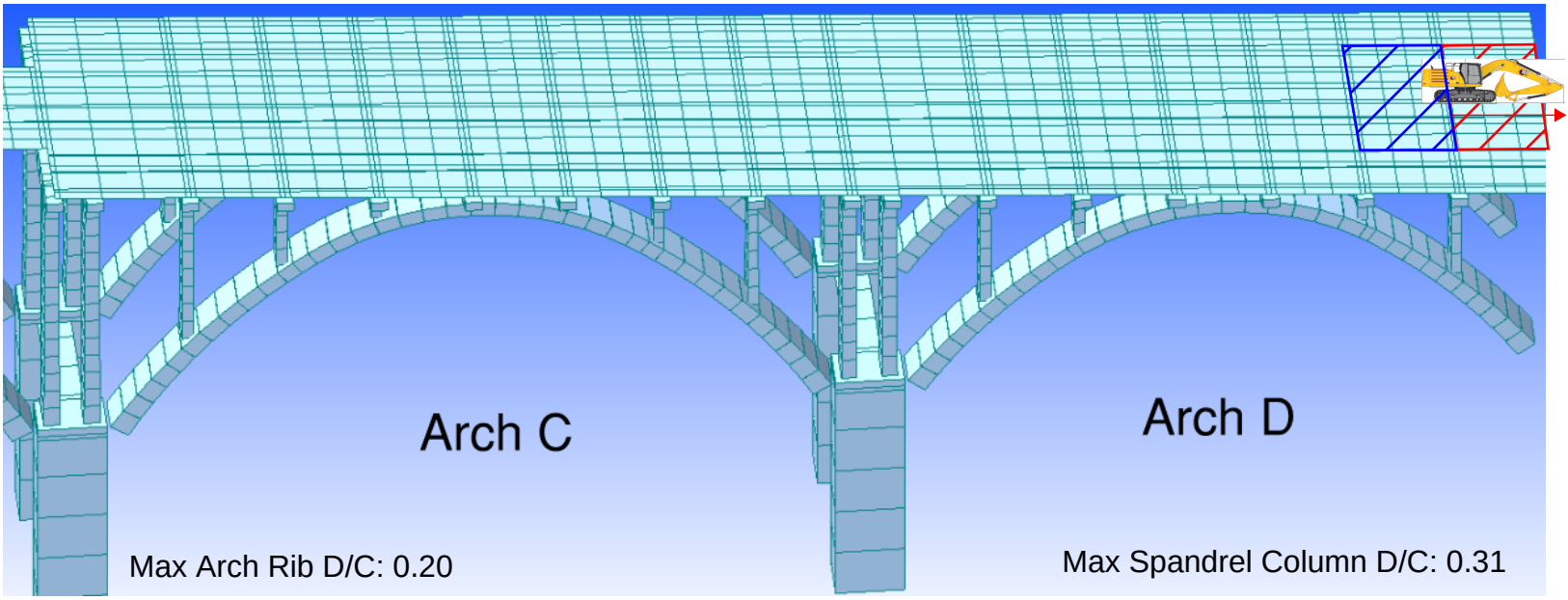
BEL 40 Iteration 3 Deck Reconstruction Analysis Stage 17.mcb



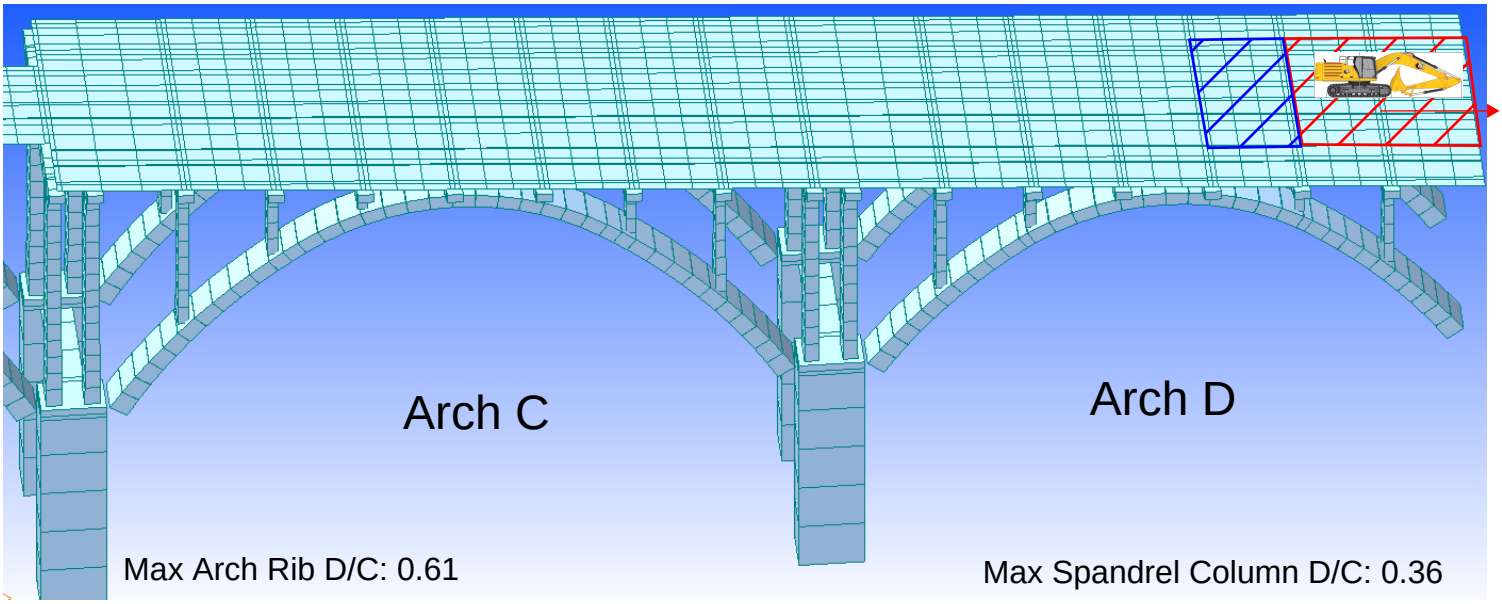
BEL 40 Iteration 3 Deck Reconstruction Analysis Stage 18.mcb



BEL 40 Iteration 3 Deck Reconstruction Analysis Stage 19.mcb



BEL 40 Iteration 3 Deck Reconstruction Analysis Stage 20.mcb



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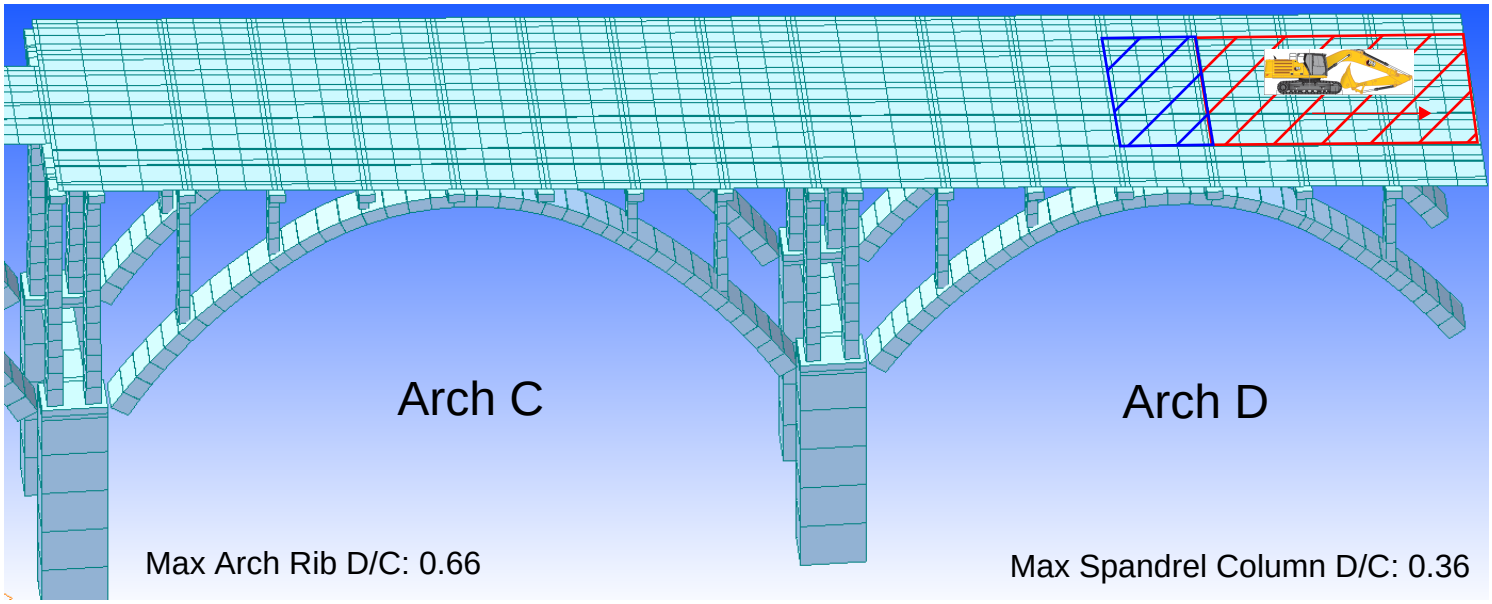
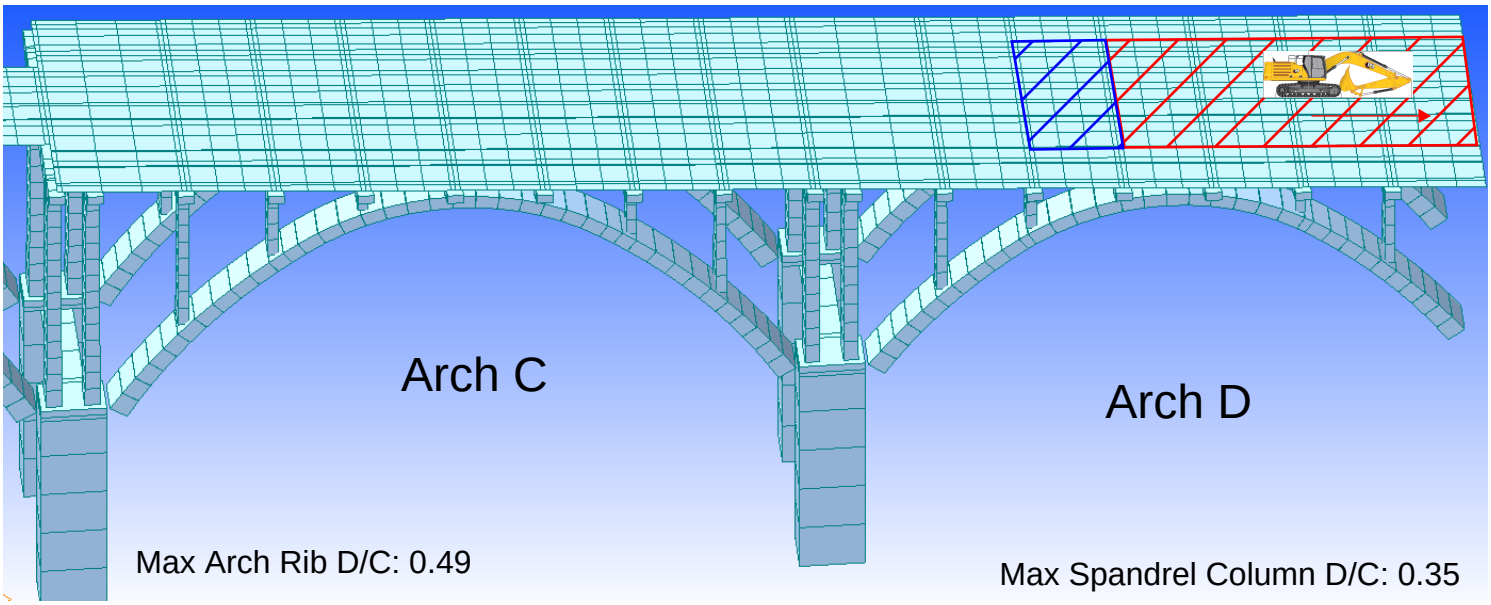
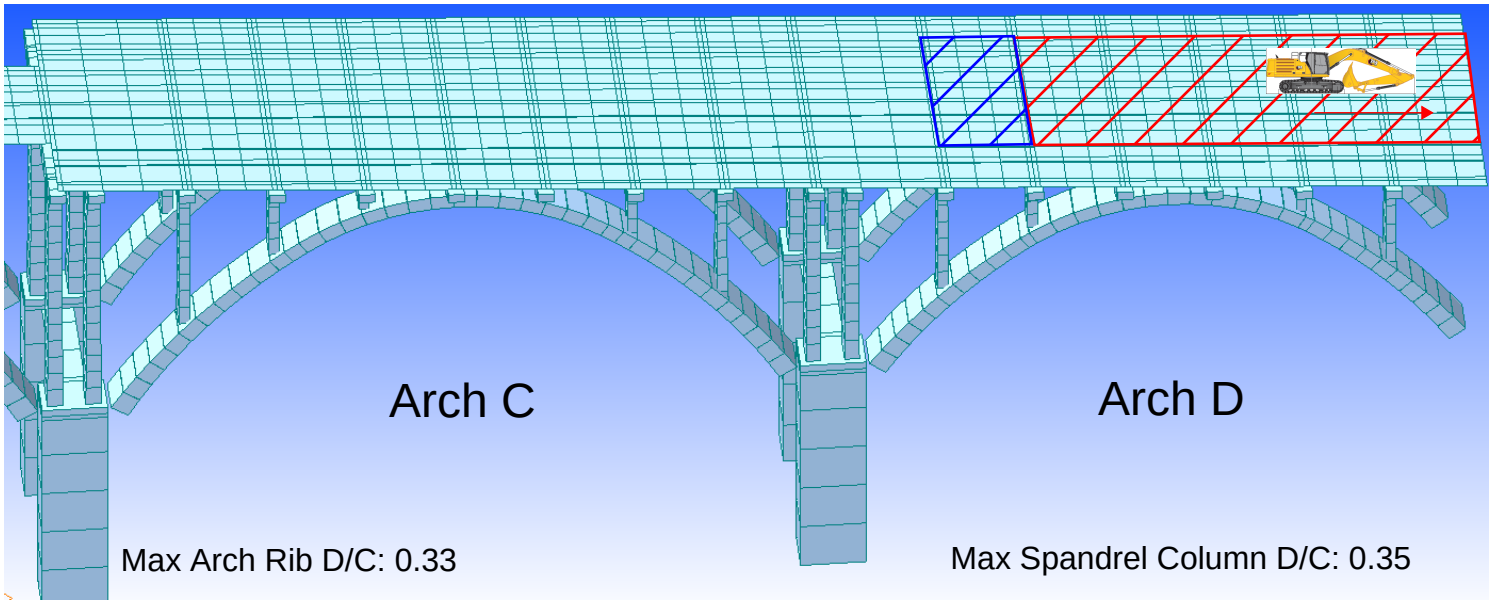


