Belmont 40 Arch Bridge Superstructure Demolition QC

Calculated: ETB 3/5/25
Checked: DBW 3/15/25

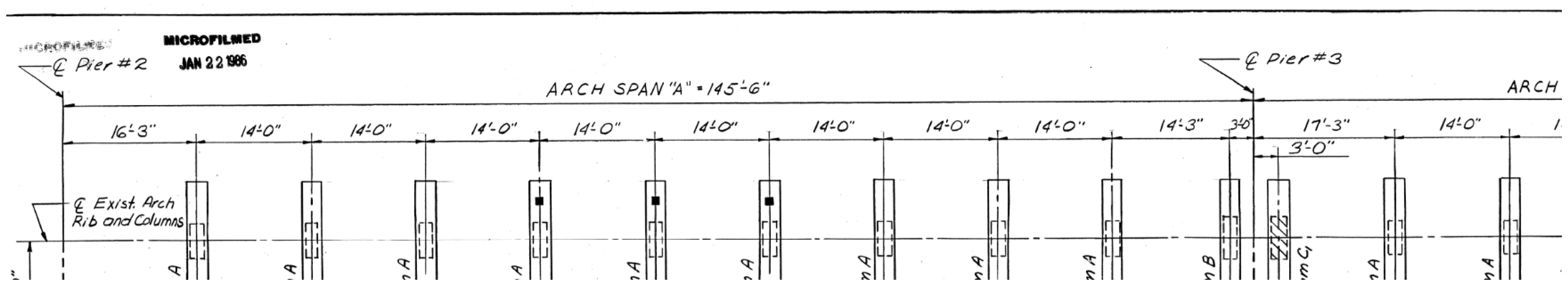
Information Provided By DBW

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

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

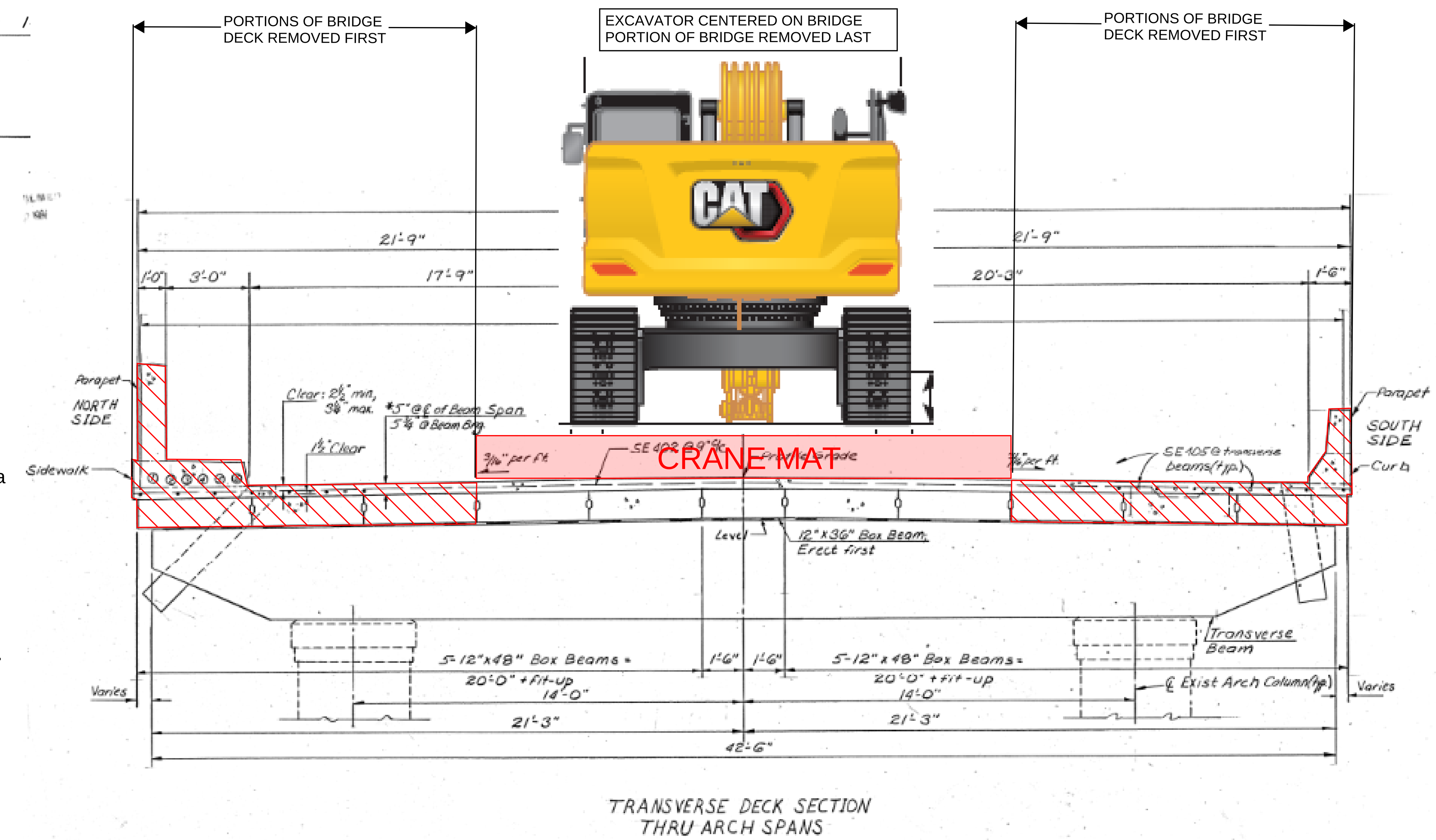
APPLY CONSTRUCTION LIVE LOAD (CR) OF CAT 336 EXCAVATOR: 81,000 lb (ON 2 TRACKS APPROX. 13' LONG) AND JOHN DEERE 744 WHEEL LOADER 57,000LB (ON TWO AXLES APPROX. 11'-3"). SPACE THE EXCAVATOR AND WHEEL LOADER AXLES 20' APART.



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'x1.5' = 18k) and has an axle spacing of 13.25'. Total axle load is 49.5k. Wheel loader weight is 57kips + 18k (slab beam) for a total axle load of 37.5k and spaced 11.25' apart. Keep a minimum distance of 20' between excavator and wheel loader.
-Assume the excavator/loader is primarily confined to the CL of the bridge. The excavator will pick each slab beam and travel to the loader, which will travel longitudinally along the bridge with each pick to place it off the bridge. 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 + wheel loader: 0.1*(49.5k*2+37.5k*2)/42.5' = 0.41klf 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. Therefore the outer three slab beams, along with the parapets and sidewalk, will be removed in their entirety before any other interior slab beams are removed. The outer slab beams will be removed evenly. See below for the arch code check's superstructure removal. These correspond to the sketches on the next page. Hatched regions are those where the slab beams and any overlay/sidewalk/deck/parapet above the slab beam has also been removed. Red hatch indicates portions of superstructure removed during current stage. Blue hatch indicates portions of superstructure previously removed.
-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 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 + John Deere 744

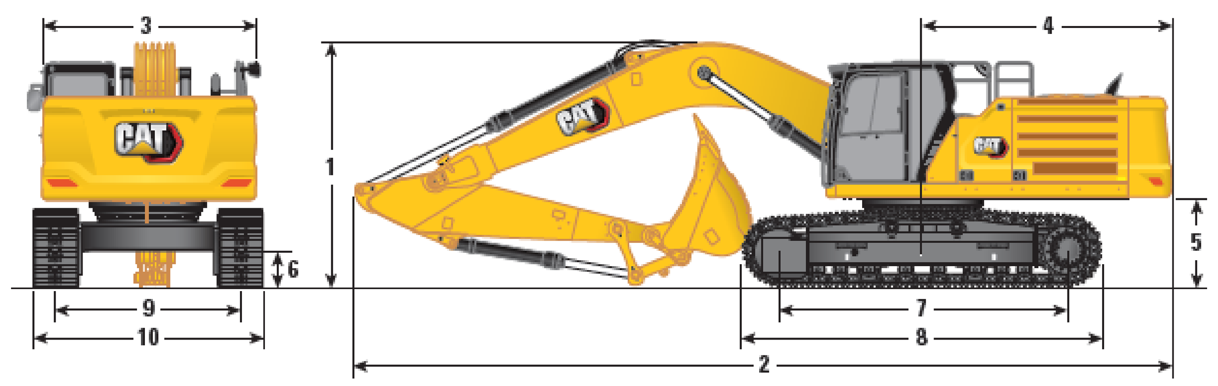
IM = DYNAMIC ALLOWANCE (10%)
TU = UNIFORM TEMPERATURE FORCE EFFECT
WS = WIND LOAD ON STRUCTURE DURING CONSTRUCTION ("INACTIVE" WIND)
CW = CONSTRUCTION WIND LOAD ("ACTIVE" WIND OF 20 MPH)
IGNORE THERMAL AND WIND FOR INITIAL PROOF OF CONCEPT CHECKS
BR = 10% OF CR IN THE LONGITUDINAL DIRECTION

Information Provided By DBW

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

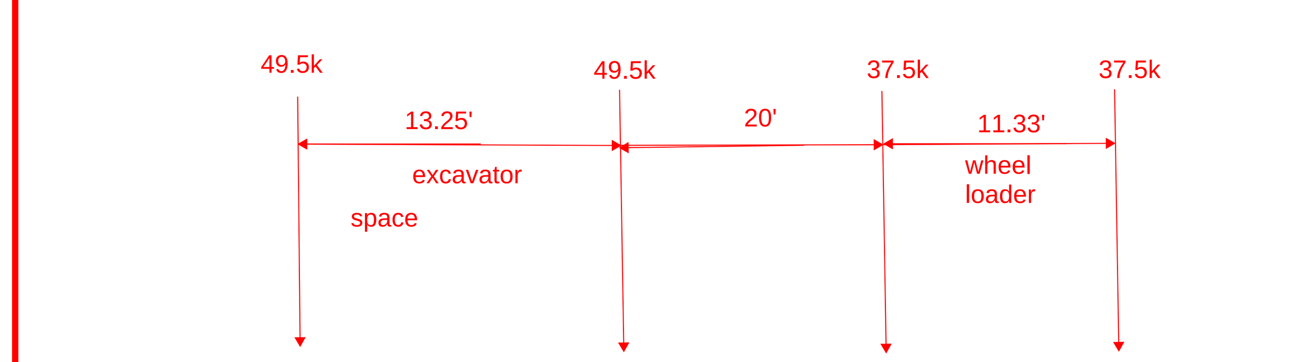
The air conditioning system on this machine contains the fluorinated greenhouse gas refrigerant R134a (Global Warming Potential = 1430). The system contains 1.00 kg of refrigerant, which has a CO_2 equivalent of 1.430 metric tonnes.

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')

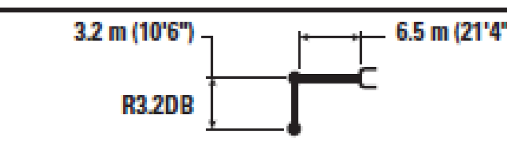
LIFT CAPACITY IS GREATER THAN 20,000 lb.

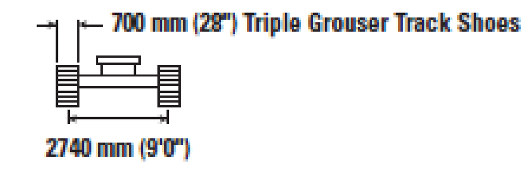
REPRESENTATIVE TRUCK DEFINED IN MIDAS
FOR EXCAVATOR PLUS WHEEL LOADER

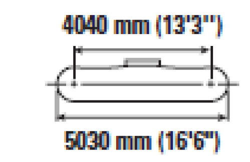


336 Hydraulic Excavator Specifications

Reach Boom Lift Capacities – Counterweight: 6.8 mt (15,000 lb) – without Bucket, Heavy Lift: On







		3000 mm (10'0")		4500 mm (15'0")		6000 mm (20'0")		7500 mm (25'0")		9000 mm (30'0")				mm ft/in
7500 mm	kg							*8750	7800			*7350	*7350	7700
25'0"	lb											*16,300	*16,300	24'11"
6000 mm	kg							*8900	7750			*7150	6150	8580
20'0"	lb							*19,450	16,650			*15,800	13,700	27'11"
4500 mm	kg			*13 500	*13 500	*10 900	10 600	*9550	7500	8200	5600	*7200	5500	9130
15'0"	lb					*23,550	22,800	*20,800	16,150			*15,850	12,100	29'10"
3000 mm	kg			*17 150	15 250	*12 600	10 000	*10 450	7250	8050	5500	*7500	5100	9410
10'0"	lb			*36,800	32,900	*27,250	21,600	*22,650	15,550	17,250	11,800	*16,500	11,250	30'10"
1500 mm	kg			*19 750	14 300	*14 100	9500	10 350	6950	7900	5350	7350	5000	9440
5'0"	lb			*42,550	30,800	*30,500	20,500	22,250	14,950	16,950	11,500	16,200	10,950	30'11"
0 mm	kg			*20 600	13 900	14 150	9200	10 150	6750	7800	5250	7500	5100	9220
0'0"	lb			*44,600	29,900	30,450	19,750	21,800	14,550	16,750	11,300	16,550	11,150	30'2"
–1500 mm	kg	*14 050	*14 050	*20 200	13 800	14 000	9050	10 000	6650			8100	5450	8750
–5'0"	lb	*31,800	*31,800	*43,800	29,700	30,100	19,450	21,550	14,350			17,800	11,950	28'7"
–3000 mm	kg	*22 200	*22 200	*18 750	13 950	14 050	9050	10 050	6700			9300	6200	7960
–10'0"	lb	*50,200	*50,200	*40,600	29,950	30,200	19,550	21,700	14,450			20,550	13,750	25'11"
–4500 mm	kg	*21 100	*21 100	*15 900	14 250	*12 050	9300					*10 200	7950	6750
–15'0"	lb	*45,450	*45,450	*34,150	30,650	*25,650	20,050					*22,400	17,800	21'10"

* ISO 10567:2007

* Indicates that the load is limited by hydraulic lifting capacity rather than tipping load. The above loads are in compliance with hydraulic excavator lift capacity standard ISO 10567:2007. They do not exceed 87% of hydraulic lifting capacity or 75% of tipping load. Weight of all lifting accessories must be deducted from the above lifting capacities. Lifting capacities are based on the machine standing on a firm, uniform supporting surface. The use of a work tool attachment point to handle/lift objects, could affect the machine lift performance.

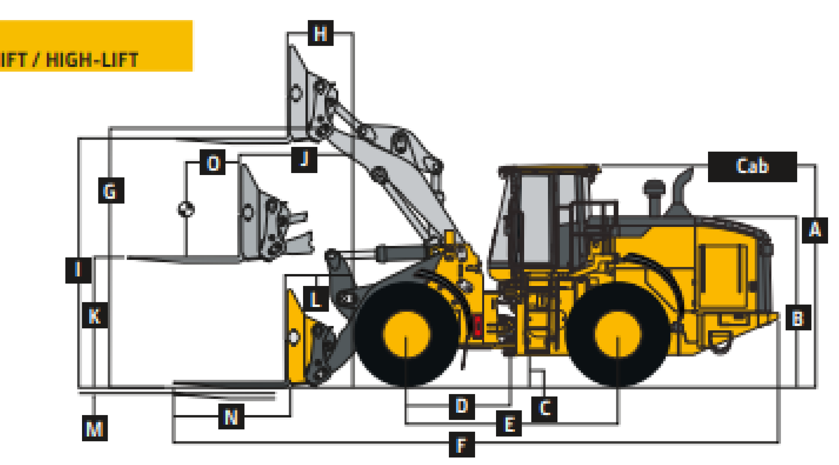
Lift capacity stays with ±5% for all available track shoes.

Always refer to the appropriate Operation and Maintenance Manual for specific product information.

While general information, pictures, and descriptions are provided, some illustrations and text may include product options and accessories NOT AVAILABLE in all regions, and in some countries products and accessories may require modifications or additions to ensure compliance with the local regulations of those countries.

744 P-TIER

Dimensions and Specifications With Coupler and Hook-On Construction Forks — **744 P-TIER STANDARD-LIFT / HIGH-LIFT**

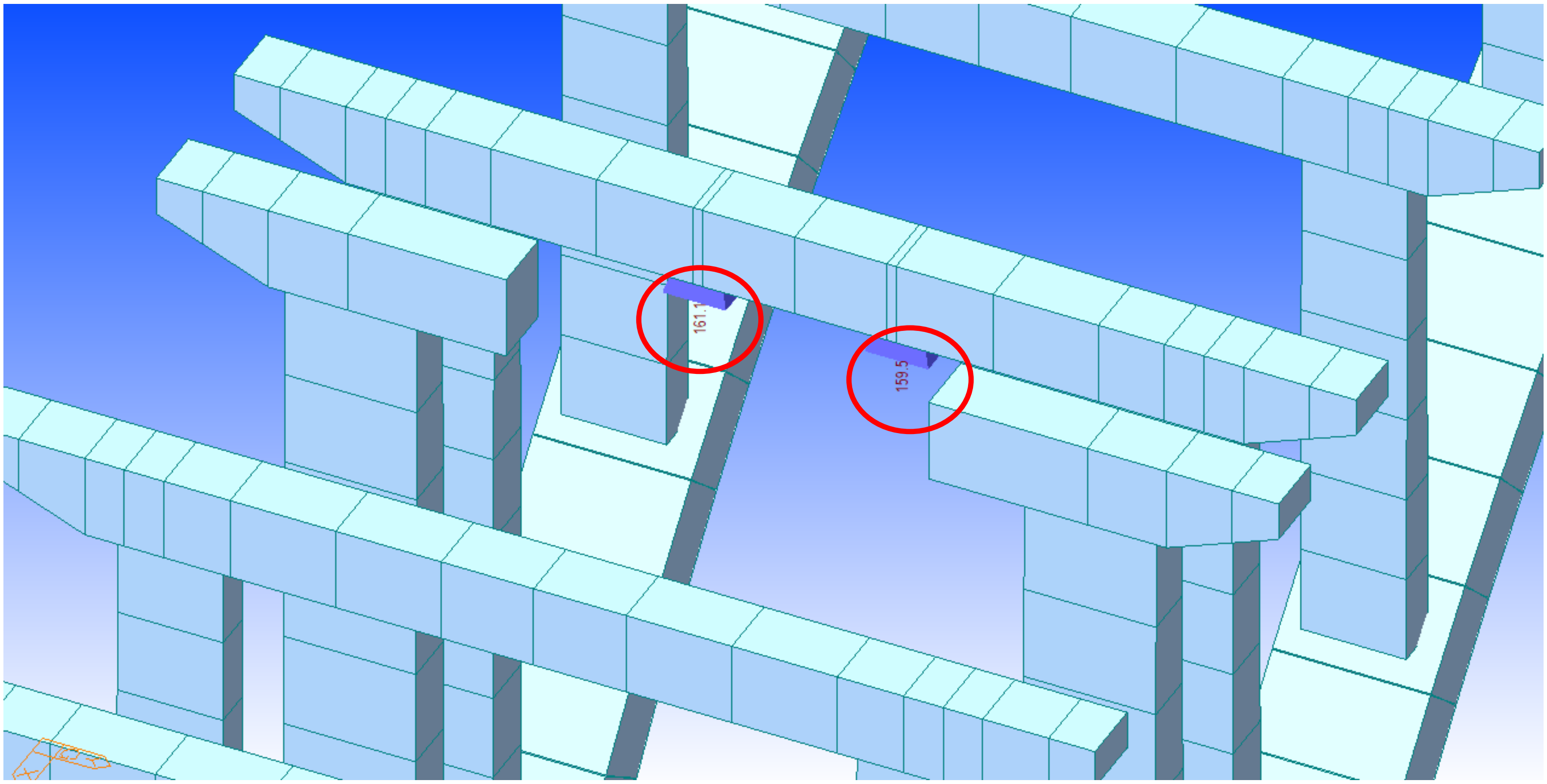


744 P-TIER STANDARD-LIFT AND HIGH-LIFT LOADERS WITH COUPLER AND HOOK-ON CONSTRUCTION FORKS

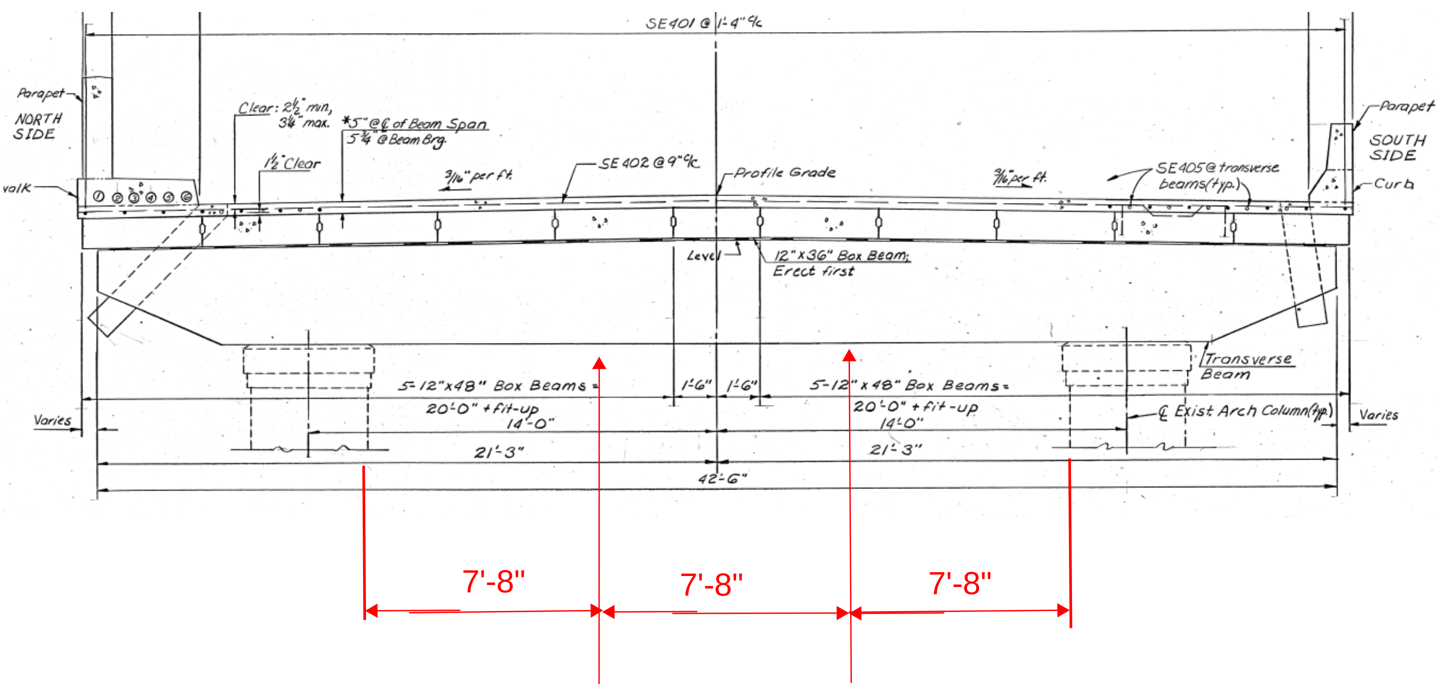
	EPA FT4/EU Stage V / EPA Tier 3/EU Stage IIIA		
	Standard-Lift	*Standard-Lift*	*High-Lift*
Dimensions With Forks	*1.83-m (72 in.) tine length*	*2.44-m (96 in.) tine length*	*1.83-m (72 in.) tine length*
A Height to Top of Cab	3.57 m (11 ft. 9 in.)	3.57 m (11 ft. 9 in.)	3.57 m (11 ft. 9 in.)
B Hood Height	2.73 m (8 ft. 11 in.)	2.73 m (8 ft. 11 in.)	2.73 m (8 ft. 11 in.)
C Ground Clearance	458 mm (18 in.)	458 mm (18 in.)	458 mm (18 in.)
D Length From Centerline to Front Axle	1.70 m (5 ft. 7 in.)	1.70 m (5 ft. 7 in.)	1.70 m (5 ft. 7 in.)
E Wheelbase	3.46 m (11 ft. 4 in.)	3.46 m (11 ft. 4 in.)	3.46 m (11 ft. 4 in.)
F Overall Length, Forks on Ground	9.82 m (32 ft. 3 in.)	10.43 m (34 ft. 3 in.)	10.49 m (34 ft. 5 in.)
G Height to Hinge Pin, Fully Raised	4.27 m (14 ft. 0 in.)	4.27 m (14 ft. 0 in.)	4.84 m (15 ft. 11 in.)
H Reach, Fully Raised	0.90 m (35 in.)	0.90 m (35 in.)	1.05 m (3 ft. 5 in.)
I Fork Height, Fully Raised	3.22 m (10 ft. 7 in.)	3.22 m (10 ft. 7 in.)	3.79 m (12 ft. 5 in.)
J Maximum Reach, Fork Level	1.77 m (5 ft. 10 in.)	1.77 m (5 ft. 10 in.)	2.29 m (7 ft. 6 in.)
K Fork Height, Maximum Reach	1.29 m (4 ft. 3 in.)	1.29 m (4 ft. 3 in.)	1.29 m (4 ft. 3 in.)
L Reach, Ground Level	1.00 m (3 ft. 3 in.)	1.00 m (3 ft. 3 in.)	1.67 m (5 ft. 6 in.)
M Depth Below Ground	56 mm (2.2 in.)	56 mm (2.2 in.)	59 mm (2.3 in.)
N Tine Length	1.83 m (72 in.)	2.44 m (96 in.)	1.83 m (72 in.)
O Load Position, 50% Tine Length	0.92 m (36 in.)	1.22 m (48 in.)	0.92 m (36 in.)
Specifications With Forks			
Tipping Load, Straight, No Tire Deflection			
EPA FT4/EU Stage V	13 078 kg (28,832 lb.)	11 859 kg (26,144 lb.)	10 941 kg (24,120 lb.)
EPA Tier 3/EU Stage IIIA	12 712 kg (28,025 lb.)	11 521 kg (25,399 lb.)	10 621 kg (23,415 lb.)
Tipping Load, Straight, With Tire Deflection			
EPA FT4/EU Stage V	12 666 kg (27,923 lb.)	11 502 kg (25,357 lb.)	10 611 kg (23,393 lb.)
EPA Tier 3/EU Stage IIIA	12 318 kg (27,157 lb.)	11 178 kg (24,643 lb.)	10 308 kg (22,725 lb.)
Tipping Load, 37-deg. Partial Turn, No Tire Deflection			
EPA FT4/EU Stage V	11 526 kg (25,410 lb.)	10 428 kg (22,989 lb.)	9586 kg (21,133 lb.)
EPA Tier 3/EU Stage IIIA	11 206 kg (24,705 lb.)	10 134 kg (22,342 lb.)	9307 kg (20,518 lb.)
Tipping Load, 40-deg. Full Turn, No Tire Deflection			
EPA FT4/EU Stage V	11 275 kg (24,857 lb.)	10 197 kg (22,480 lb.)	9367 kg (20,650 lb.)
EPA Tier 3/EU Stage IIIA	10 963 kg (24,169 lb.)	9909 kg (21,846 lb.)	9094 kg (20,049 lb.)
Tipping Load, 40-deg. Full Turn, With Tire Deflection			
EPA FT4/EU Stage V	10 710 kg (23,611 lb.)	9702 kg (21,389 lb.)	8907 kg (19,636 lb.)
EPA Tier 3/EU Stage IIIA	10 425 kg (22,983 lb.)	9438 kg (20,807 lb.)	8661 kg (19,094 lb.)
Rated Operating Load, 50% Full-Turn Tipping Load, With Tire Deflection (conforms to ISO 14397-1)*			
EPA FT4/EU Stage V	5355 kg (11,806 lb.)	4851 kg (10,695 lb.)	4454 kg (9,819 lb.)
EPA Tier 3/EU Stage IIIA	5213 kg (11,493 lb.)	4719 kg (10,404 lb.)	4331 kg (9,548 lb.)
Rated Operating Load, Rough Terrain, 60% Full-Turn Tipping Load, With Tire Deflection (conforms to EN474-3)*			
EPA FT4/EU Stage V	6426 kg (14,167 lb.)	5821 kg (12,833 lb.)	5344 kg (11,781 lb.)
EPA Tier 3/EU Stage IIIA	6255 kg (13,790 lb.)	5663 kg (12,485 lb.)	5197 kg (11,457 lb.)
Rated Operating Load, Firm and Level Ground, 80% Full-Turn Tipping Load, With Tire Deflection (conforms to EN474-3)*			
EPA FT4/EU Stage V	8568 kg (18,889 lb.)	7762 kg (17,112 lb.)	7126 kg (15,710 lb.)
EPA Tier 3/EU Stage IIIA	8340 kg (18,387 lb.)	7550 kg (16,645 lb.)	6929 kg (15,276 lb.)
Operating Weight			
EPA FT4/EU Stage V	25 022 kg (55,164 lb.)	25 194 kg (55,543 lb.)	25 562 kg (56,354 lb.)
EPA Tier 3/EU Stage IIIA	24 713 kg (54,483 lb.)	24 885 kg (54,862 lb.)	25 253 kg (55,673 lb.)

Loader operating information is based on machine with identified linkage and standard equipment, JD9 PSS 6090 (EPA FT4/EU Stage V) and JD9 6090H (EPA Tier 3/EU Stage IIIA) engines, ROPS cab, rear cast bumper/counterweight, transmission side-frame guards, bottom guards, standard tires, full fuel tank, and 79-kg (175 lb.) operator. This information is affected by changes in tires, ballast, and different attachments.