BEL 40 Iteration 3 Deck Reconstruction Analysis Stage 22.mcb



BEL 40 Iteration 3 Deck Reconstruction Analysis Stage 23.mcb



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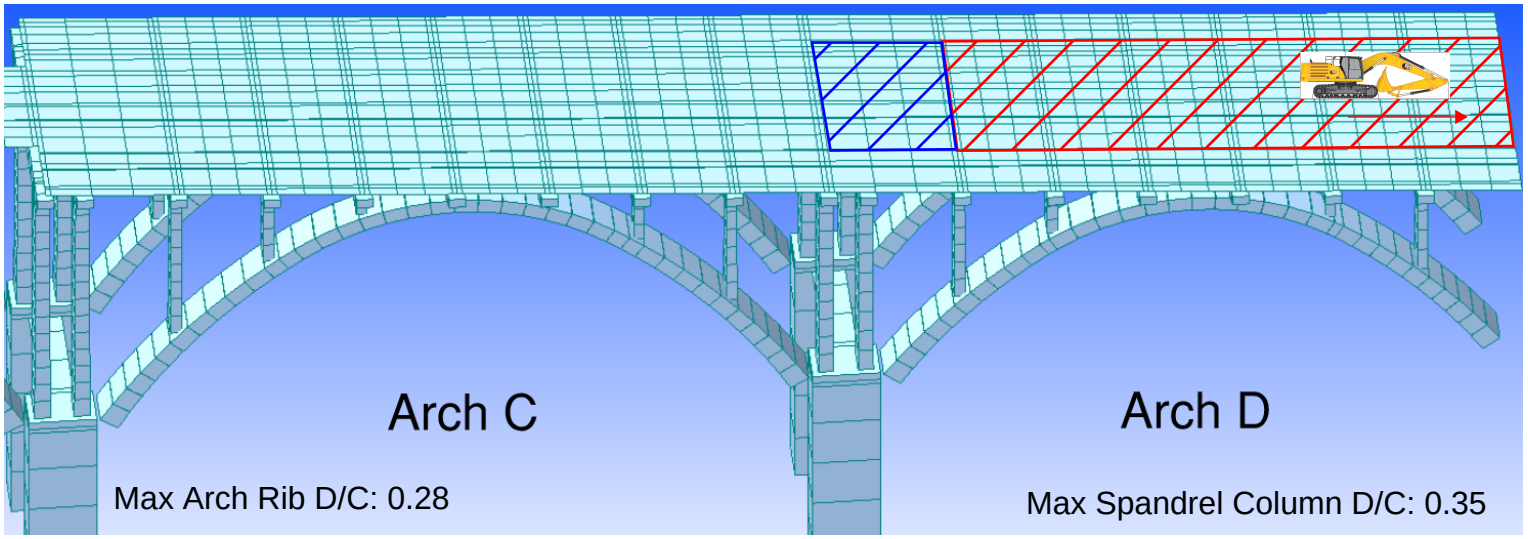
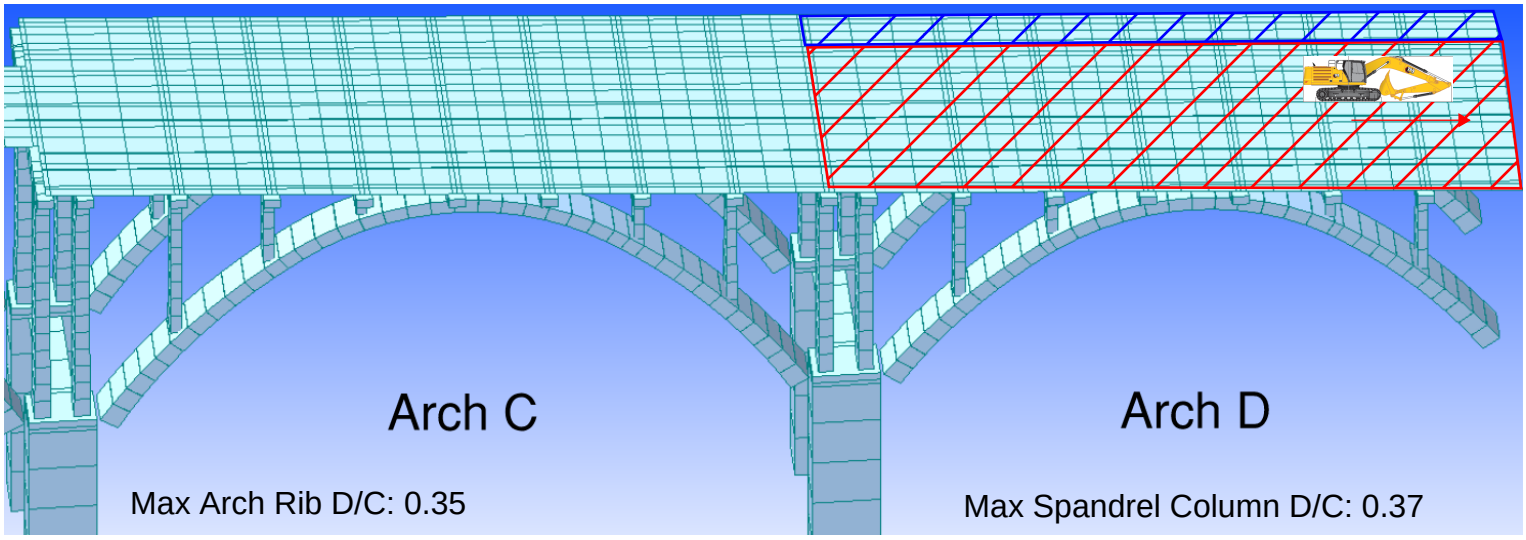
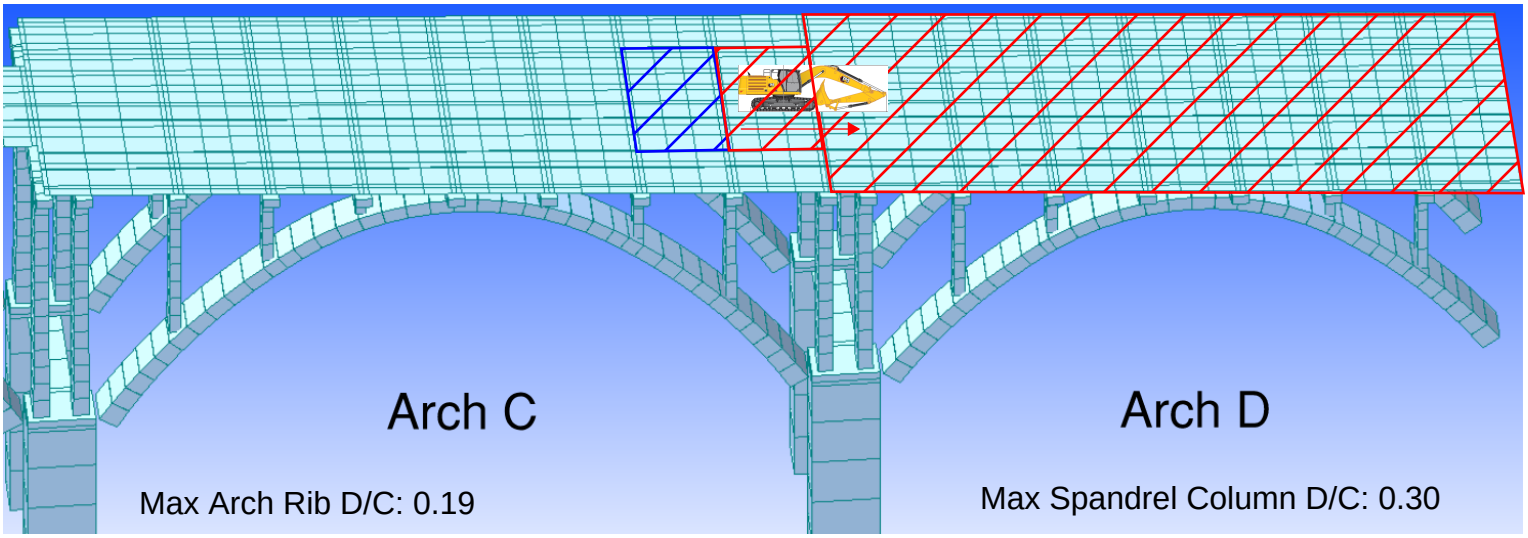