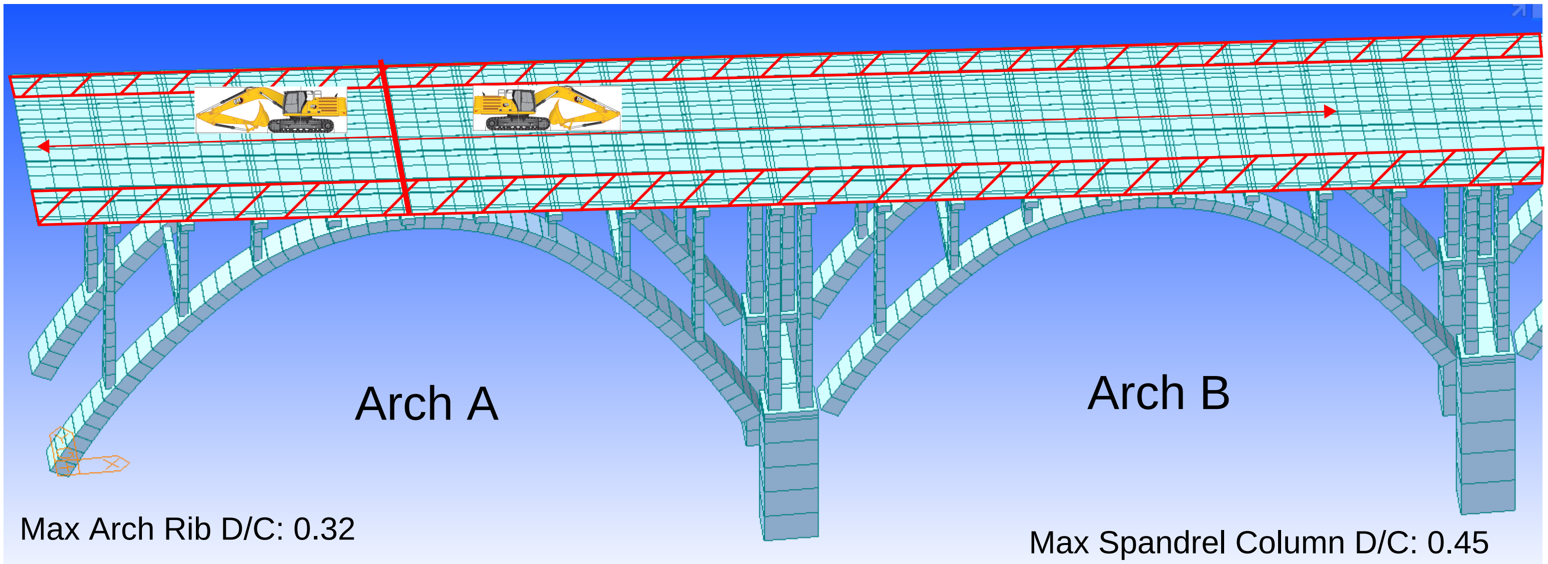
**Rated operating capacity based on Deere attachments only.*



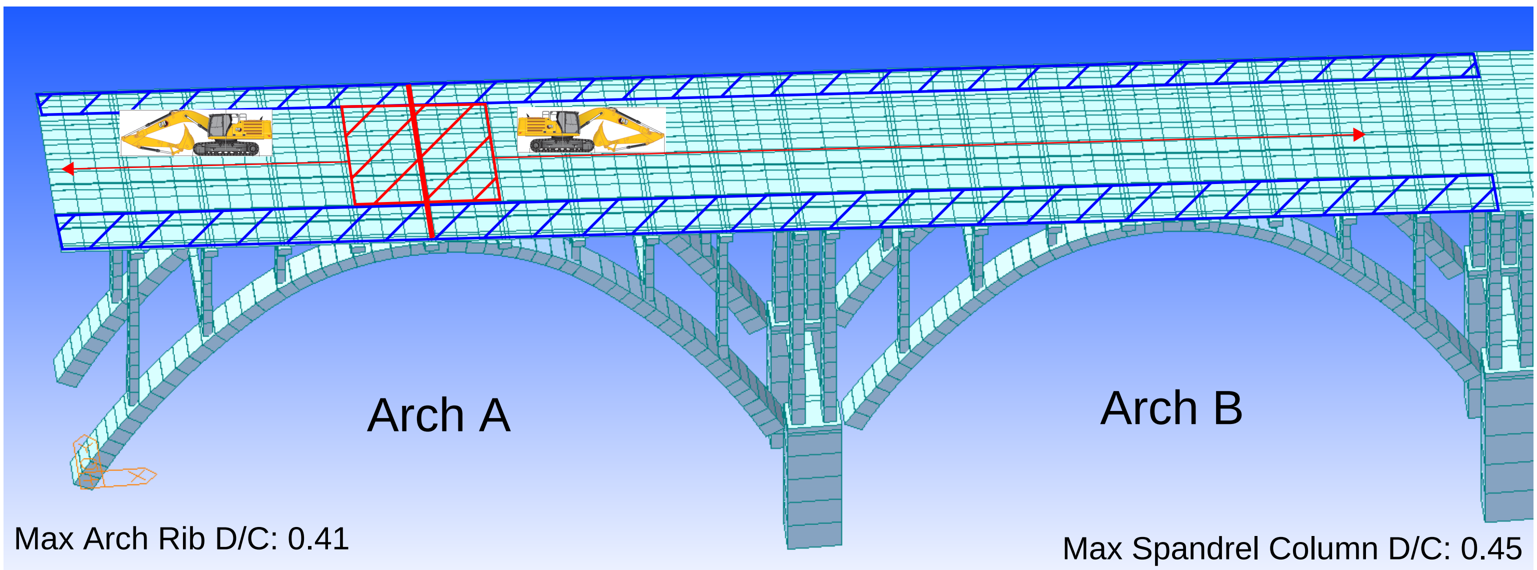
PROPOSED LOCATIONS OF TEMPORARY SHORING TOWERS UNDER FLOORBEAMS



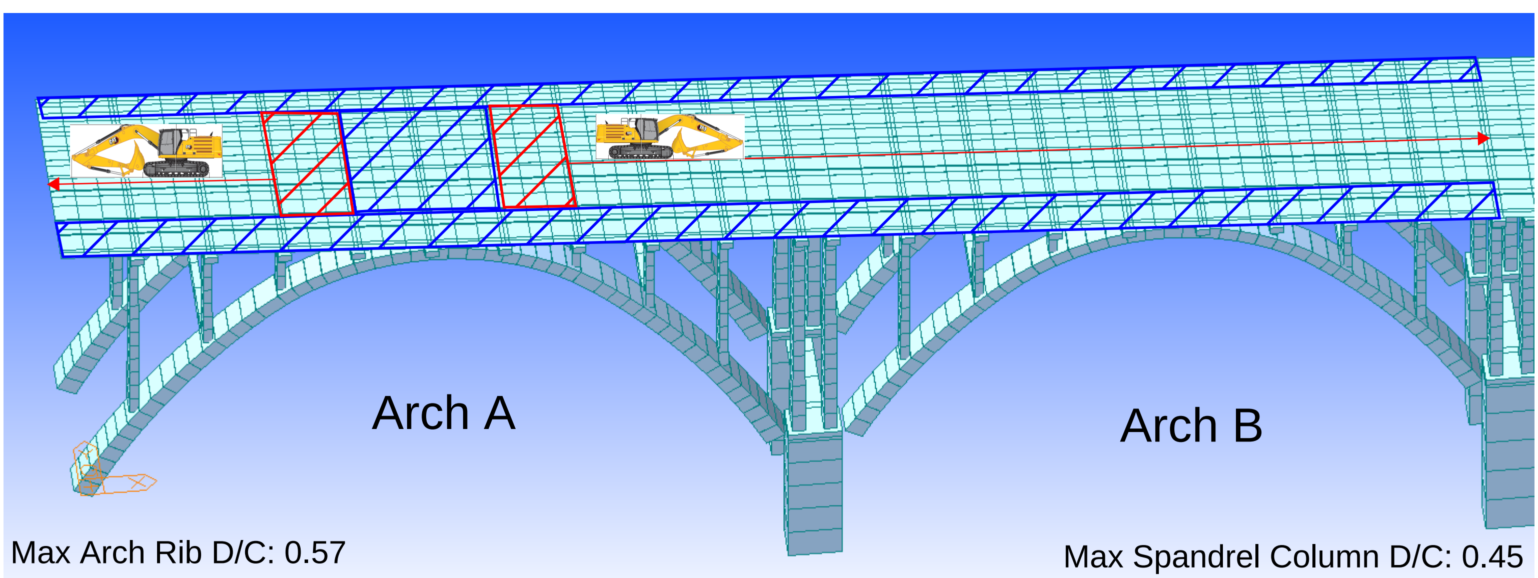
say 165k is
factored load that
each temporary
shoring support
needs to handle



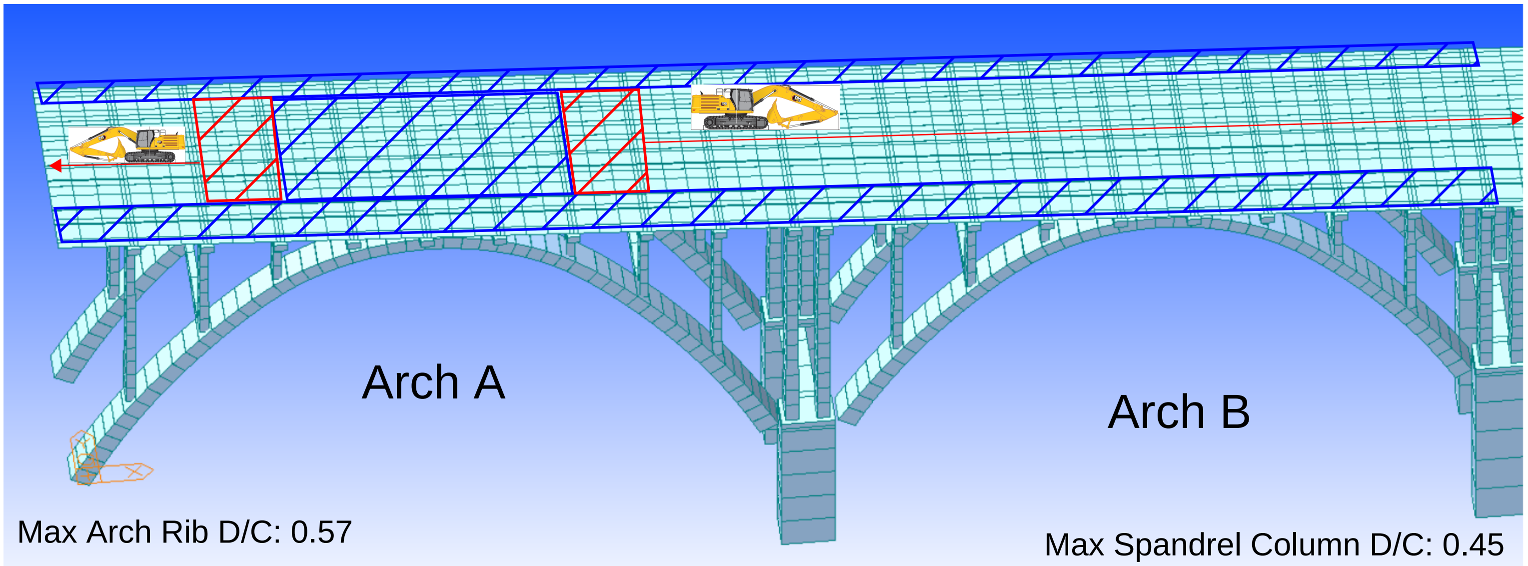
BEL 40 Iteration 3 Demo Analysis Arch Model First Stage.mcb



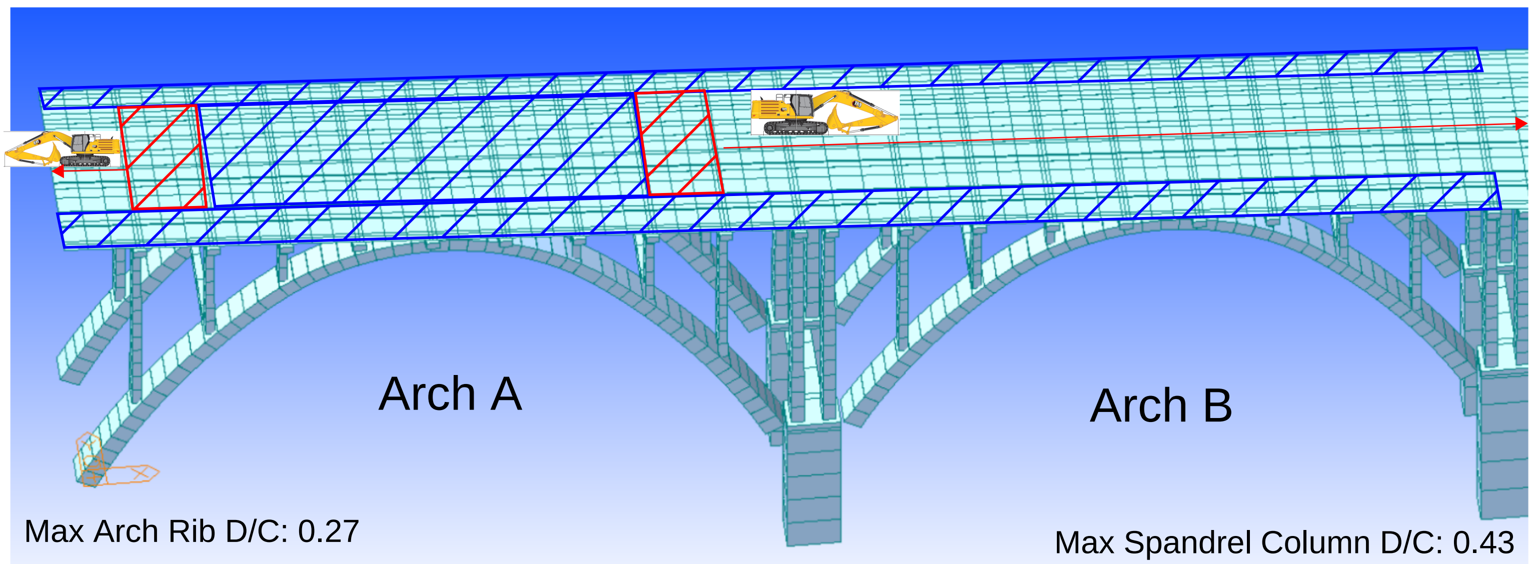
BEL 40 Iteration 3 Demo Analysis Arch Model Second Stage.mcb



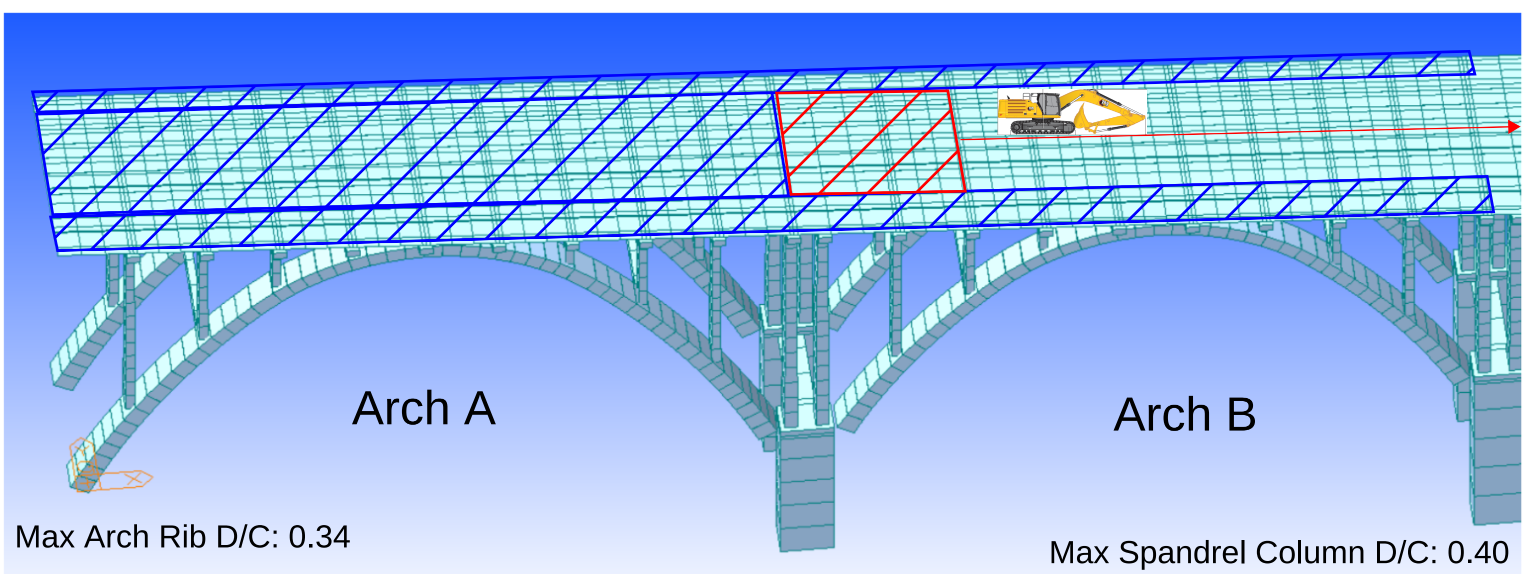
BEL 40 Iteration 3 Demo Analysis Arch Model Third Stage.mcb



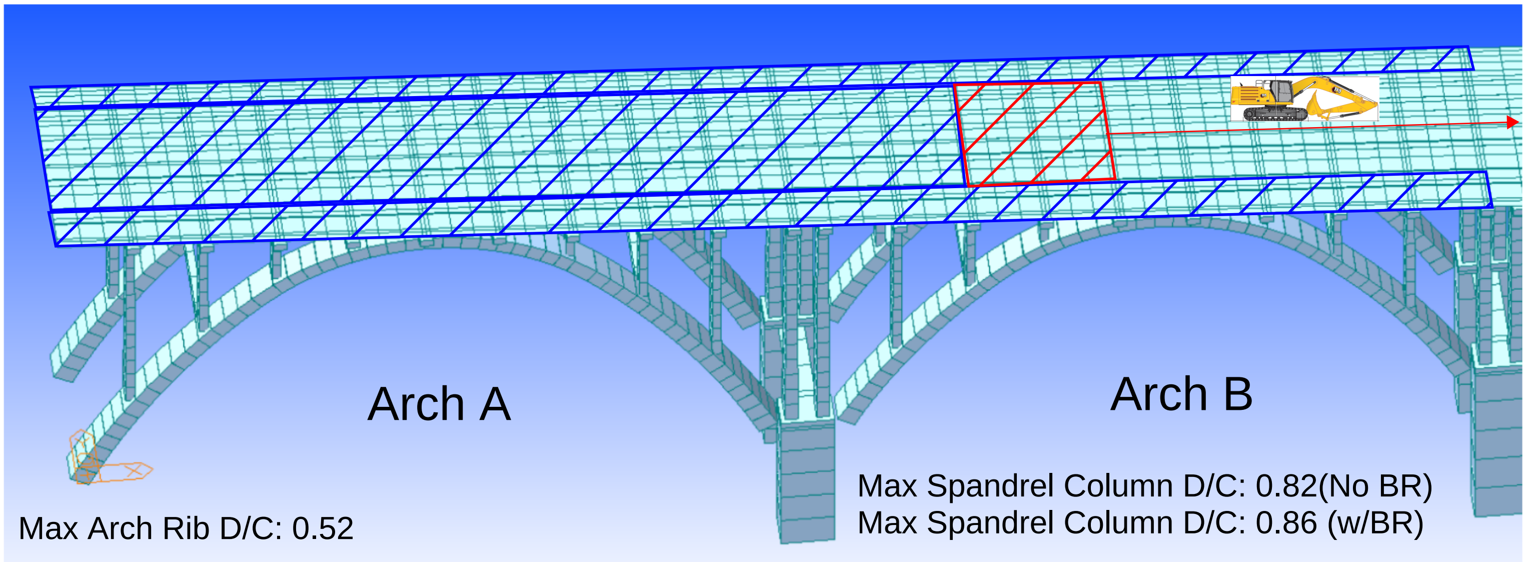
BEL 40 Iteration 3 Demo Analysis Arch Model Fourth Stage.mcb



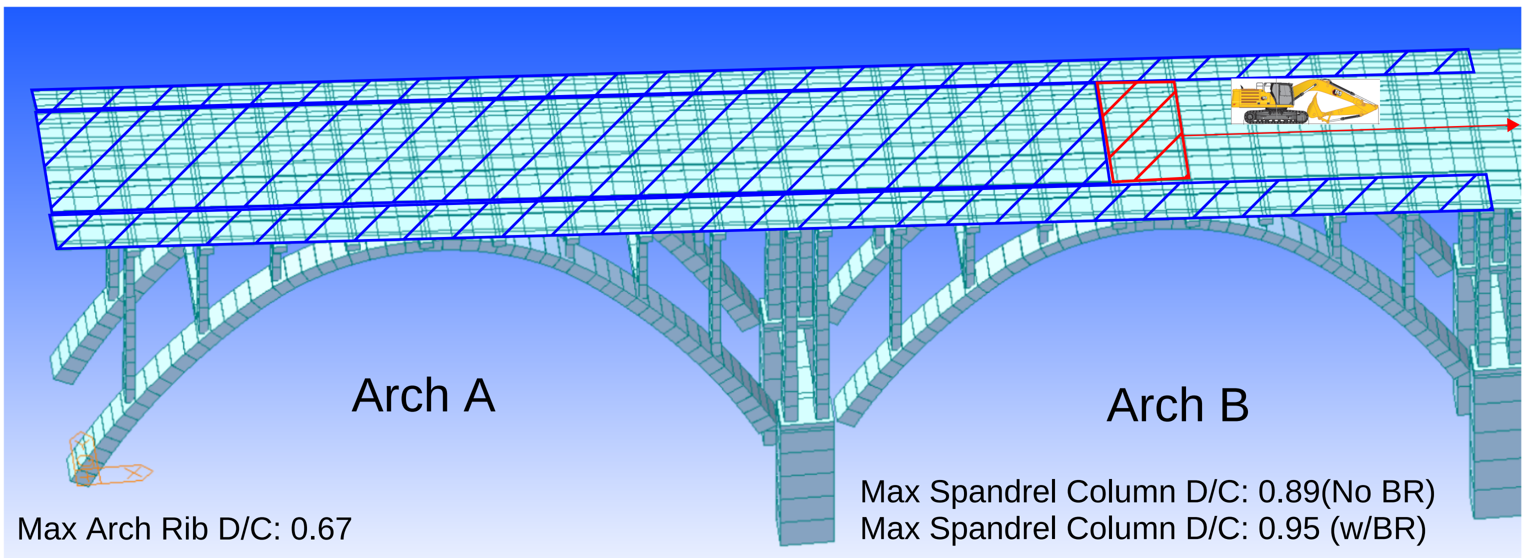
BEL 40 Iteration 3 Demo Analysis Arch Model Fifth Stage.mcb



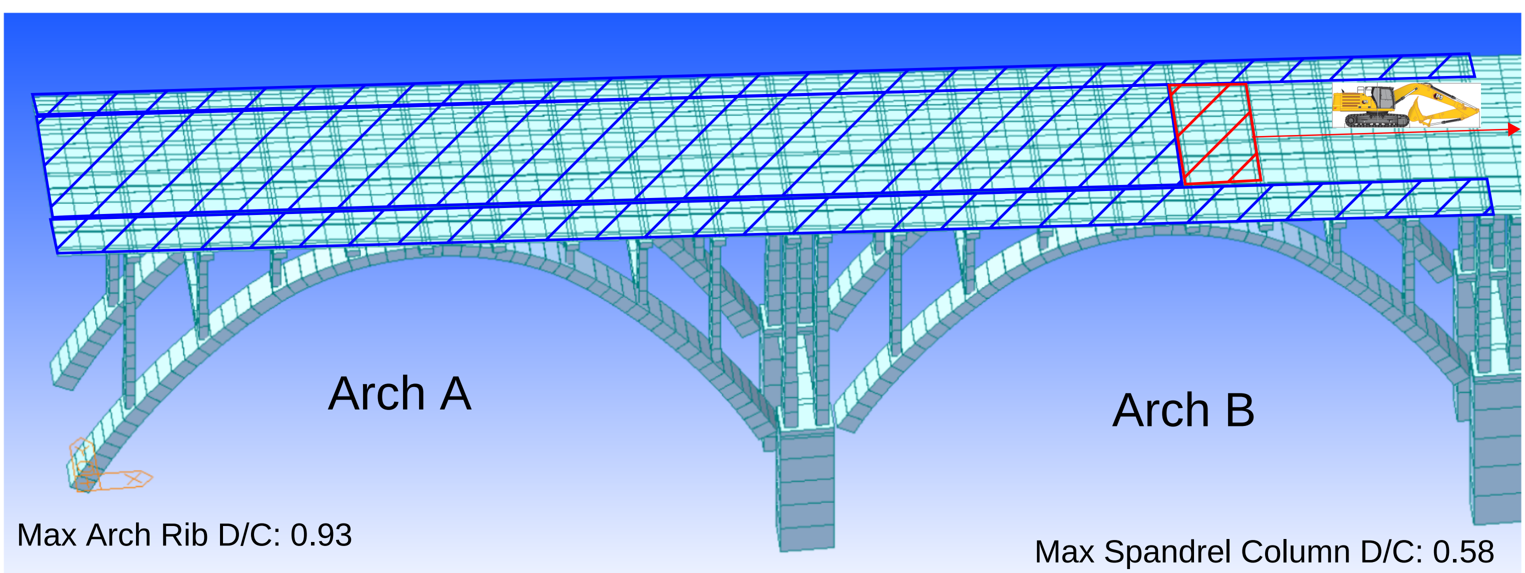
BEL 40 Iteration 3 Demo Analysis Arch Model Sixth Stage.mcb



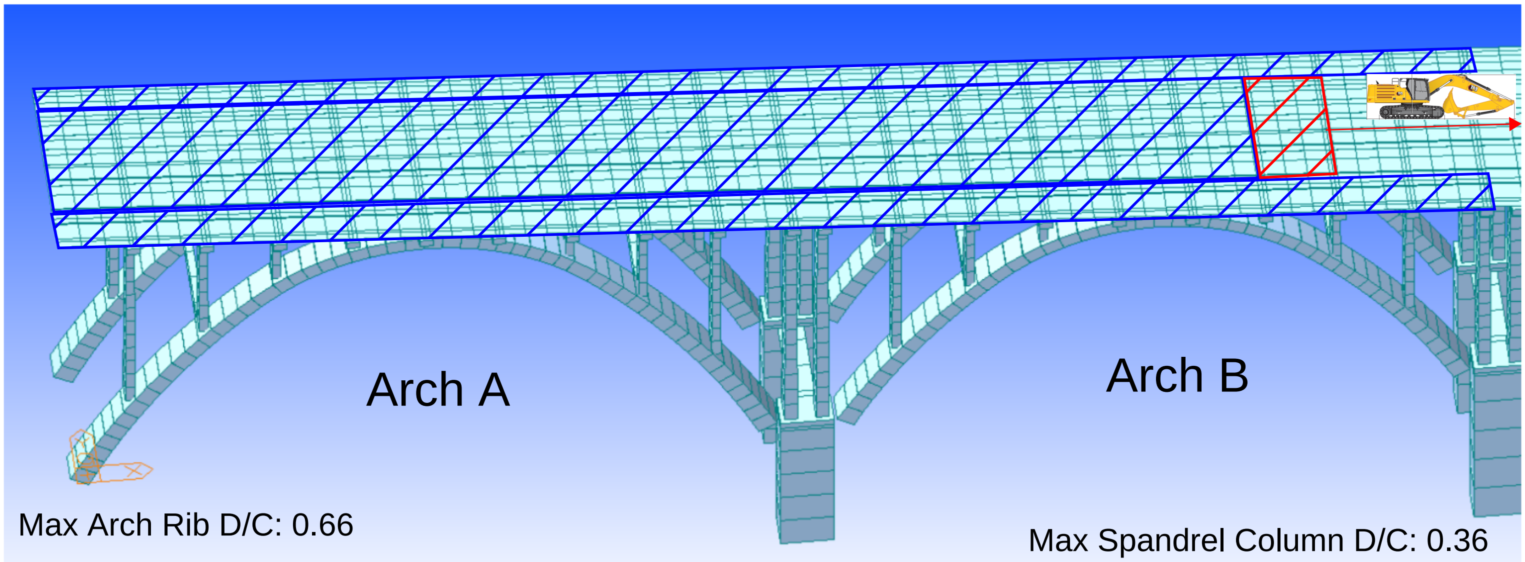
BEL 40 Iteration 3 Demo Analysis Arch Model Seventh Stage.mcb



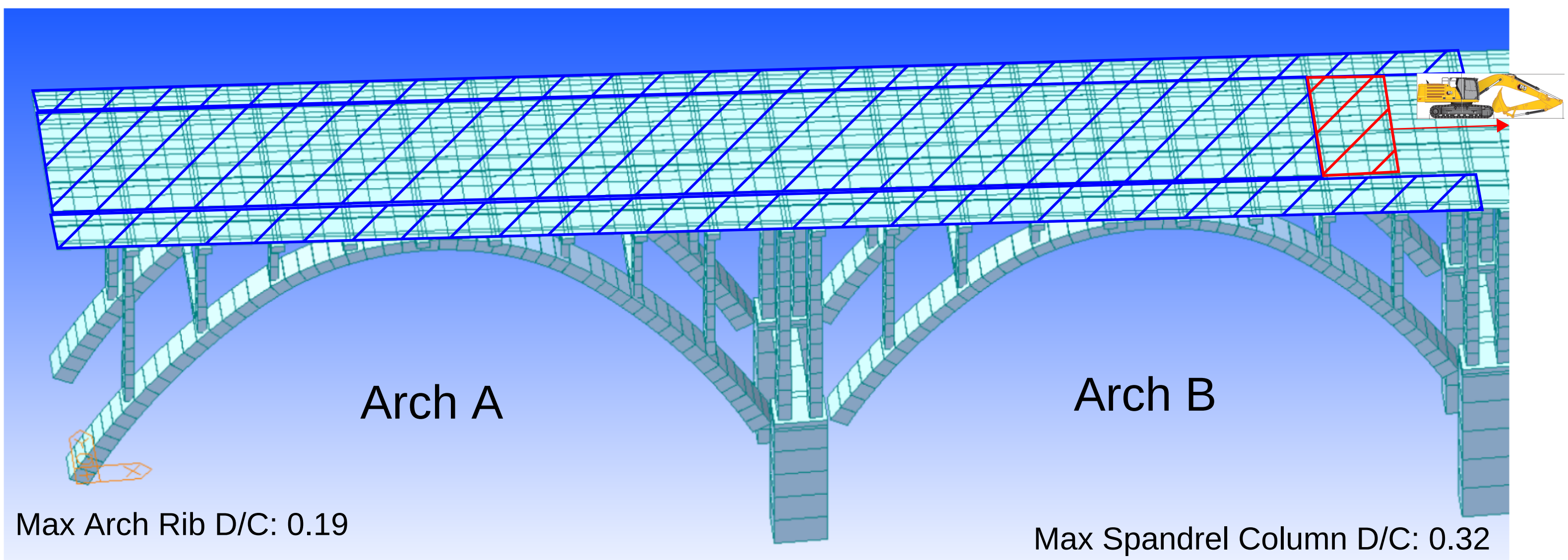
BEL 40 Iteration 3 Demo Analysis Arch Model Eighth Stage.mcb