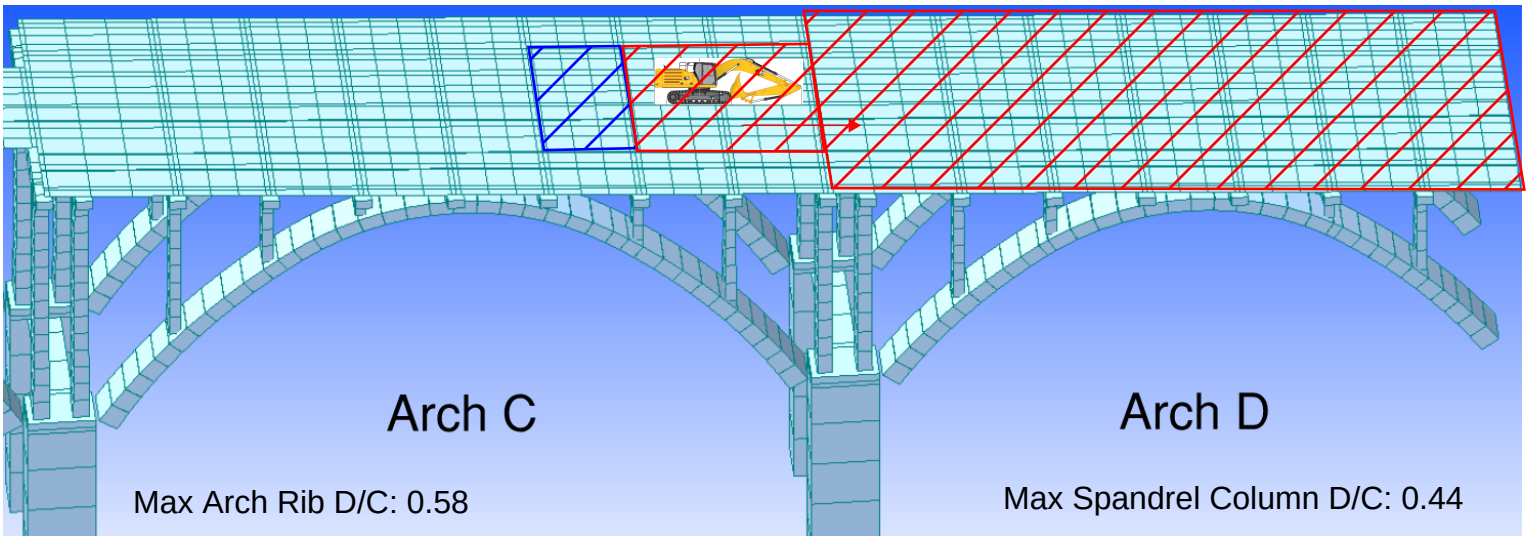
BEL 40 Iteration 3 Deck Reconstruction Analysis Stage 25.mcb



BEL 40 Iteration 3 Deck Reconstruction Analysis Stage 26.mcb



BEL 40 Iteration 3 Deck Reconstruction Analysis Stage 27.mcb



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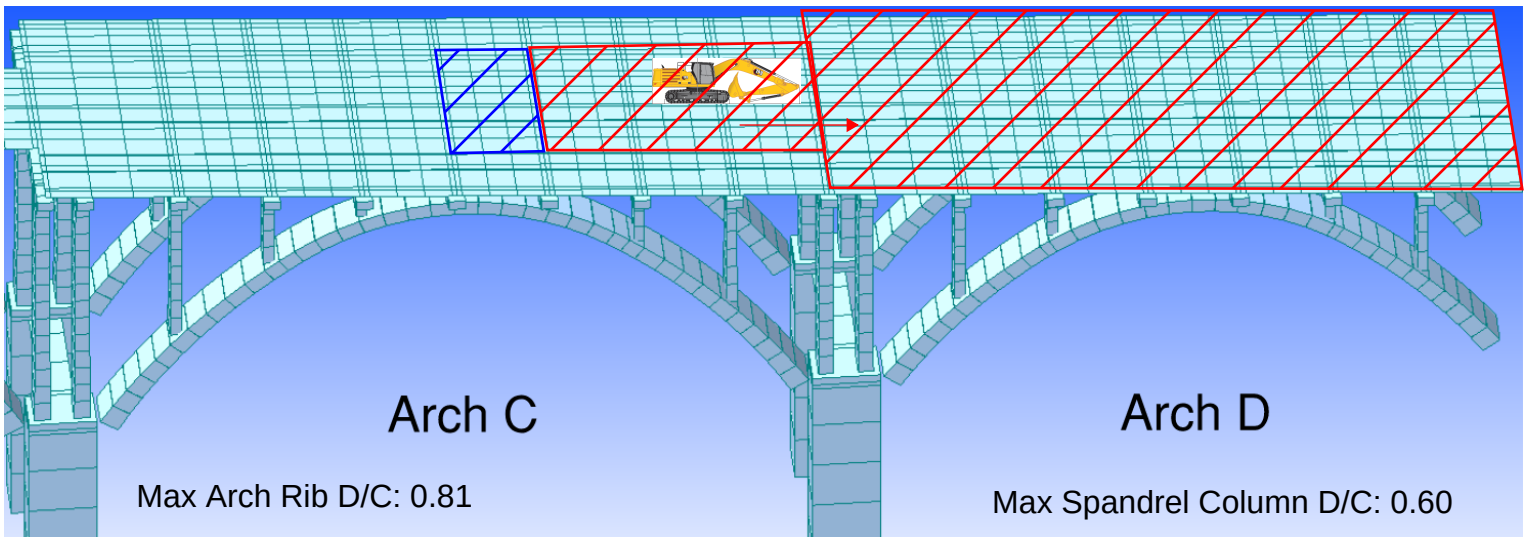

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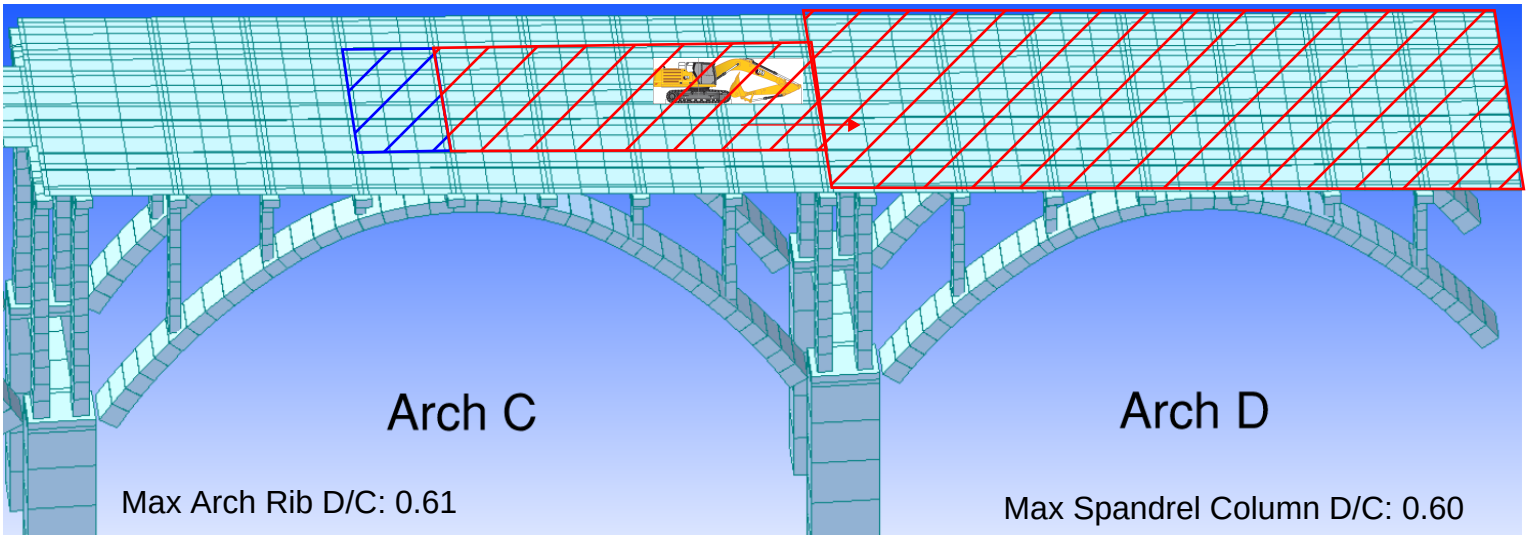

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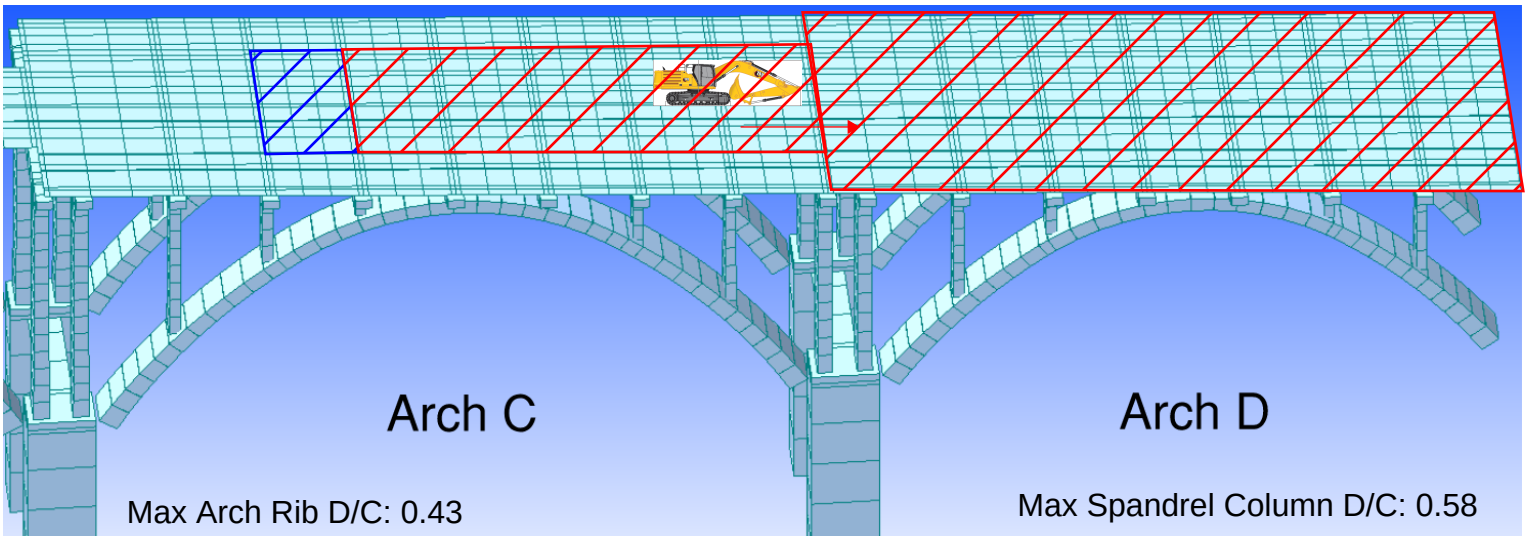
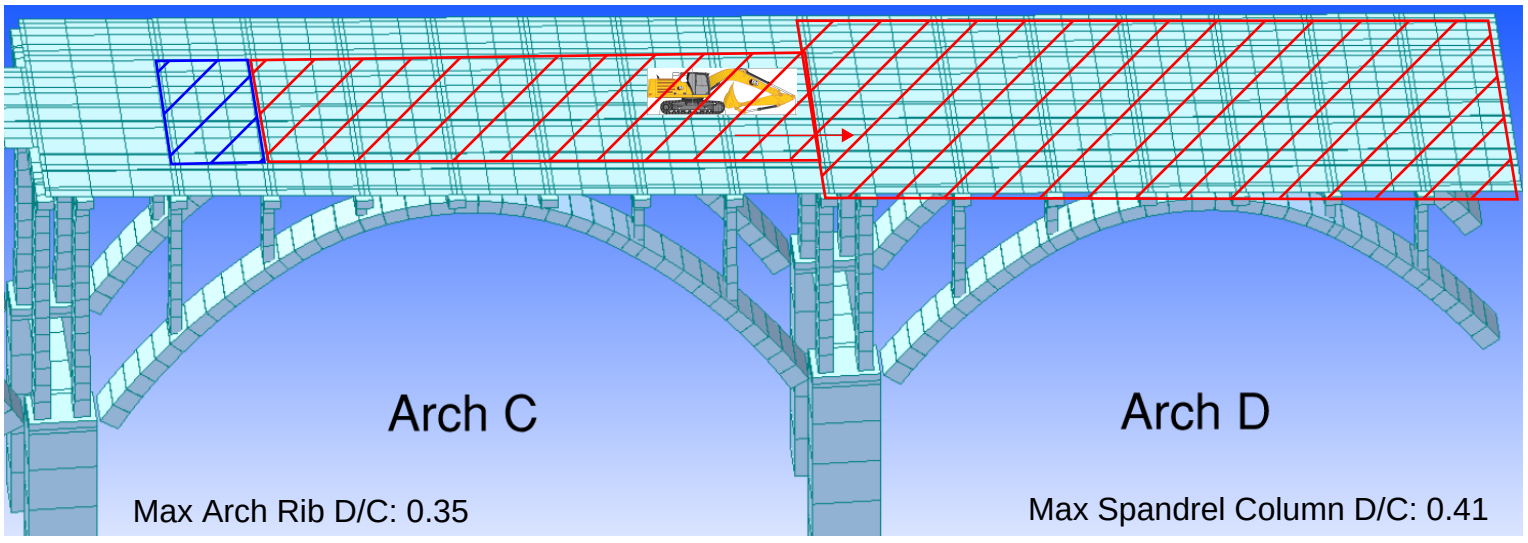