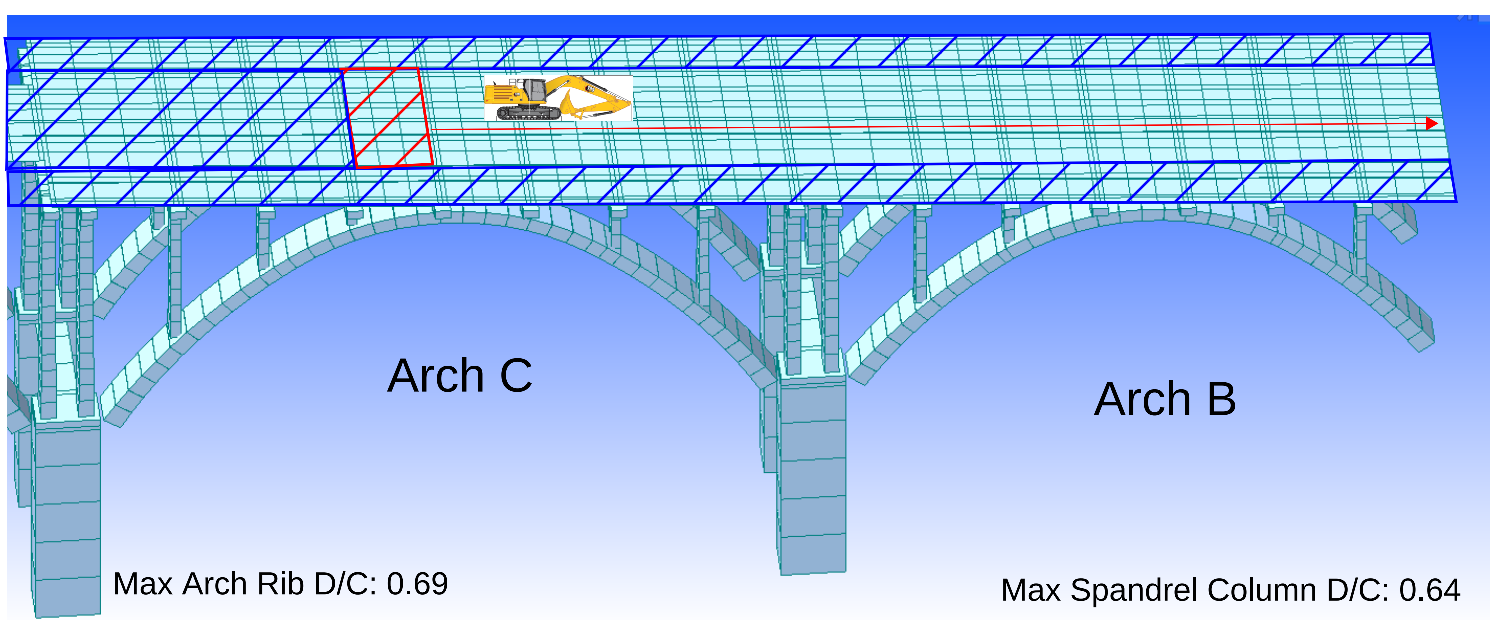
BEL 40 Iteration 3 Demo Analysis Arch Model Ninth Stage.mcb



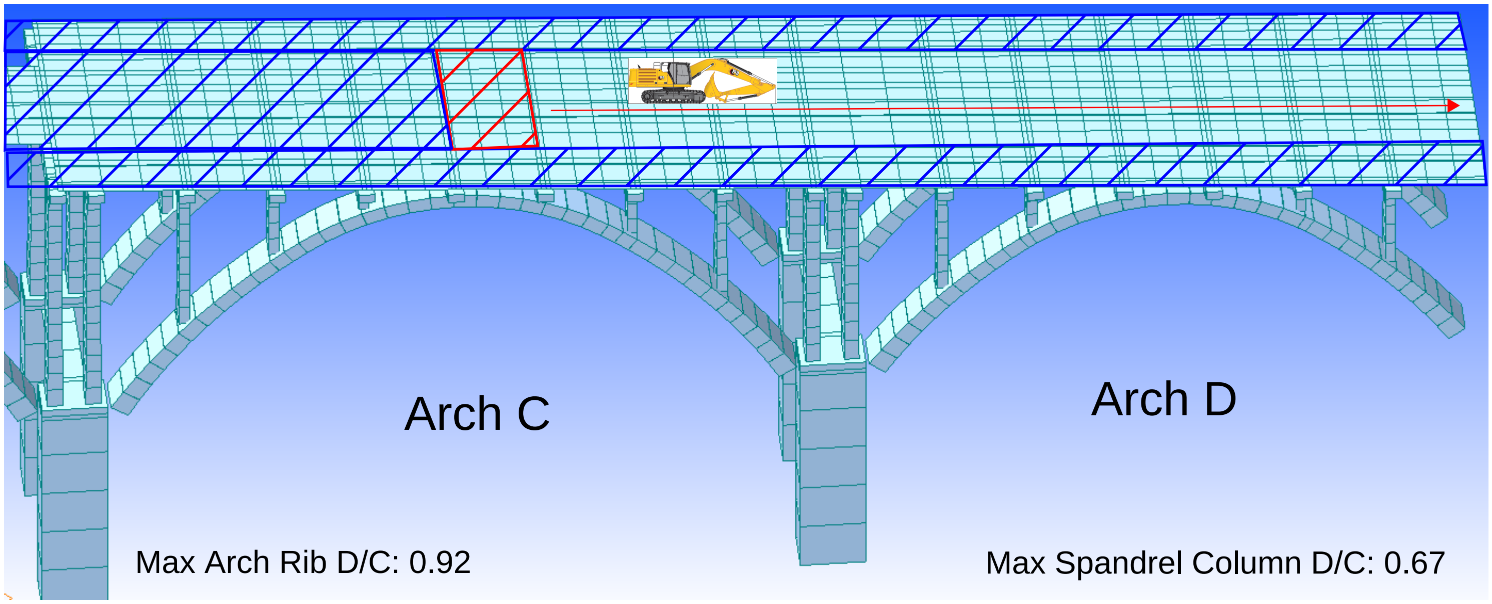
BEL 40 Iteration 3 Demo Analysis Arch Model Tenth Stage.mcb



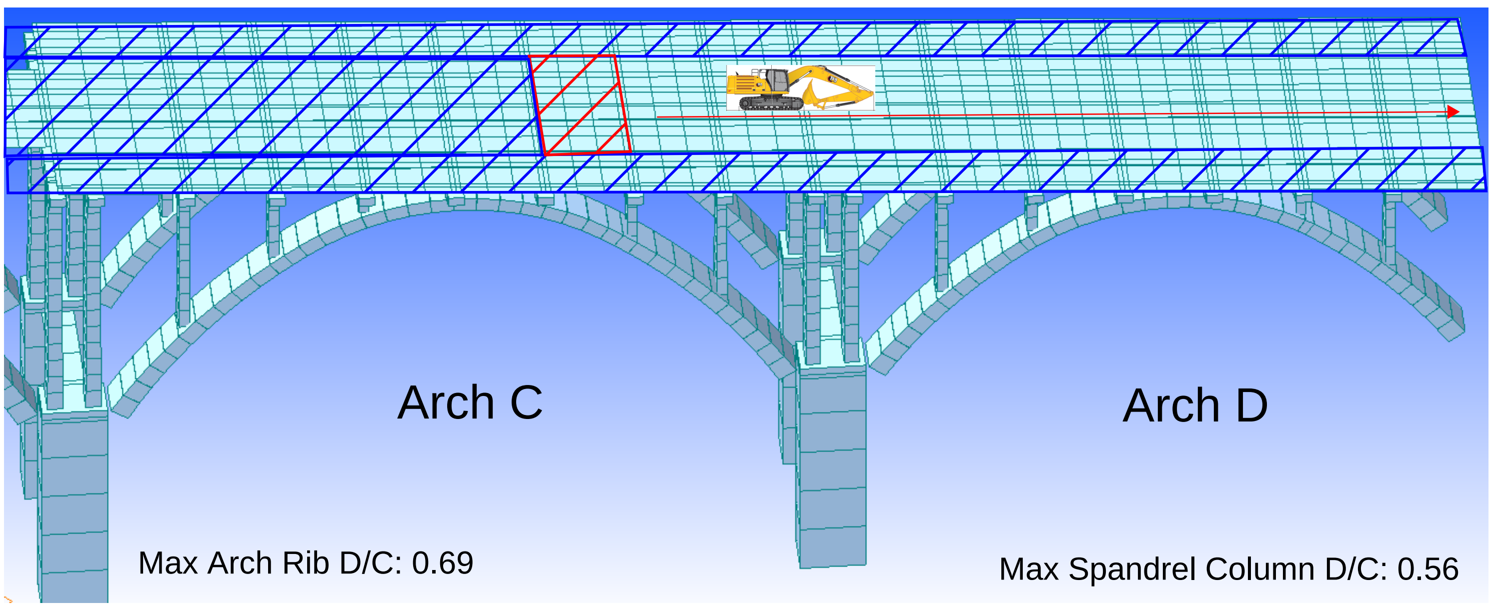
BEL 40 Iteration 3 Demo Analysis Arch Model Eleventh Stage.mcb



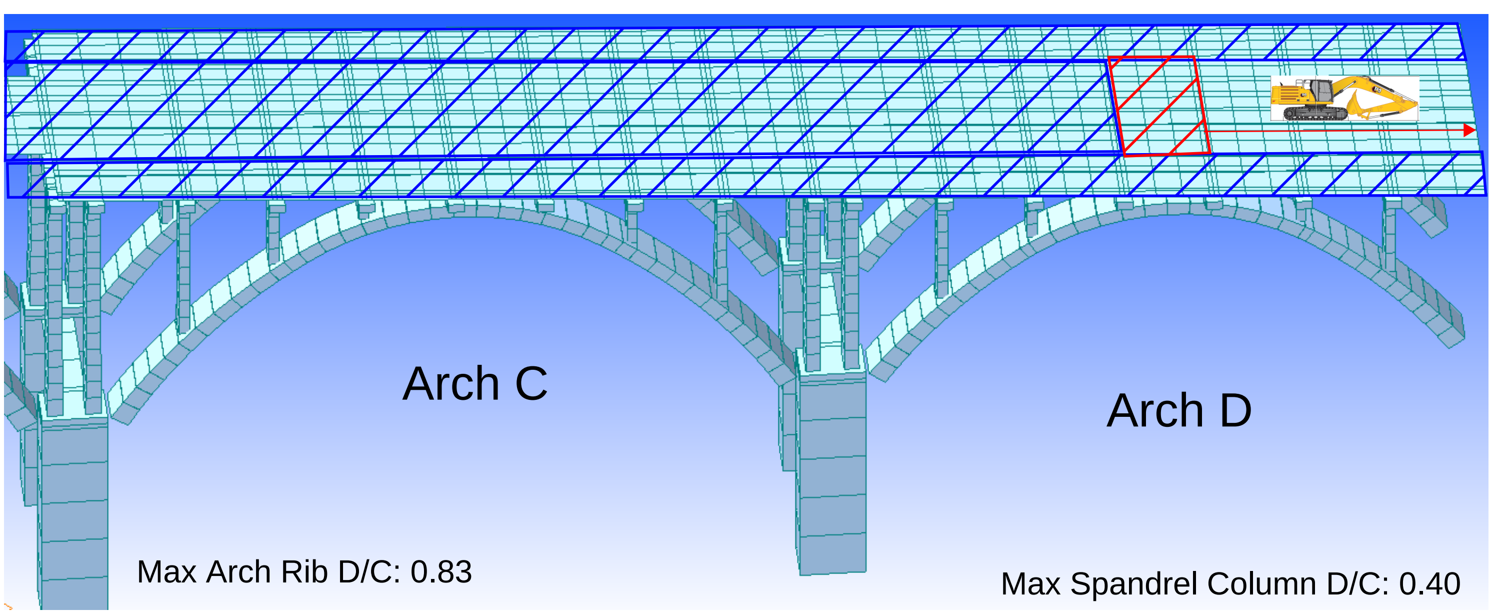
BEL 40 Iteration 3 Demo Analysis Arch Model Twelfth Stage.mcb



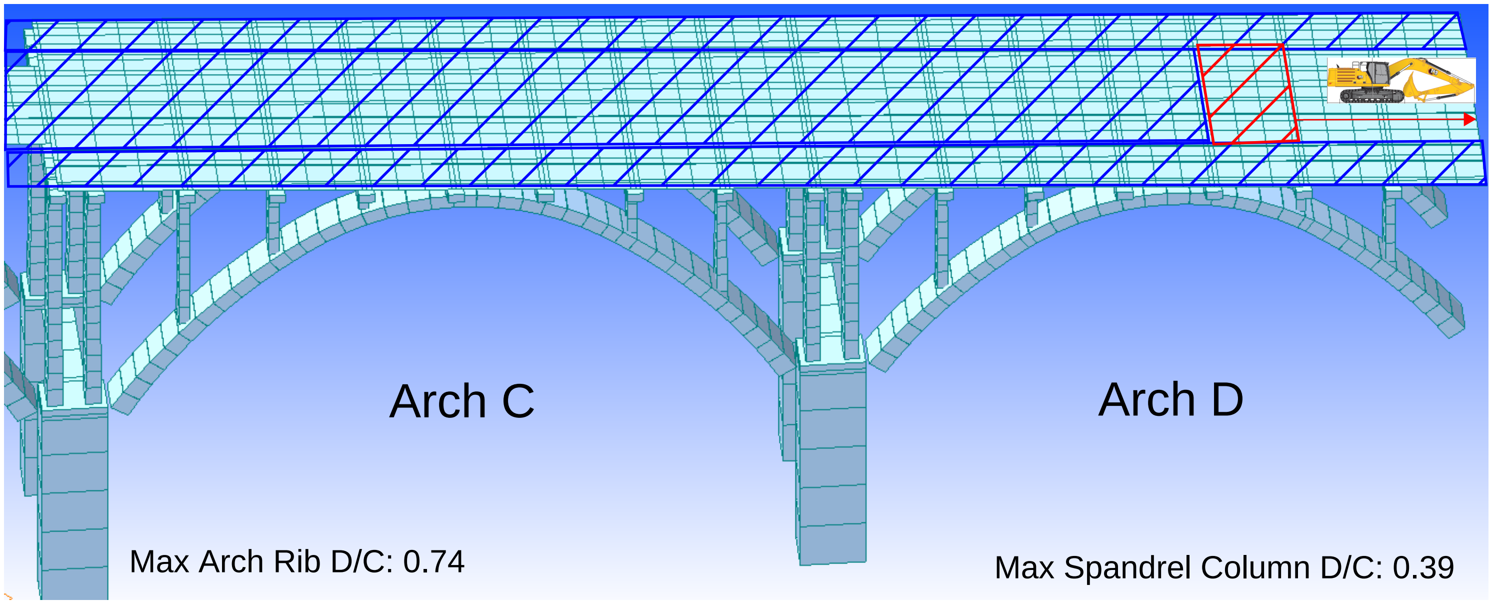
BEL 40 Iteration 3 Demo Analysis Arch Model Thirteenth Stage.mcb



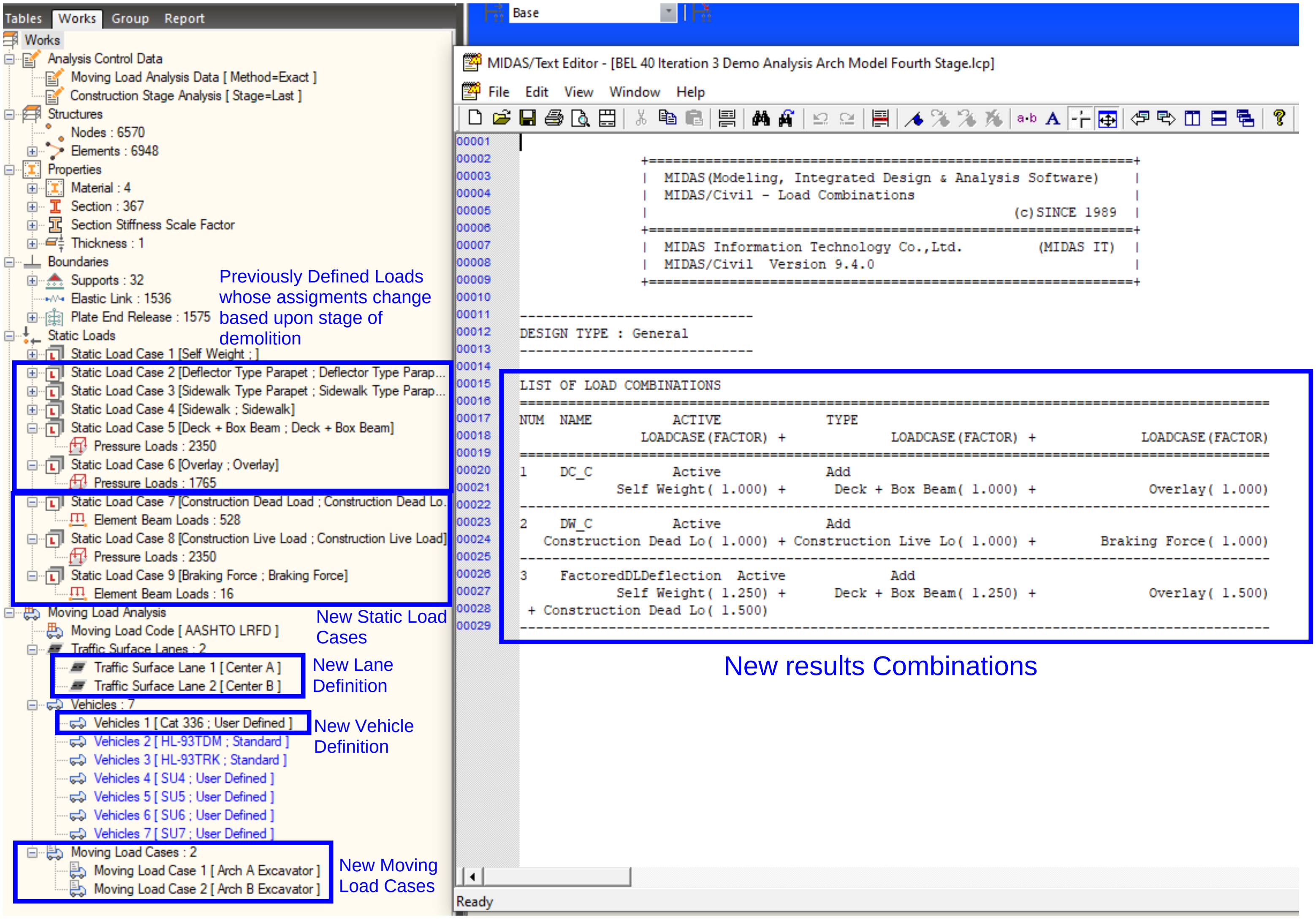
BEL 40 Iteration 3 Demo Analysis Arch Model Fourteenth Stage.mcb



BEL 40 Iteration 3 Demo Analysis Arch Model Fifteenth Stage.mcb



BEL 40 Iteration 3 Demo Analysis Arch Model Sixteenth Stage.mcb


Tables Works Group Report
Works
Analysis Control Data
Moving Load Analysis Data [Method=Exact]
Construction Stage Analysis [Stage=Last]
Structures
Nodes : 6570
Elements : 6948
Properties
Material : 4
Section : 367
Section Stiffness Scale Factor
Thickness : 1
Boundaries
Supports : 32
Elastic Link : 1536
Plate End Release : 1575
Static Loads
Static Load Case 1 [Self Weight ;]
Static Load Case 2 [Deflector Type Parapet ; Deflector Type Parap...
Static Load Case 3 [Sidewalk Type Parapet ; Sidewalk Type Parap...
Static Load Case 4 [Sidewalk ; Sidewalk]
Static Load Case 5 [Deck + Box Beam ; Deck + Box Beam]
Pressure Loads : 2350
Static Load Case 6 [Overlay ; Overlay]
Pressure Loads : 1765
Static Load Case 7 [Construction Dead Load ; Construction Dead Lo...
Element Beam Loads : 528
Static Load Case 8 [Construction Live Load ; Construction Live Load]
Pressure Loads : 2350
Static Load Case 9 [Braking Force ; Braking Force]
Element Beam Loads : 16
Moving Load Analysis
Moving Load Code [AASHTO LRFD]
Traffic Surface Lanes : 2
Traffic Surface Lane 1 [Center A]
Traffic Surface Lane 2 [Center B]
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]
Moving Load Cases : 2
Moving Load Case 1 [Arch A Excavator]
Moving Load Case 2 [Arch B Excavator]
Previously Defined Loads whose assigments change based upon stage of demolition
New Static Load Cases
New Lane Definition
New Vehicle Definition
New Moving Load Cases
Base
MIDAS/Text Editor - [BEL 40 Iteration 3 Demo Analysis Arch Model Fourth Stage.lcp]
File Edit View Window Help
MIDAS(Modeling, Integrated Design & Analysis Software)
MIDAS/Civil - Load Combinations
(c)SINCE 1989
MIDAS Information Technology Co.,Ltd. (MIDAS IT)
MIDAS/Civil Version 9.4.0
DESIGN TYPE : General
LIST OF LOAD COMBINATIONS
NUM NAME ACTIVE TYPE
LOADCASE(FACTOR) + LOADCASE(FACTOR) + LOADCASE(FACTOR)
1 DC_C Active Add
Self Weight(1.000) + Deck + Box Beam(1.000) + Overlay(1.000)
2 DW_C Active Add
Construction Dead Lo(1.000) + Construction Live Lo(1.000) + Braking Force(1.000)
3 FactoredDLDeflection Active Add
Self Weight(1.250) + Deck + Box Beam(1.250) + Overlay(1.500)
+ Construction Dead Lo(1.500)
New results Combinations
Ready


MICROFILMED
JAN 22 1986
BEGIN WORK
STA.106+14
BRM-25 00 (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); ITem 606 Type 5, 12'-6" L.F.
FHWA REGION
STATE
PROJECT
5
OHIO
2
74
BEL-40-23.38
FLOW
30'-6"
46'-6"
45'-6"
141'-6"
145'-6"
132'-6"
132'-6"
118'-6"
118'-6"
Joint Spacing
Pier Spacing
22' R.
Sta.106+14.0(±)
Sta. 106+34.00
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); 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
-7.00 % Grade
-7.00 % Grade
TRAFFIC DATA (Highway)
Current ADT (1980) = 7,800
=12,480
DETAIL "A"
West Abutment
Pier No.1
ARCH "A"
ARCH "B"
ARCH "C"
ARCH "D"
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
Plaque
Parapet
Abutment wall
Approach Slab
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
DEPARTMENT OF TRANSPORTATION
BUREAU OF BRIDGES AND STRUCTURAL DESIGN
1/72
GENERAL PLAN AND ELEVATION
BRIDGE NO. BEL-40-2338
OVER THE B.&O. RAILROAD AND WHEELING CREEK
DESIGNED AJM
DRAWN AJM
TRACED
CHECKED R.L.D.
REVIEWED WJJ
DATE 12-1-80
REVISED
Pier #2
Pier #3
ARCH SPAN "A" = 145'-6"
ARCH SPAN "B" = 132'-6"
BEL-40-23.38
Beam A
Beam B
Beam C
℄ Bridge
℄ Transverse beams (typ.)

FHWA REGION	STATE	PROJECT		
5	OHIO			

BEL-40-23.38

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.

NOTES: (Con't)

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

STATE OF OHIO
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14/72

TRANSVERSE BEAM LAYOUT

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

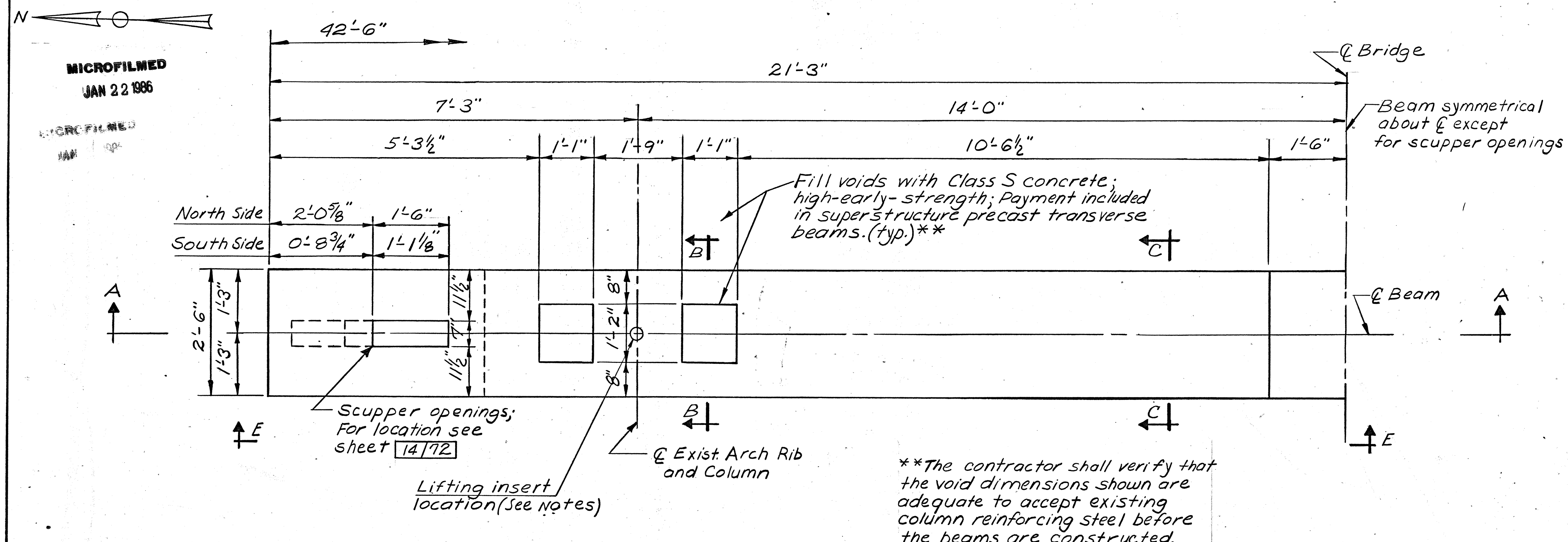
DESIGNED	DRAWN	TRACED	CHECKED	REVIEWED	DATE	REVISED
J.A.M.	J.A.M.		R.L.D.	WJJ	12-1-80	