BEL 40 Iteration 3 Deck Reconstruction Analysis Stage 31.mcb



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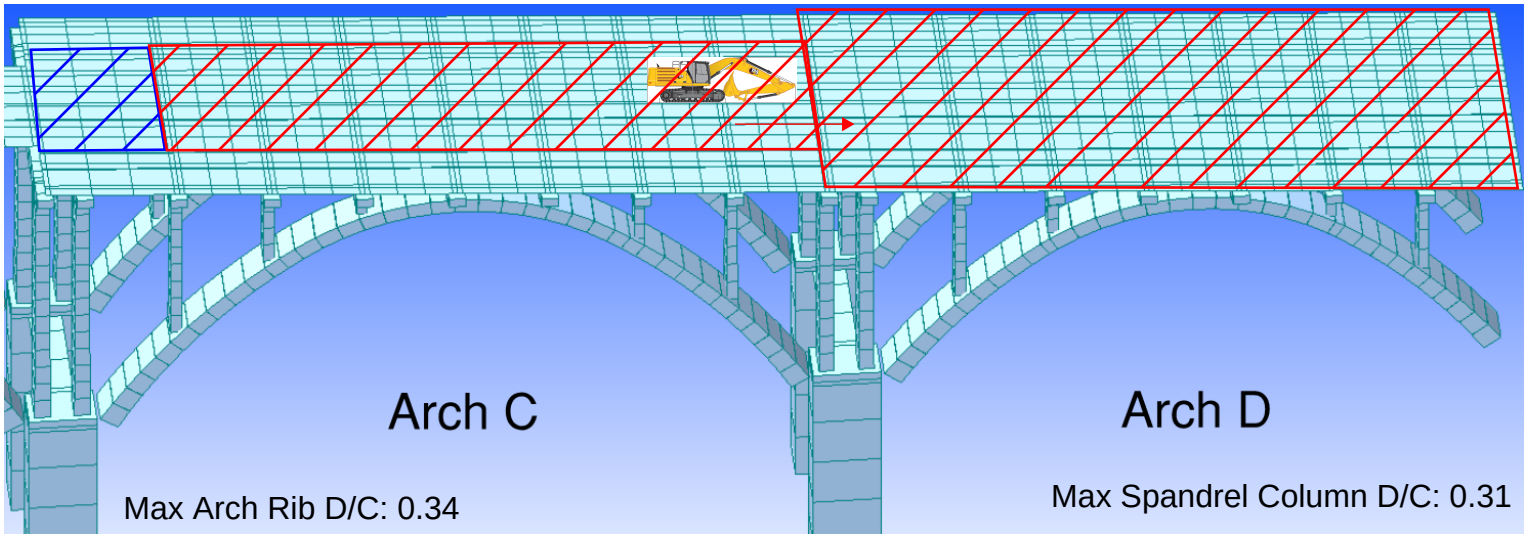
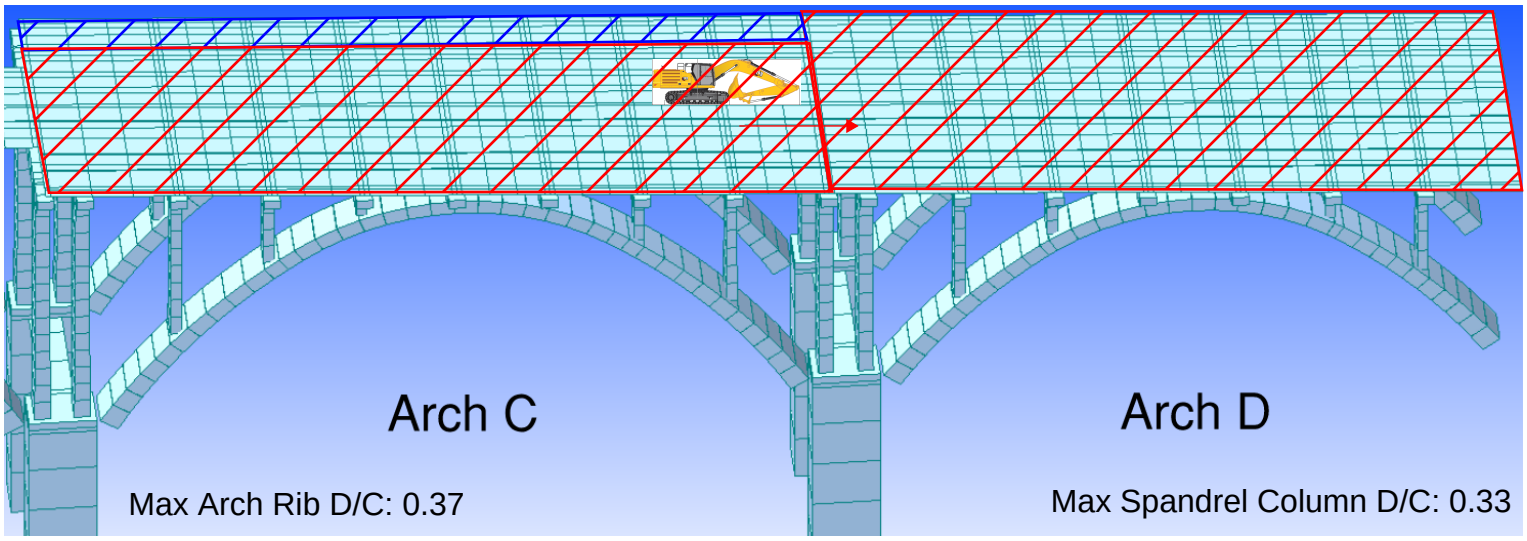


BEL 40 Iteration 3 Deck Reconstruction Analysis Stage 33.mcb



BEL 40 Iteration 3 Deck Reconstruction Analysis Stage 34.mcb

Tables | Works | Group | Report

- Works
  - Analysis Control Data
    - Moving Load Analysis Data [Method=Exact]
    - Construction Stage Analysis [Stage=Last]
  - Structures
    - Nodes : 6908
    - Elements : 5940
  - Properties
    - Material : 4
    - Section : 367
    - Section Stiffness Scale Factor
    - Thickness : 1
  - Boundaries
    - Supports : 32
    - Elastic Link : 1536
    - Plate End Release : 1701
  - Static Loads
    - Static Load Case 1 [Self Weight ;]
    - Static Load Case 2 [Deflector Type Parapet ; Deflector Type Parapet]
    - Static Load Case 3 [Sidewalk Type Parapet ; Sidewalk Type Parapet]
    - Static Load Case 4 [Sidewalk ; Sidewalk]
    - Static Load Case 5 [Deck ; Deck]
    - Static Load Case 6 [Overlay ; Overlay]
    - Static Load Case 7 [Construction Dead Load ; Construction Dead Load]
    - Static Load Case 8 [Construction Live Load ; Construction Live Load]
    - Static Load Case 9 [Braking Force ; Braking Force]
    - Static Load Case 10 [Crane Mats ; Crane Mats]
  - Moving Load Analysis
    - Moving Load Code [AASHTO LRFD]
    - Traffic Surface Lanes : 2
      - Traffic Surface Lane 1 [Const From Left]
      - Traffic Surface Lane 2 [Const From Right]
    - Vehicles : 7
      - Vehicles 1 [Cat 336 ; User Defined]
      - Vehicles 2 [HL-93TDM ; Standard]
      - Vehicles 3 [HL-93TRK ; Standard]
      - Vehicles 4 [SU4 ; User Defined]
      - Vehicles 5 [SU5 ; User Defined]
      - Vehicles 6 [SU6 ; User Defined]
      - Vehicles 7 [SU7 ; User Defined]
    - Vehicle Classes : 1
      - Vehicle Class 1 [HL-93 VC]
    - Moving Load Cases : 2
      - Moving Load Case 1 [Arch A&B]
      - Moving Load Case 2 [Arch C&D]

updated the load combinations to reflect the loads present on the bridge during these construction stages.

```
LIST OF LOAD COMBINATIONS
=================================================================================================
NUM  NAME          ACTIVE             TYPE
               LOADCASE(FACTOR) +             LOADCASE(FACTOR) +             LOADCASE(FACTOR)
=================================================================================================
1    DC_C          Active             Add
           Self Weight( 1.000) +                  Deck( 1.000)
-------------------------------------------------------------------------------------------------
2    DW_C          Active             Add
   Construction Dead Lo( 1.000) + Construction Live Lo( 1.000) +           Crane Mats( 1.000)
-------------------------------------------------------------------------------------------------
3    FactoredDLDeflection  Active            Add
           Self Weight( 1.250) +                  Deck( 1.250) + Construction Dead Lo( 1.500)
 + Construction Live Lo( 1.500) +           Crane Mats( 1.500)
-------------------------------------------------------------------------------------------------
```

this load used to be the slab beam plus deck load. Now it is just the slab beam load (slab beams are 12" thick)

increased this load to account for weight of the HP sections

Modified to include SU4 truck and slightly lighter excavator tread loads as defined earlier in this pdf.

Added these moving load cases for the construction equipment moving from the left and right and meeting at the middle of the bridge

FHWA REGION	STATE	PROJECT	
5	OHIO		

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BEL-40-23.38

BEGIN WORK
STA. 106+14
BRM-2500(1)

*Add a 6" x 8" wood or W6 x 15.5 steel post set in 4" min. concrete encasement 2'-3" from the end of the concrete parapet. Use a back-up plate and spacer block.

For details see Standard Construction Drawings GR-3B (Type J)* and GR-4A. (Type T); 1 Item 606 Type 5, 12'6" L.F.

30'-6" | 46'-6" | 45'-6" | 141'-6" | 145'-6" | 132'-6" | 132'-6" | 118'-6" | 118'-6" | Joint Spacing | Pier Spacing

FLOW

82° R.

Sta. 106+34.00

Sta. 106+14.00 (BK)

107+00

110+00

111+00

End Approach Slab
Sta. 106+69.75

Sta. 106+64.50

2'-10½"

1'-0"

3'-0"

3'-0"

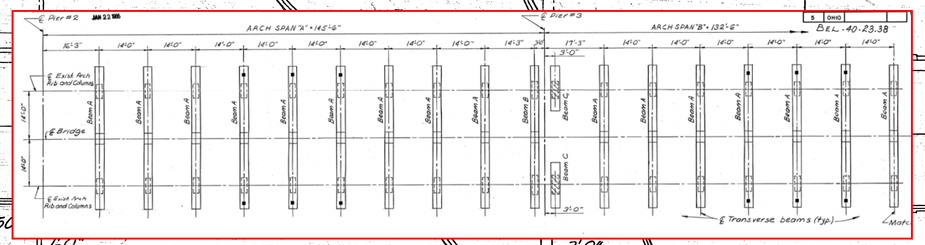
3'-0"

Sta. 106+27

For details see Standard Construction Drawings GR-3 and GR-4 (Type A); 1 Item 606 Type 5, 12'6" L.F.

CREEK

PLAN



BLAINE HILL VIADUCT LOCATION
USGS Map: Ohio - Belmont Co.
Lansing 7.5 Quadrangle
Latitude N 40° 04' 01"
Longitude W 80° 49' 16"

Sta. 106+34
Elev. 810.00
Sta. 106+44.25

Sta. 106+54.5
Elev. 808.57
Sta. 106+64.5
Elev. 807.87

Sta. 106+84.94
Elev. 806.43

Sta. 107+30.5
Elev. 803.25

Sta. 108+76
Elev. 793.06

Sta. 110+08.5
Elev. 783.79

Sta. 111+27
Elev. 775.49

Sta. 112+3[illegible]
Elev. 768.[illegible]

DETAIL "A"

West Abutment
Pier No. 1

ARCH "A"
ARCH "B"
ARCH "C"
ARCH "D"

-7.00% Grade

-7.00% Grade

TRAFFIC DATA (Highway)
Current ADT (1980) = 7,800
[illegible]) = 12,480

TRAFFIC
PH)

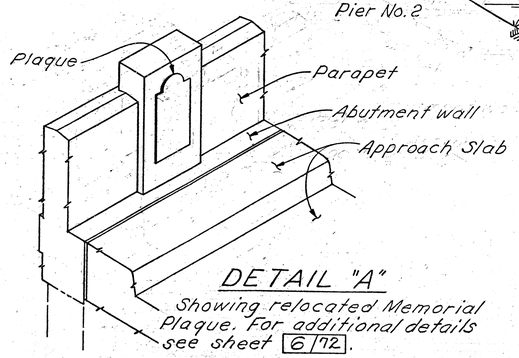
H.W. (1913) 725.0
H.W. (normal) 714.0

Existing ground line

Existing ground line

Pier No. 2
Pier No. 3
Pier No. 4
Pier No. 5
Pier No. 6

ELEVATION



DETAIL "A"
Showing relocated Memorial Plaque. For additional details see sheet 6/72.

NOTE:
Elevations shown opposite stationing are for ℄ Bridge.

Rev. 5-5-81

STATE OF OHIO
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GENERAL PLAN AND ELEVATION

BRIDGE NO. BEL-40-2338
OVER THE B. & O. RAILROAD
AND WHEELING CREEK

DESIGNED	DRAWN	TRACED	CHECKED	REVIEWED	DATE	REVISED
AJM	AJM		R.L.D.	WJJ	12-1-80	

FHWA REGION	STATE	PROJECT	
5	OHIO		

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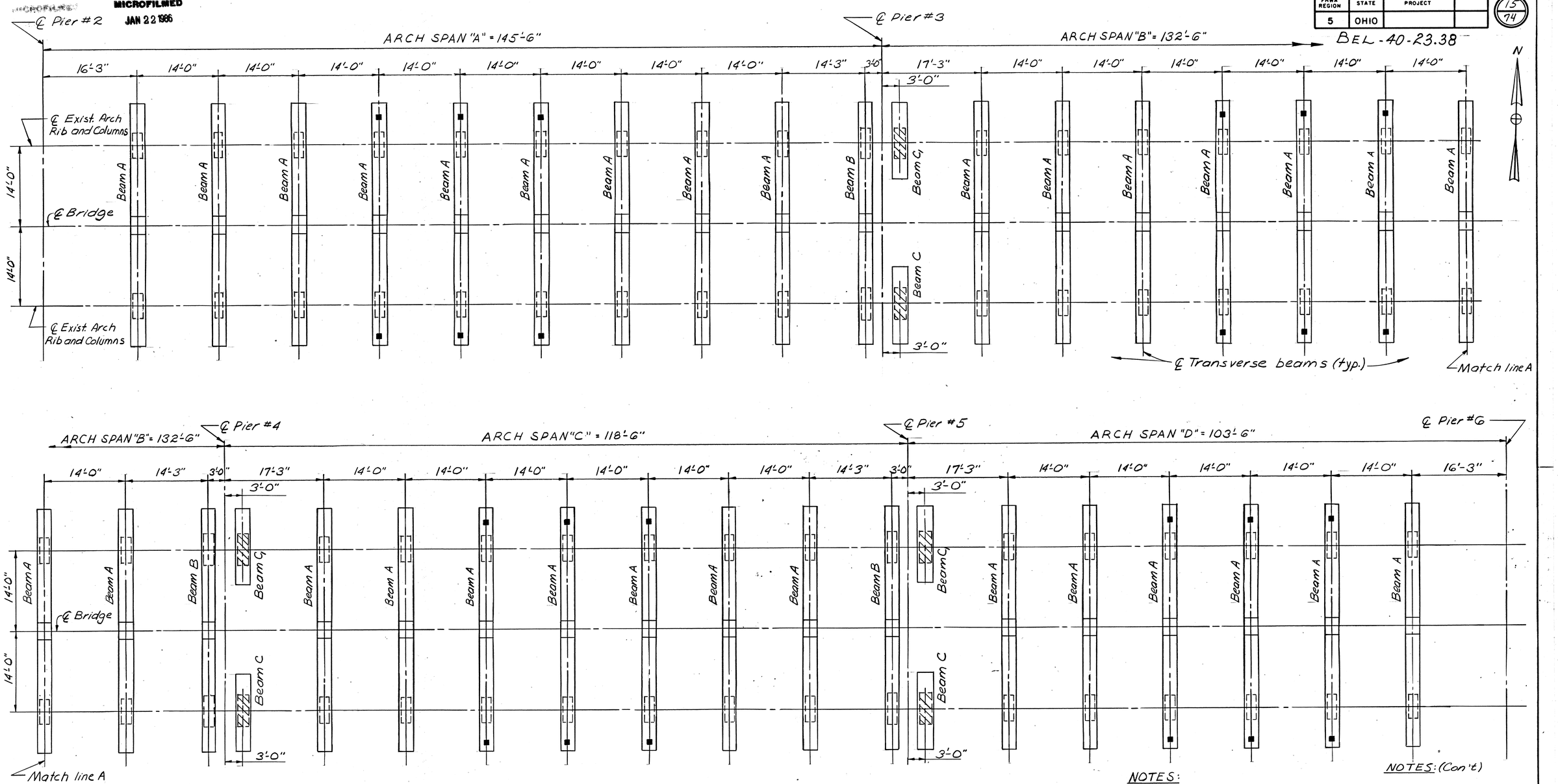

PRECAST TRANSVERSE BEAM PLAN

LEGEND:

Existing Pier Columns not used for load carrying. Beams C and C1 are used for architectural purposes.

Scupper location = ■

NOTES:

For beam details see sheet:
15/72 - Beam A
16/72 - Beam B
17/72 - Beams C and C1

For Scupper details see sheets 48/72 and 49/72.

For Transverse Beam elevations see sheets 28/72 to 35/72 incl.

All plan lengths shown are horizontal (typ., unless noted)

NOTES: (Con't)

Rev. 3-23-81

STATE OF OHIO
DEPARTMENT OF TRANSPORTATION
BUREAU OF BRIDGES AND STRUCTURAL DESIGN

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TRANSVERSE BEAM LAYOUT

BRIDGE NO. BEL-40-2338
OVER THE B. & O. RAILROAD
AND WHEELING CREEK

DESIGNED	DRAWN	TRACED	CHECKED	REVIEWED	DATE	REVISED
J.A.M.	J.A.M.		R.L.D.	W.J.J.	12-1-80	

FHWA REGION	STATE	PROJECT	
5	OHIO		

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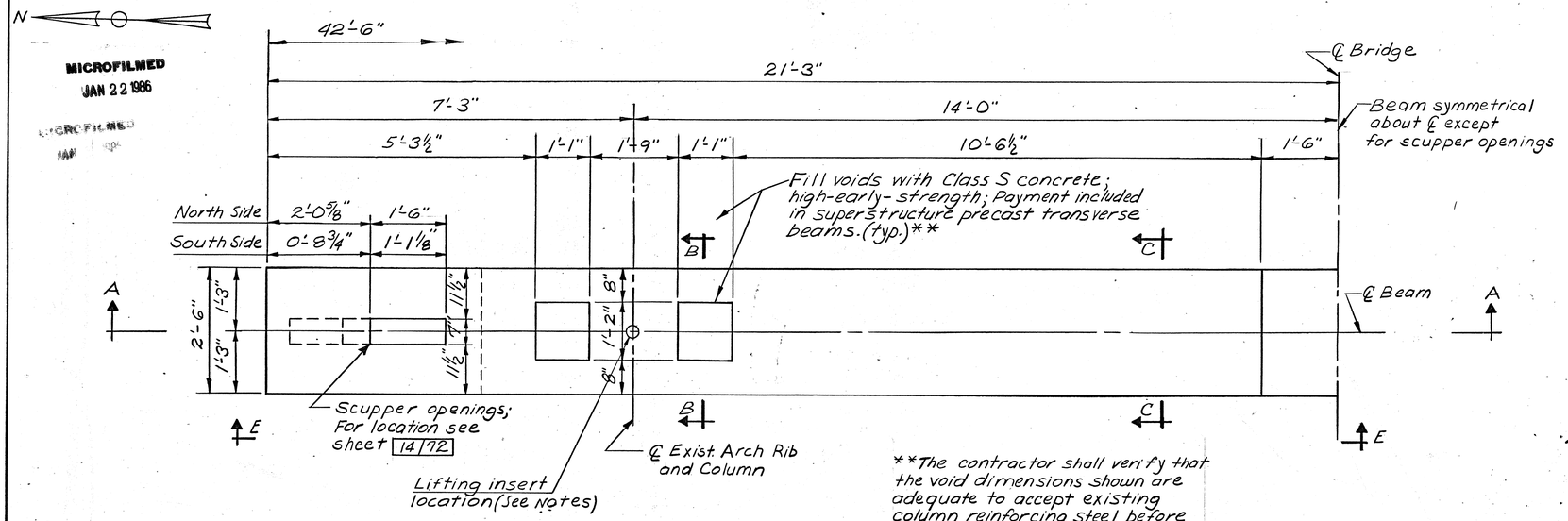
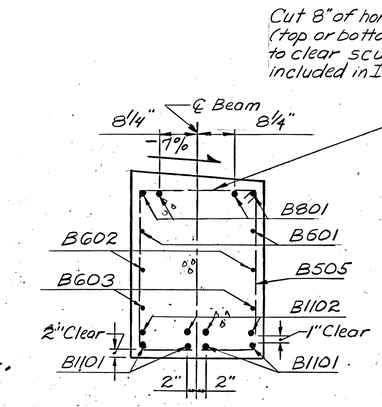
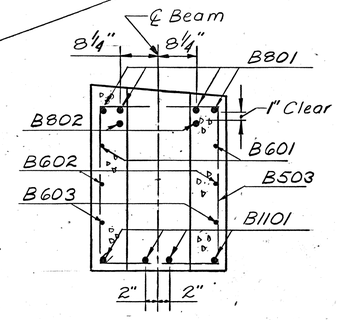


PLAN-BEAM A

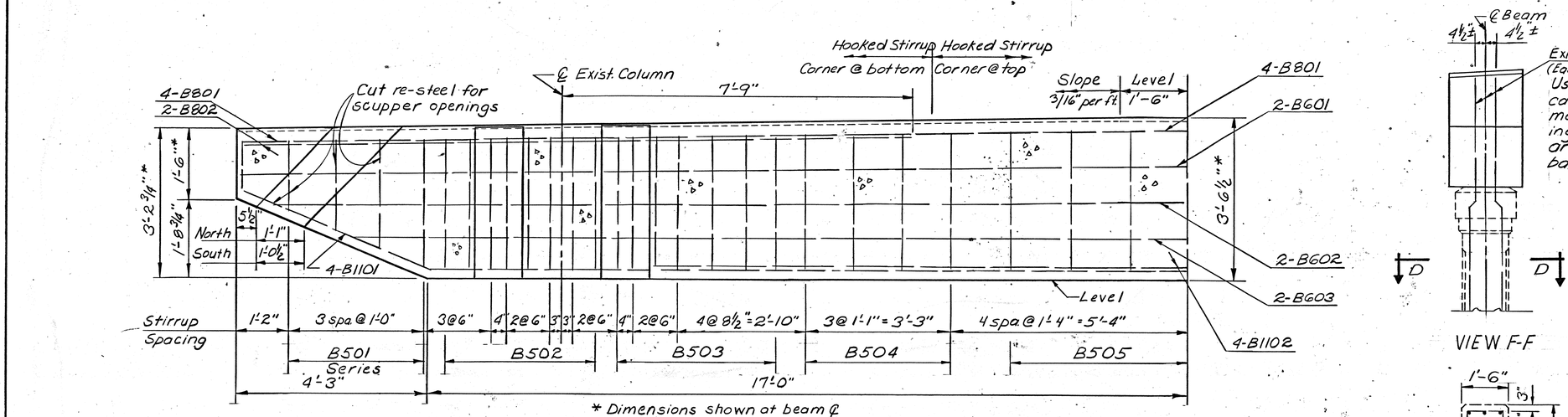
**The contractor shall verify that the void dimensions shown are adequate to accept existing column reinforcing steel before the beams are constructed.