Rev. 3-23-81

FHWA REGION	STATE	PROJECT	
5	OHIO		

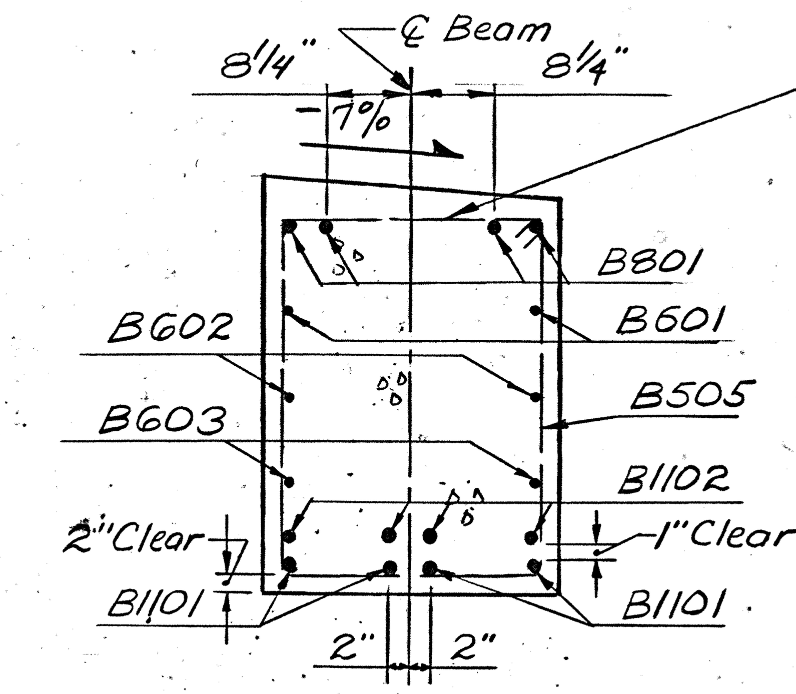
16/74

BEL-40-23.38

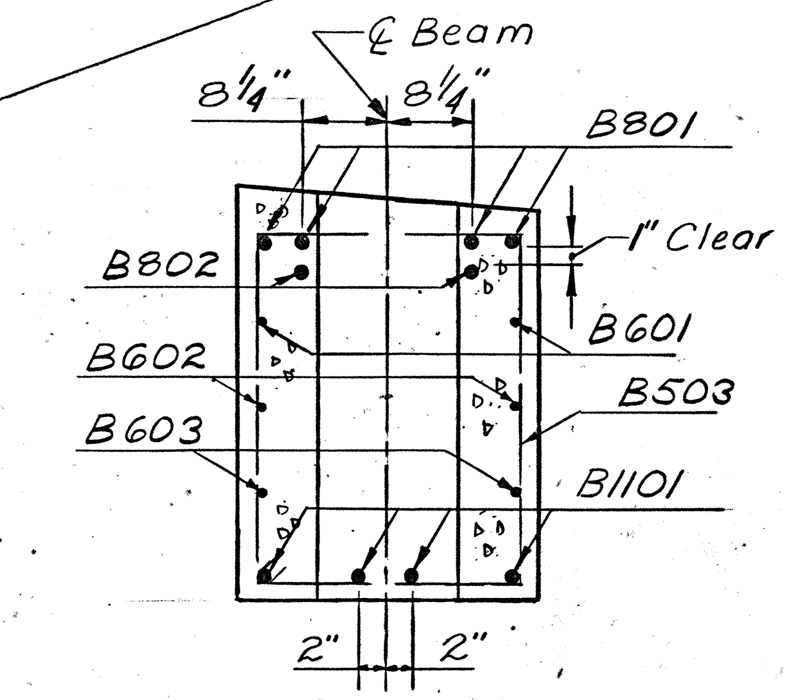


PLAN-BEAM A

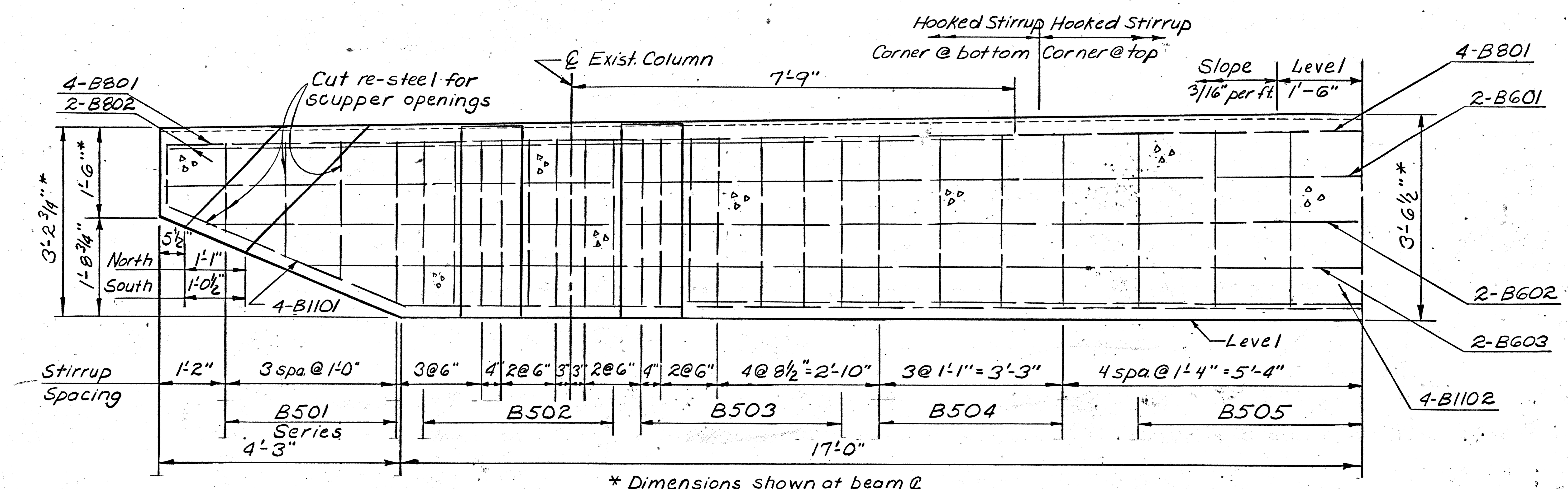
Cut 8" of horizontal leg of stirrup (top or bottom) where necessary to clear scupper opening. Payment included in Item 509.



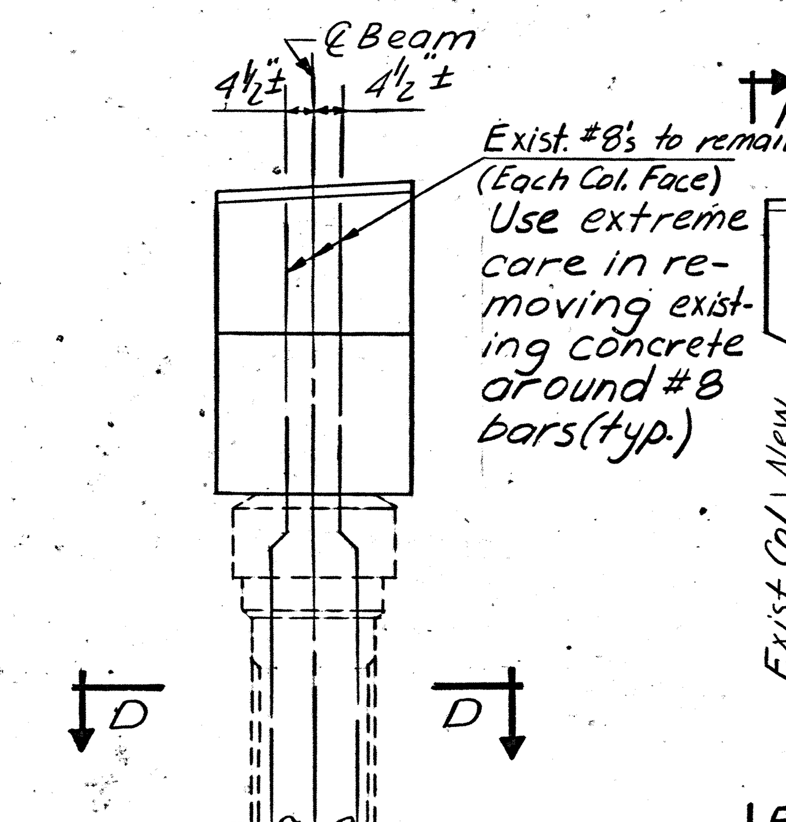
SECTION C-C



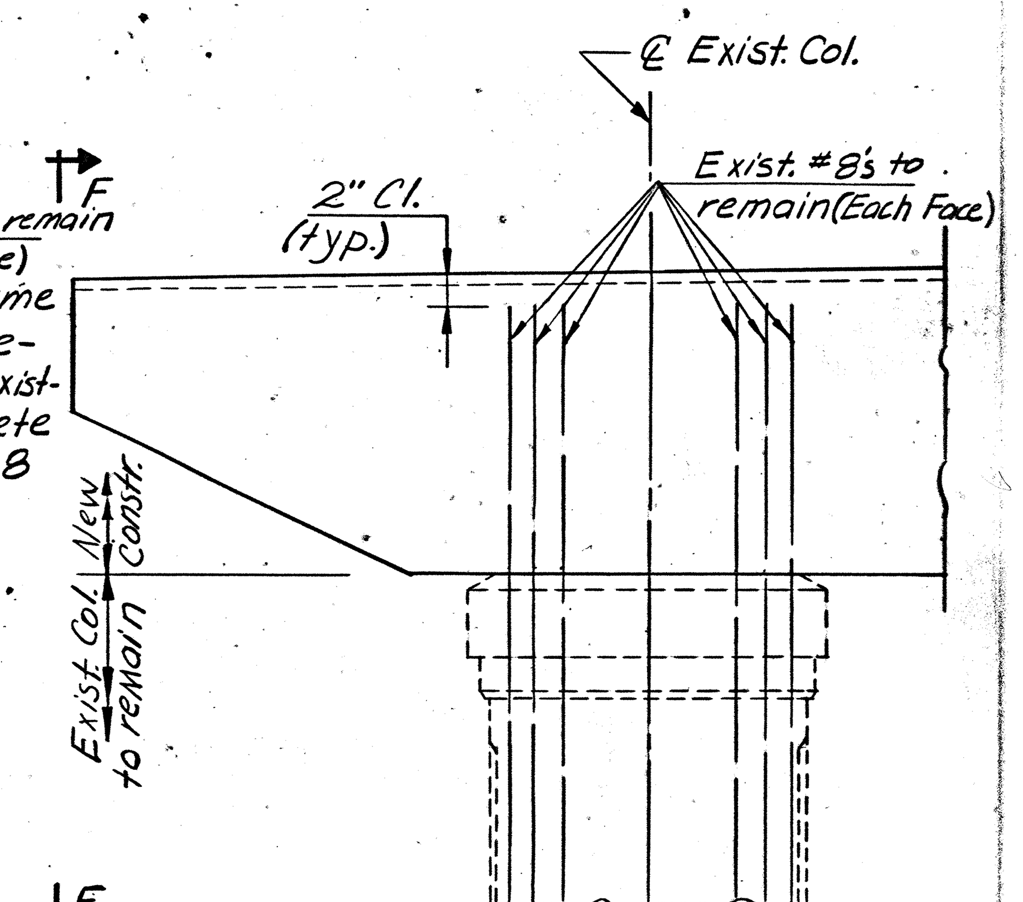
SECTION B-B



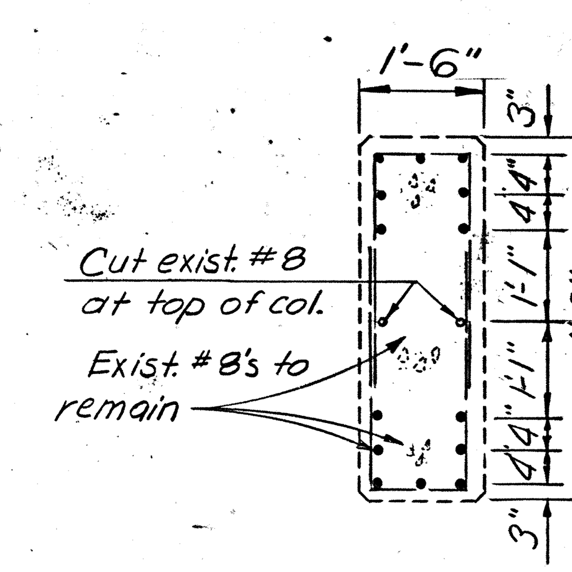
SECTION A-A
(Along Beam ℄)



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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BUREAU OF BRIDGES AND STRUCTURAL DESIGN

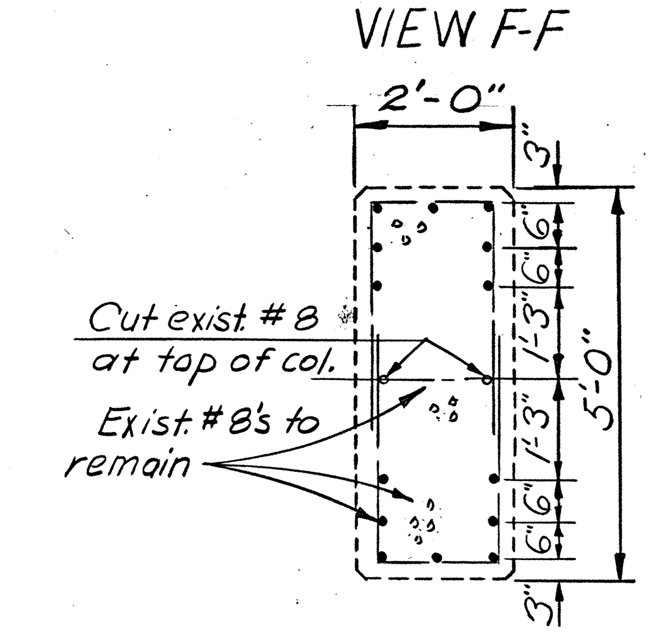
15/72

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	

SECTION A-A
(Along Beam ℄)