SECTION C-C

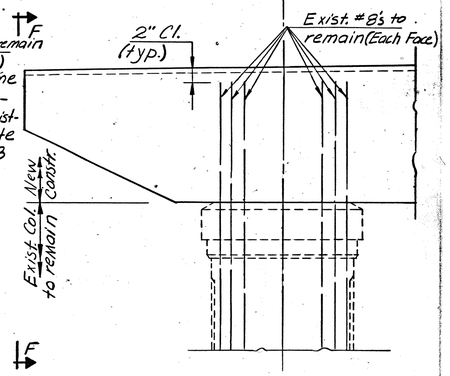


SECTION B-B

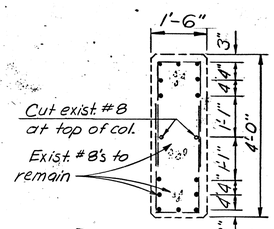


SECTION A-A
(Along Beam ℄)

VIEW F-F



PARTIAL VIEW E-E
(Showing Existing Column)



SECTION D-D

NOTES

LIFTING inserts shall be of the contractor's design approved by the Director. Cut it off close to the beam after erection. Payment included in transverse beams.

NOTES(con't)

SUPPORT locations during storage and transportation shall be under the lifting inserts. Ship, store upright

NOTES(con't)

FOR beam layout plan see sheet 14/72
FOR scupper details see sheets 48/72 and 49/72
BEAMS shall be precast
CONCRETE, Class S

STATE OF OHIO
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TRANSVERSE BEAM A DETAILS

BRIDGE NO. BEL-40-2338
OVER THE B. & O. RAILROAD
AND WHEELING CREEK

DESIGNED	DRAWN	TRACED	CHECKED	REVIEWED	DATE	REVISED
J.A.M.	J.A.M.		R.L.D.	WJJ	12-1-80	

FHWA REGION	STATE	PROJECT	
5	OHIO		

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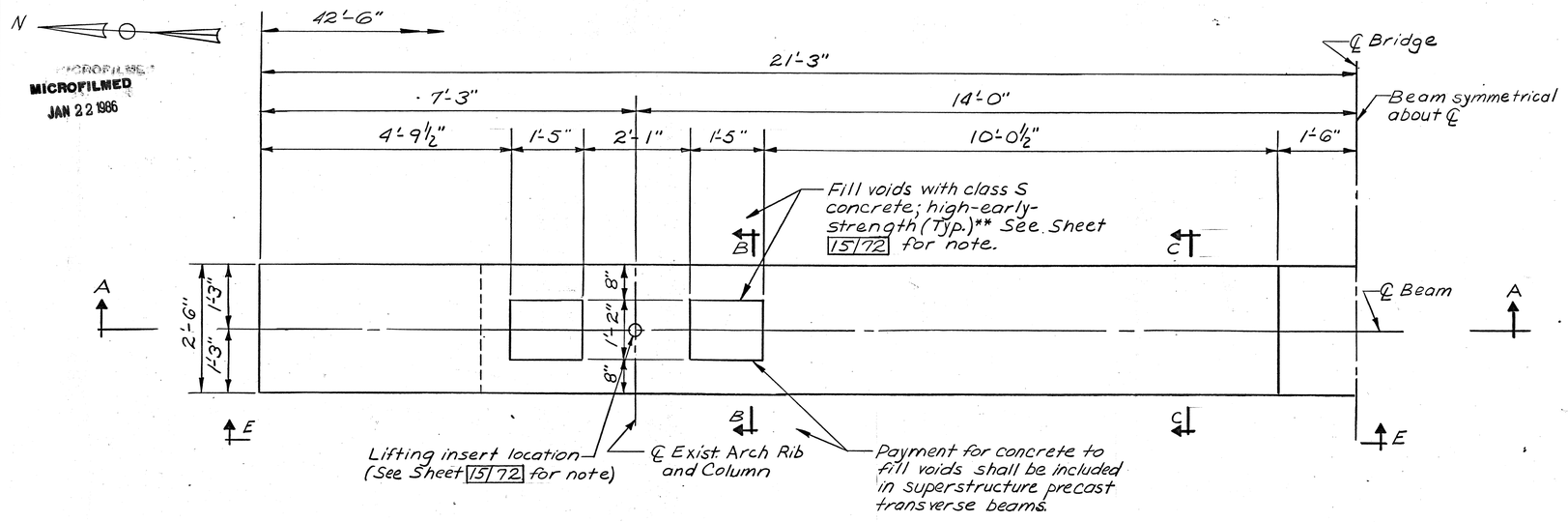
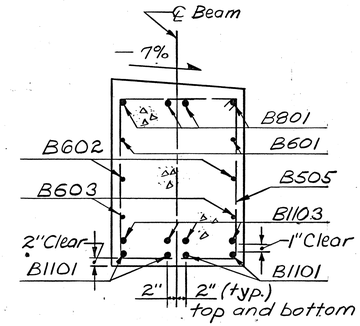
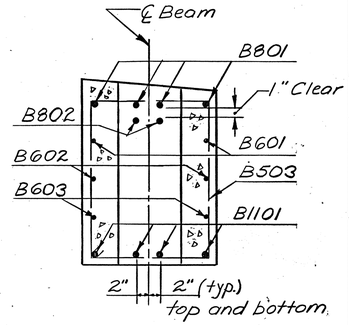


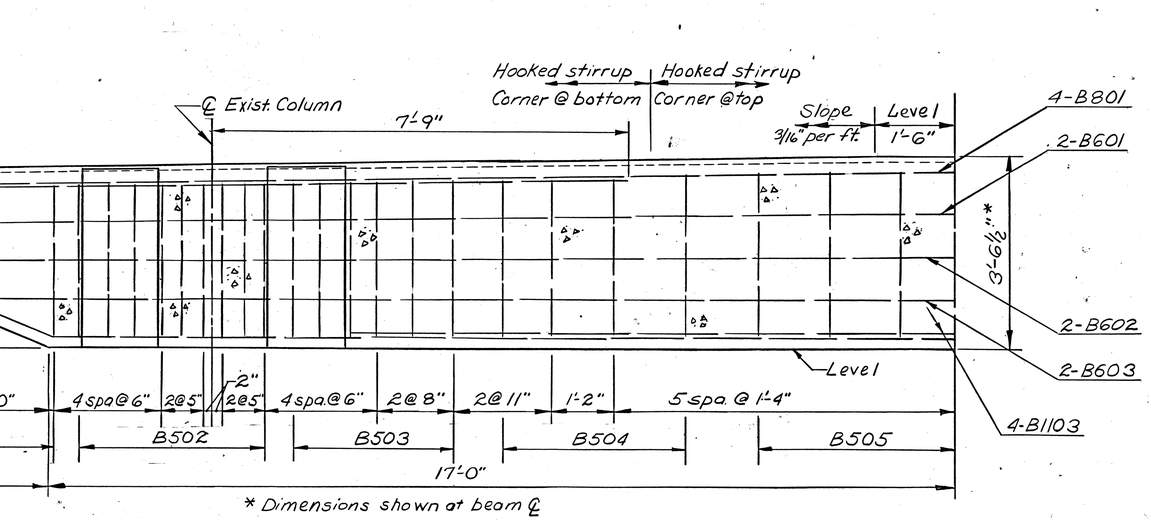
PLAN-BEAM B



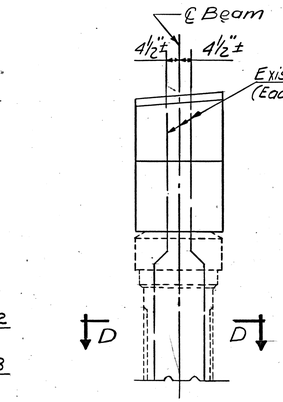
SECTION C-C



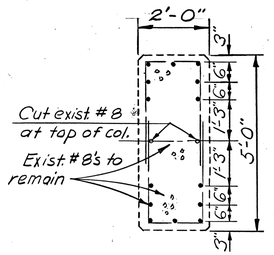
SECTION B-B



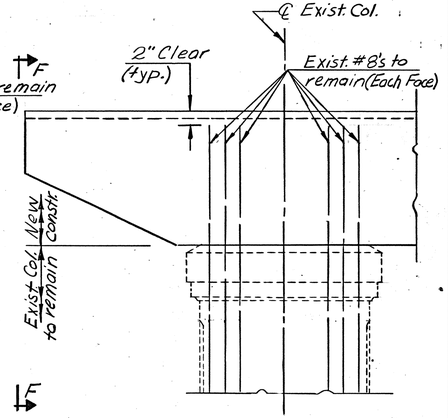
SECTION A-A
(Along Beam ℄)



VIEW F-F



SECTION D-D



PARTIAL VIEW E-E
(Showing Existing Column)

NOTES

BEAMS shall be precast CONCRETE, Class S
FOR beam layout plan see sheet 14/72

STATE OF OHIO
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TRANSVERSE BEAM B DETAILS

BRIDGE NO. BEL-40-2338
OVER THE B. & O. RAILROAD
AND WHEELING CREEK

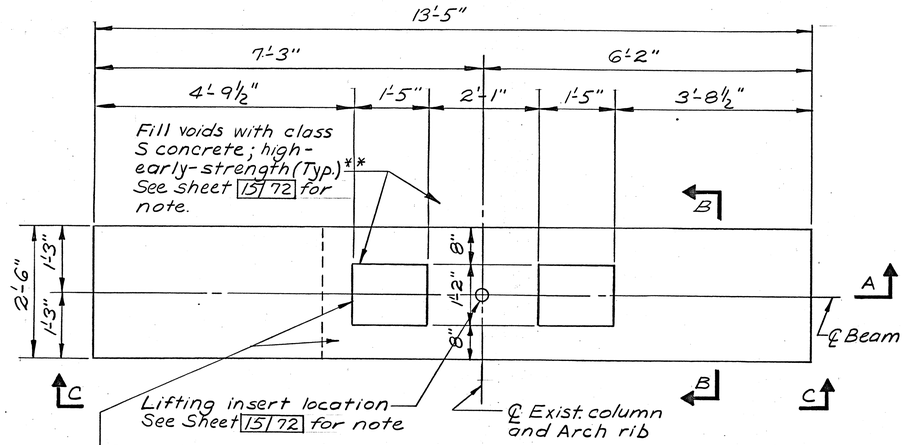
DESIGNED	DRAWN	TRACED	CHECKED	REVIEWED	DATE	REVISED
J.A.M.	J.A.M.		R.L.D	WJJ	12-1-80	

FHWA REGION	STATE	PROJECT	
5	OHIO		

18/74

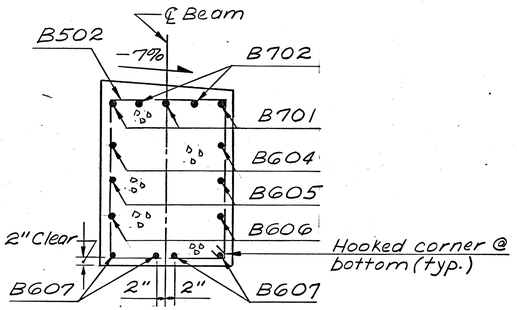
BEL-40-23.38

N

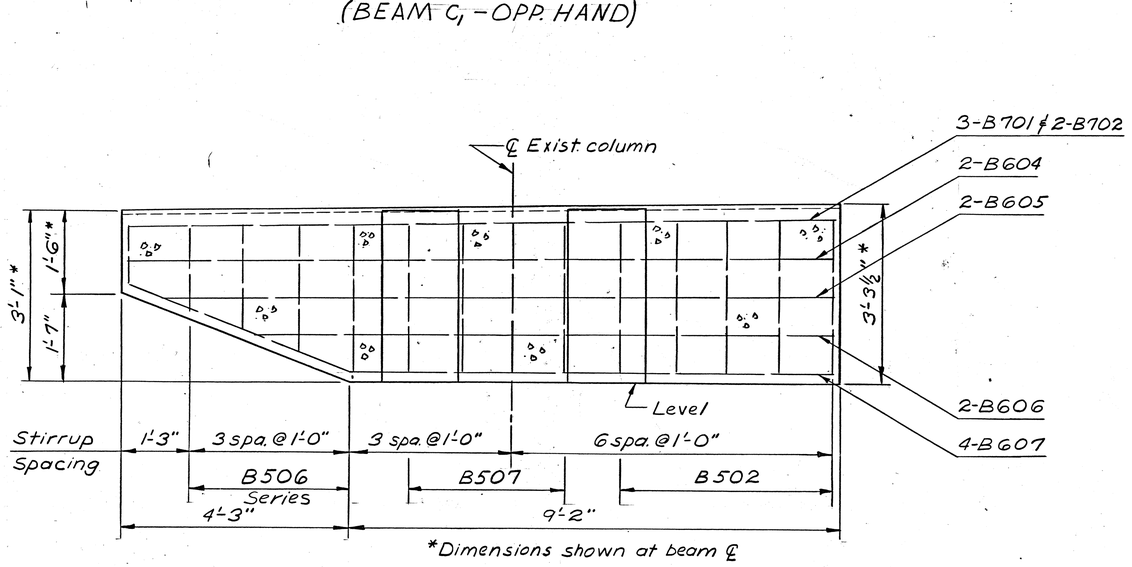


Payment for concrete to fill voids shall be included in superstructure precast transverse beams.

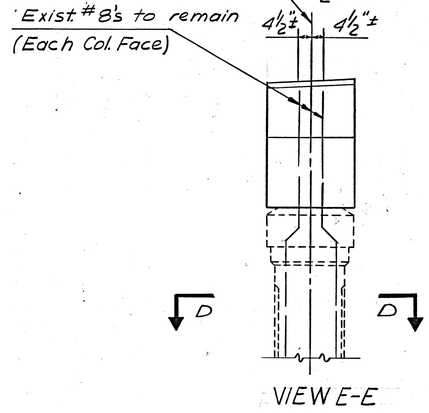
PLAN-BEAM C
(BEAM C, - OPP. HAND)



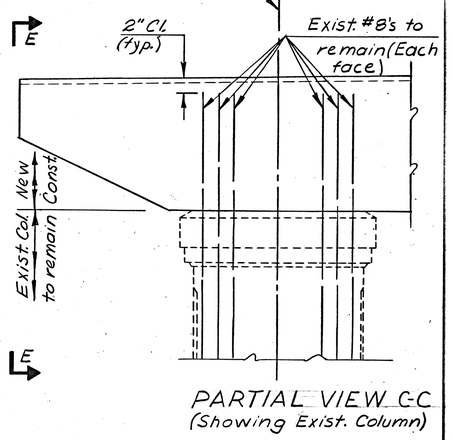
SECTION B-B



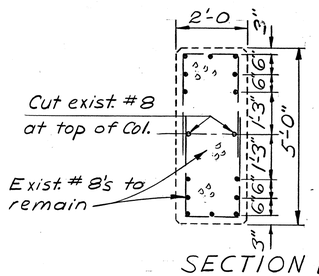
SECTION A-A
(Along Beam ℄)



VIEW E-E



PARTIAL VIEW C-C
(Showing Exist. Column)



SECTION D-D

NOTES

FOR beam layout plan see sheet 14/72

BEAMS shall be precast CONCRETE, Class S

STATE OF OHIO
DEPARTMENT OF TRANSPORTATION
BUREAU OF BRIDGES AND STRUCTURAL DESIGN

17/72

TRANSVERSE BEAMS C&G, DETAILS

BRIDGE NO. BEL-40-2338
OVER THE B. & O. RAILROAD
AND WHEELING CREEK

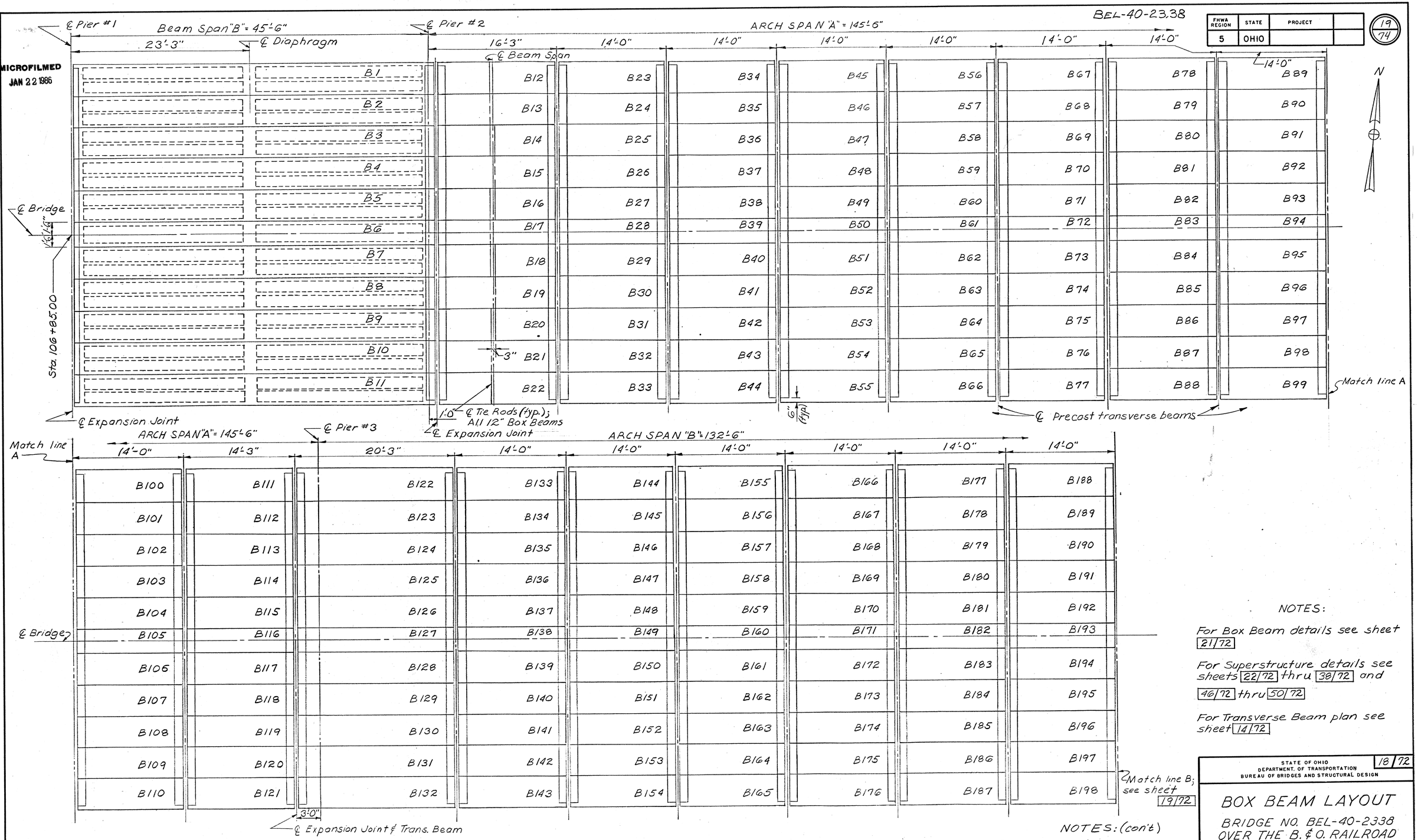
DESIGNED	DRAWN	TRACED	CHECKED	REVIEWED	DATE	REVISED
J.A.M.	J.A.M.		R.L.D.	WJJ	12-1-80	

1-02.77

BEL-40-23.38

FHWA REGION	STATE	PROJECT	
5	OHIO		

19/74



PRESTRESSED CONCRETE BEAM PLAN

NOTES:

For Box Beam details see sheet 21/72

For Superstructure details see sheets 22/72 thru 38/72 and 46/72 thru 50/72

For Transverse Beam plan see sheet 14/72

NOTES: (con't)

Box beams shall have the same identification marks on the shop drawings as on the project plans.

STATE OF OHIO
DEPARTMENT OF TRANSPORTATION
BUREAU OF BRIDGES AND STRUCTURAL DESIGN

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BOX BEAM LAYOUT

BRIDGE NO. BEL-40-2338
OVER THE B. & O. RAILROAD
AND WHEELING CREEK

DESIGNED	DRAWN	TRACED	CHECKED	REVIEWED	DATE	REVISED
J.A.M.	J.A.M.		R.L.D.	WJJ	12-1-80	

FHWA REGION	STATE	PROJECT	
5	OHIO		

20/74

BEL-40-23.38

ARCH SPAN "B" = 132'-6" | ℄ PIER #4 | ARCH SPAN "C" = 118'-6"

14'-0" | 14'-3" | 20'-3" | 14'-0" | 14'-0" | 14'-0" | 14'-0" | 14'-0" | 14'-0" | 14'-3"

Match line B; see sheet 18/72

B199	B210	B221	B232	B243	B254	B265	B276	B287	B298
B200	B211	B222	B233	B244	B255	B266	B277	B288	B299
B201	B212	B223	B234	B245	B256	B267	B278	B289	B300
B202	B213	B224	B235	B246	B257	B268	B279	B290	B301
B203	B214	B225	B236	B247	B258	B269	B280	B291	B302
B204	B215	B226	B237	B248	B259	B270	B281	B292	B303
B205	B216	B227	B238	B249	B260	B271	B282	B293	B304
B206	B217	B228	B239	B250	B261	B272	B283	B294	B305
B207	B218	B229	B240	B251	B262	B273	B284	B295	B306
B208	B219	B230	B241	B252	B263	B274	B285	B296	B307
B209	B220	B231	B242	B253	B264	B275	B286	B297	B308

℄ Bridge

1'-1½"

℄ Pier #5

℄ Expansion Joint and Transverse beam

3'-0"

6" (typ.)

℄ Pier #6

℄ Precast Trans. Beam (typ.)

℄ Expansion Joint ℄ Trans. Beam

3'-0"

℄ Pier #5

Match line C

Match line C

℄ Pier #5

N

ARCH SPAN "D" = 103'-6"

20'-3" | 14'-0" | 14'-0" | 14'-0" | 14'-0" | 14'-0" | 15'-3" | 1'-0"

Match line C

B309	B320	B331	B342	B353	B364	B375
B310	B321	B332	B343	B354	B365	B376
B311	B322	B333	B344	B355	B366	B377
B312	B323	B334	B345	B356	B367	B378
B313	B324	B335	B346	B357	B368	B379
B314	B325	B336	B347	B358	B369	B380
B315	B326	B337	B348	B359	B370	B381
B316	B327	B338	B349	B360	B371	B382
B317	B328	B339	B350	B361	B372	B383
B318	B329	B340	B351	B362	B373	B384
B319	B330	B341	B352	B363	B374	B385

℄ Bridge

3'-0"

Match line D; see sheet 20/72

℄ Expansion Joint

PRESTRESSED CONCRETE BEAM PLAN

FOR notes see sheet 18/72

STATE OF OHIO
DEPARTMENT OF TRANSPORTATION
BUREAU OF BRIDGES AND STRUCTURAL DESIGN

19/72

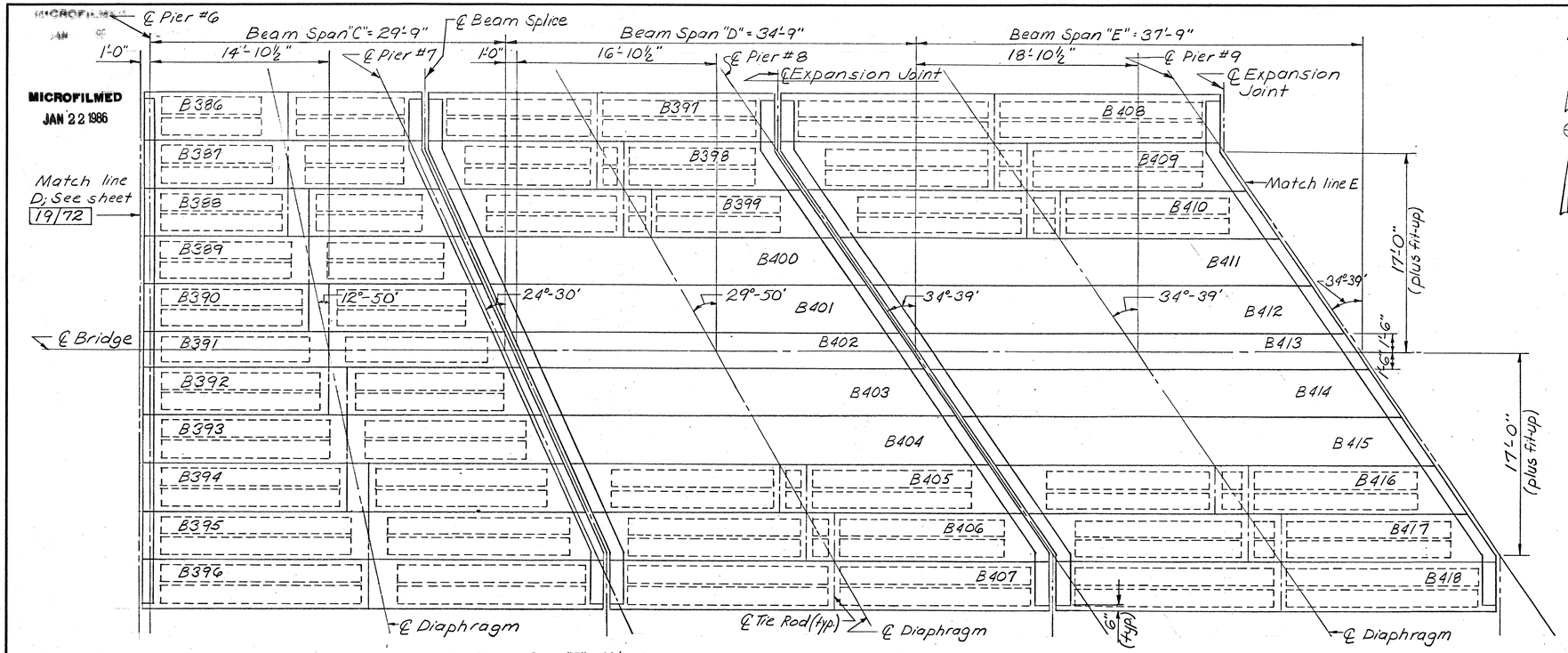
BOX BEAM LAYOUT

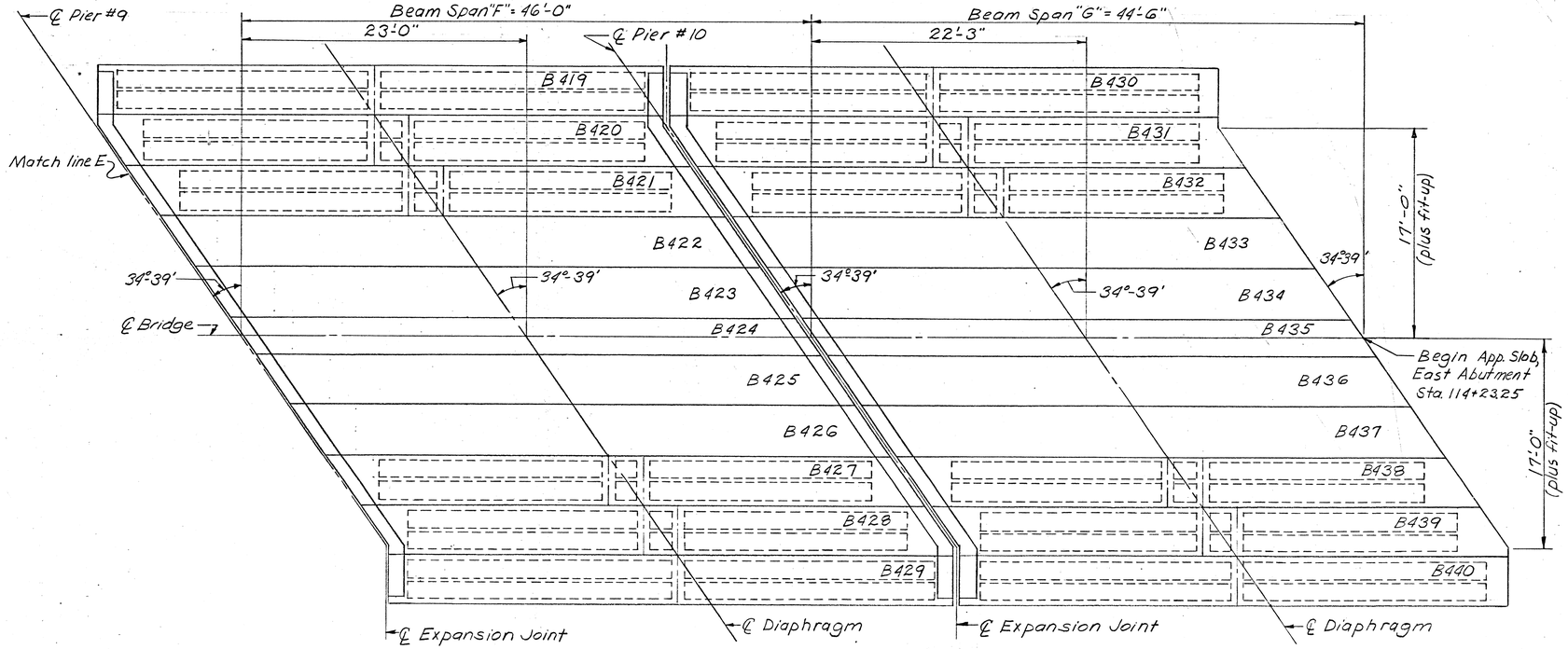
BRIDGE NO. BEL-40-2338
OVER THE B. & O. RAILROAD
AND WHEELING CREEK

DESIGNED	DRAWN	TRACED	CHECKED	REVIEWED	DATE	REVISED
J.A.M.	J.A.M.		R.L.D.	WJJ	12-1-80	

FHWA REGION	STATE	PROJECT	
5	OHIO		

BEL-40-23.38





PRESTRESSED CONCRETE BEAM PLAN

For notes see sheet 18/72

STATE OF OHIO
DEPARTMENT OF TRANSPORTATION
BUREAU OF BRIDGES AND STRUCTURAL DESIGN

20/72

BOX BEAM LAYOUT

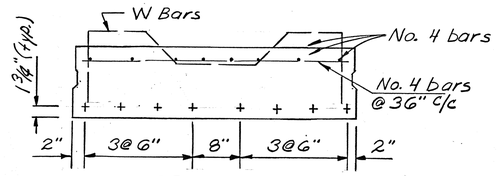
BRIDGE NO. BEL-40-23.38
OVER THE B. & O. RAILROAD
AND WHEELING CREEK

DESIGNED	DRAWN	TRACED	CHECKED	REVIEWED	DATE
J.A.M.	J.A.M.		R.L.D.	WJJ	12-1

FHWA REGION	STATE	PROJECT	
5	OHIO		

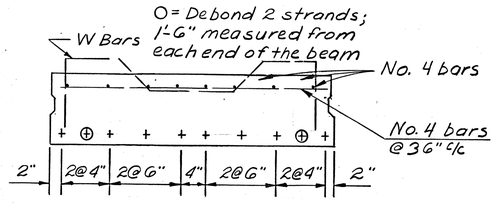
22/74

BEL-40-23.38



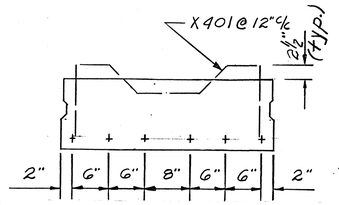
CB 12-48
(8 Strands)

All beams in Arch Spans A,B,C,D except B122 to B132 Incl.; B221 to B231 Incl.; B309 to B319 Incl.; and B17, B28, B39, B50, B61, B72, B83, B94, B105, B116, B138, B149, B160, B171, B182, B193, B204, B215, B231, B248, B259, B270, B281, B292, B303, B325, B336, B347, B358, B369, B380



CB 12-48
(10 Strands)

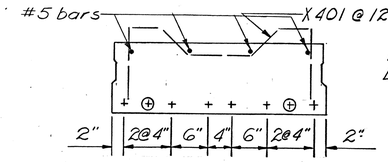
Beams B122 to B126 Incl.; B128 to B132 Incl.; B221 to B225 Incl.; B227 to B231 Incl.; B309 to B313 Incl.; B315 to B319



B 12-36
(6 Strands)

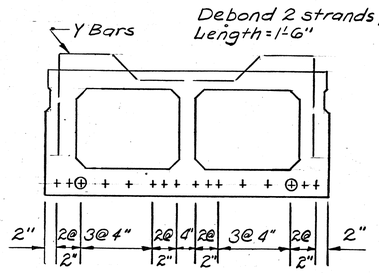
Beams B17, B28, B39, B50, B61, B72, B83, B94, B105, B116, B138, B149, B160, B171, B182, B193, B204, B215, B237, B248, B259, B270, B281, B292, B303, B325, B336, B347, B358, B369, B380
(modified for composite construction)

Dimensions and reinforcing not shown is the same as for B12-36 (8 Strands, this sheet)



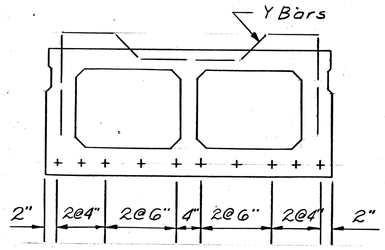
B 12-36
(8 Strands)

Beams B127, B226, B314
(modified for composite construction)



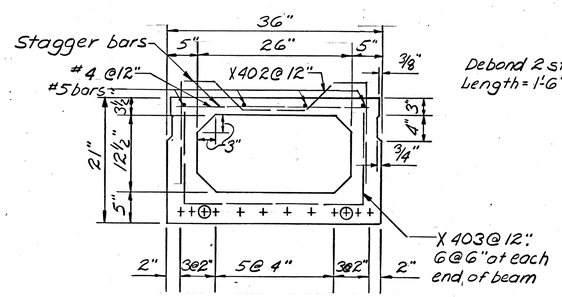
CB 21-48
(16 Strands)

Beams B1 to B5 Incl.; B7 to B11 Incl.; B419 to B423 Incl.; B425 to B429 Incl.; B430 to B434 Incl.; B436 to B440 Incl.



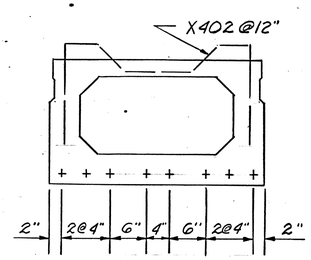
CB 21-48
(10 Strands)

Beams B386 to B390 Incl.; B392 to B396 Incl.; B397 to B401 Incl.; B403 to B407 Incl.; B408 to B412 Incl.; B414 to B418 Incl.



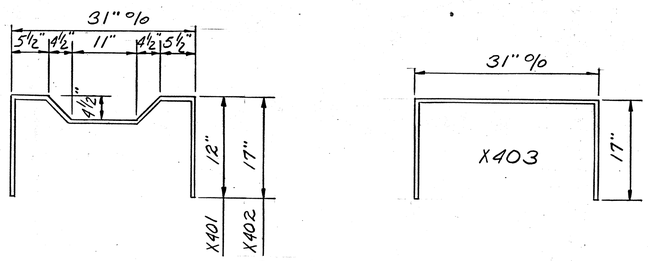
B 21-36
(12 Strands)
(modified for composite construction)
Beams B6, B424, B435

Debond 2 strands; Length=1'-6"

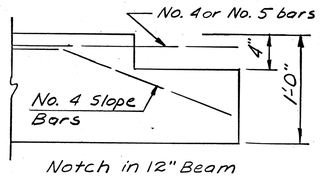


B 21-36
(8 Strands)
(modified for composite construction)
Beams B391, B402, B413

Dimensions and reinforcement not shown is the same as for B21-36 (12 Strands)



Bending Diagrams
(Bars X401, X402, W, Y shall be epoxy coated. Payment included in Item 515)



Notch in 12" Beam

Additional Top Bars Each End

Beam	Bar Size	No. Req'd	Length
CB 21-48 (16 Strands)	#4	7	9'-6"
CB 21-48 (10 Strands)	#4	3	6'-0"
B 21-36 (12 Strands)	#5	3	8'-6"
B 21-36 (8 Strands)	#5	1	6'-6"

NOTES

For beam notches and dowel hole locations see sheets 26/72, 49/72, 26A/72,

For additional beam details see Std. Drwg. PSBD-1-71, Sheets 1, 2, 3

Top surface finish for composite members as per Item 515.06.

Sloping sides of beams at ℄ of bridge is not required.

Box beams are composite members

STATE OF OHIO
DEPARTMENT OF TRANSPORTATION
BUREAU OF BRIDGES AND STRUCTURAL DESIGN

21/72

BOX BEAM DETAILS

BRIDGE NO. BEL-40-2338
OVER THE B. & O. RAILROAD
AND WHEELING CREEK

DESIGNED	DRAWN	TRACED	CHECKED	REVIEWED	DATE	REVISED
J.A.M.	J.A.M.		R.L.D.	WJJ	12-1-80	-