SECTION D-D

NOTES

BEAMS shall be precast

CONCRETE, Class S

FOR beam layout plan see sheet 14/72

FHWA REGION	STATE	PROJECT	
5	OHIO		

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BEL-40-23.38

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

16/72

TRANSVERSE BEAM B DETAILS

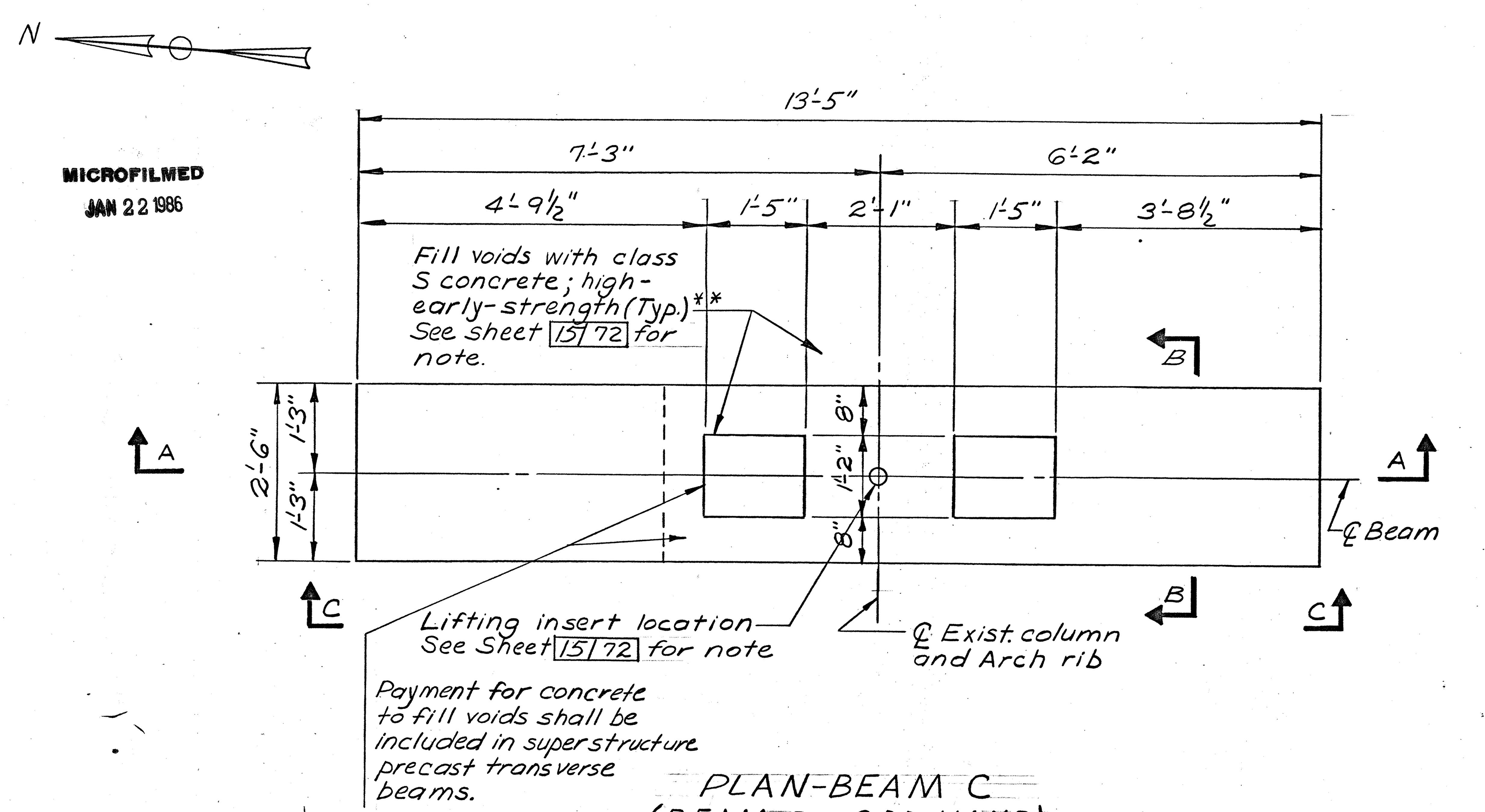
BRIDGE NO. BEL-40-2338
OVER THE B. & O. RAILROAD
AND WHEELING CREEK

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

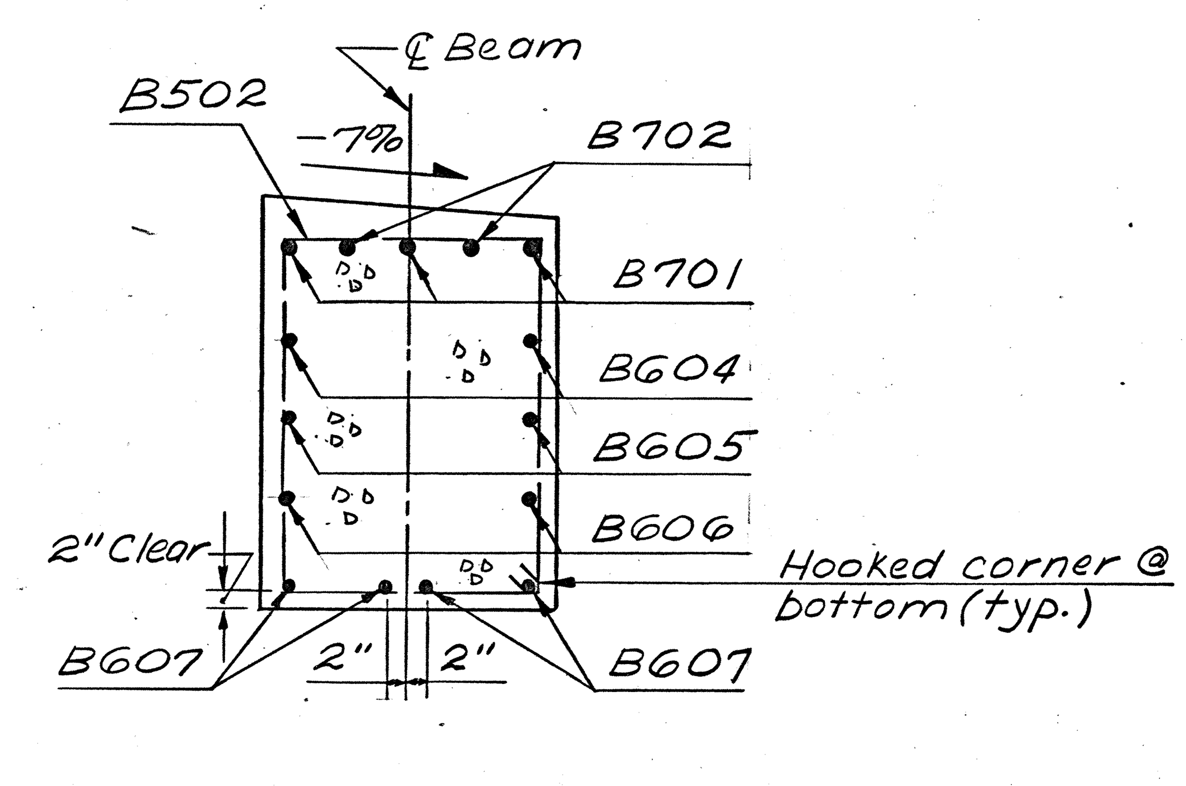
FHWA REGION	STATE	PROJECT		
5	OHIO			

18/74

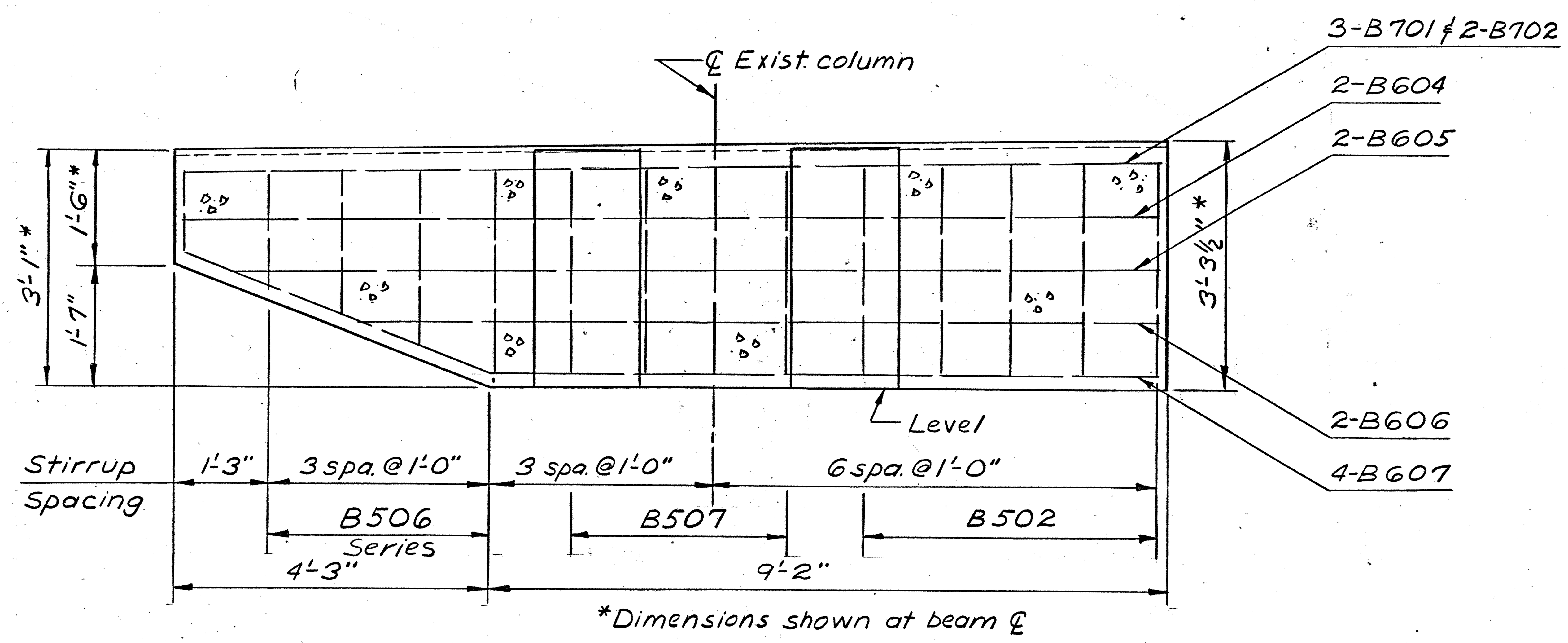
BEL-40-23.38



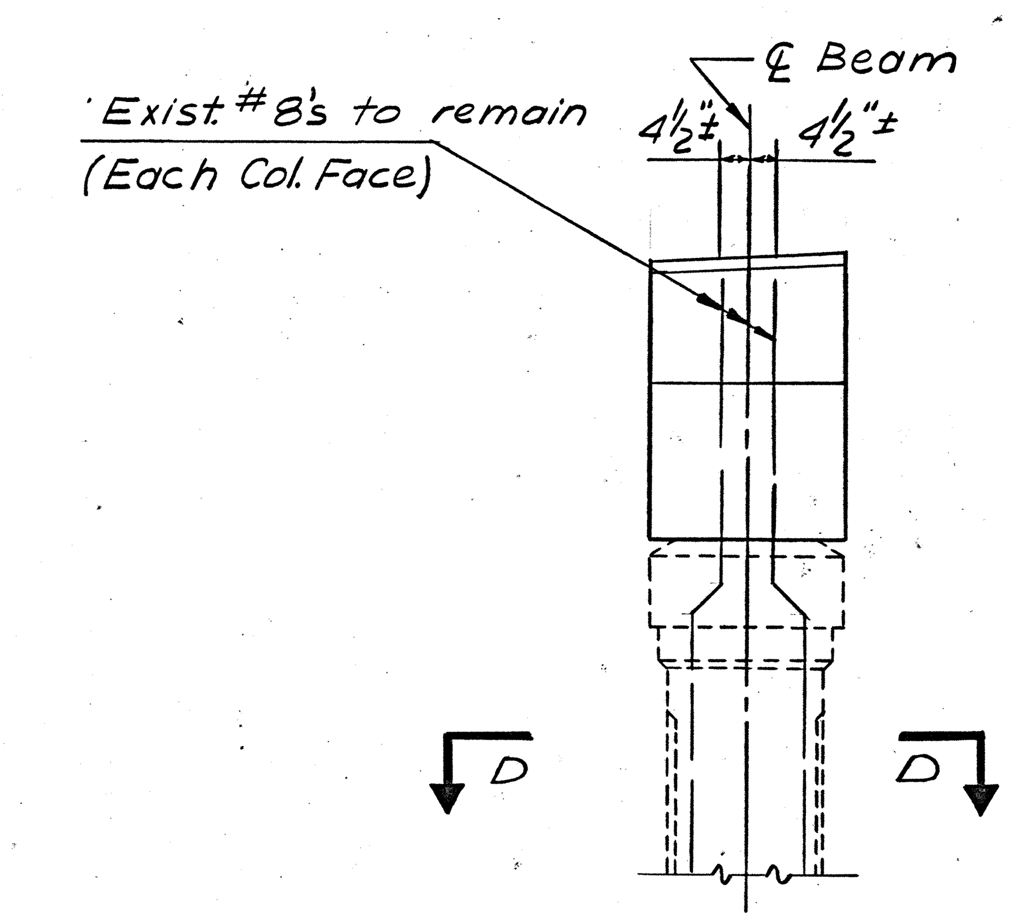
PLAN-BEAM C
(BEAM C₁ -OPP. HAND)



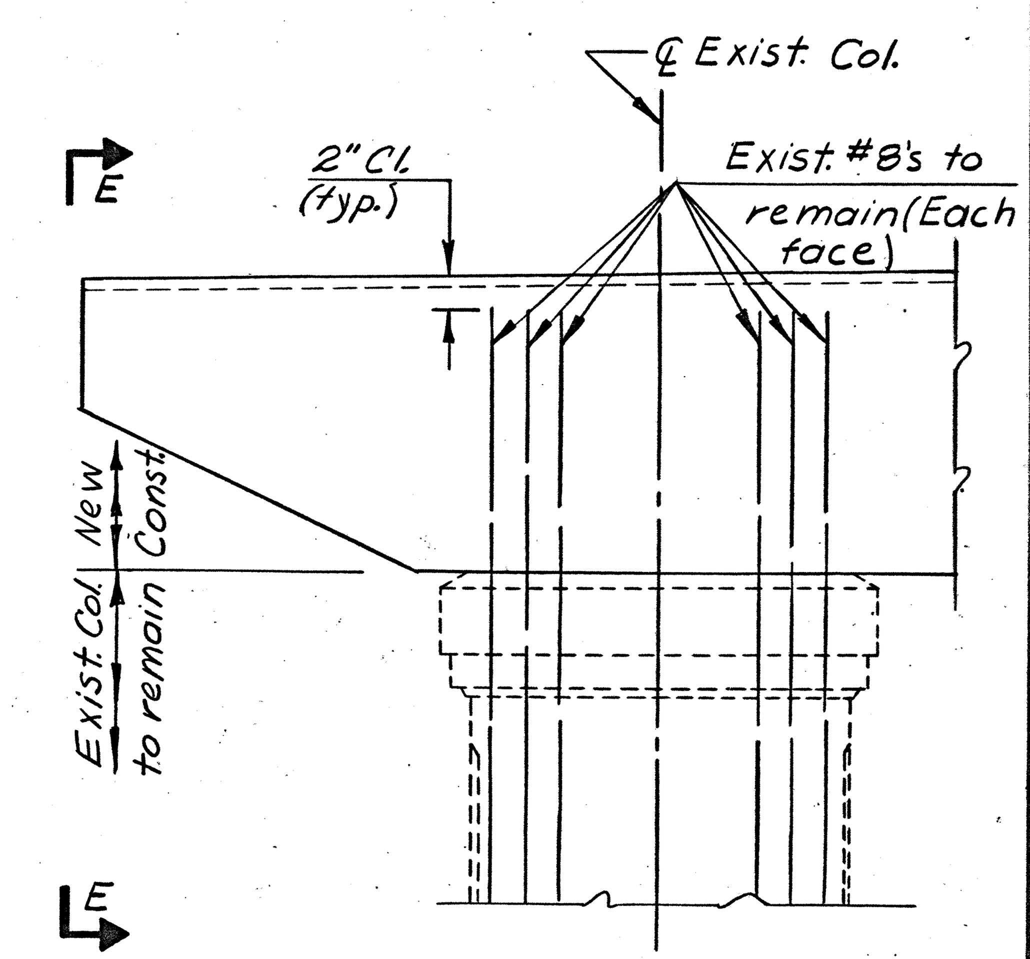
SECTION B-B



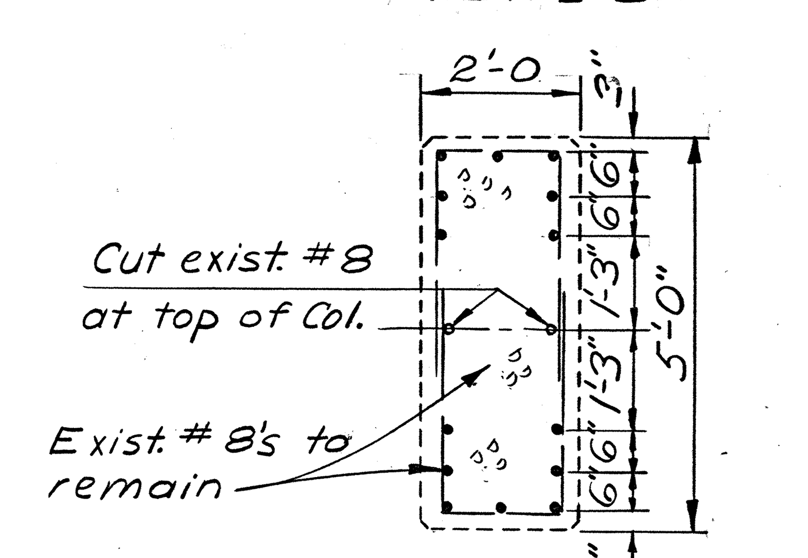
SECTION A-A
(Along Beam ℄)



VIEW E-E



PARTIAL VIEW C-C
(Showing Exist. Column)



SECTION D-D

NOTES

FOR beam layout plan see sheet 14/72

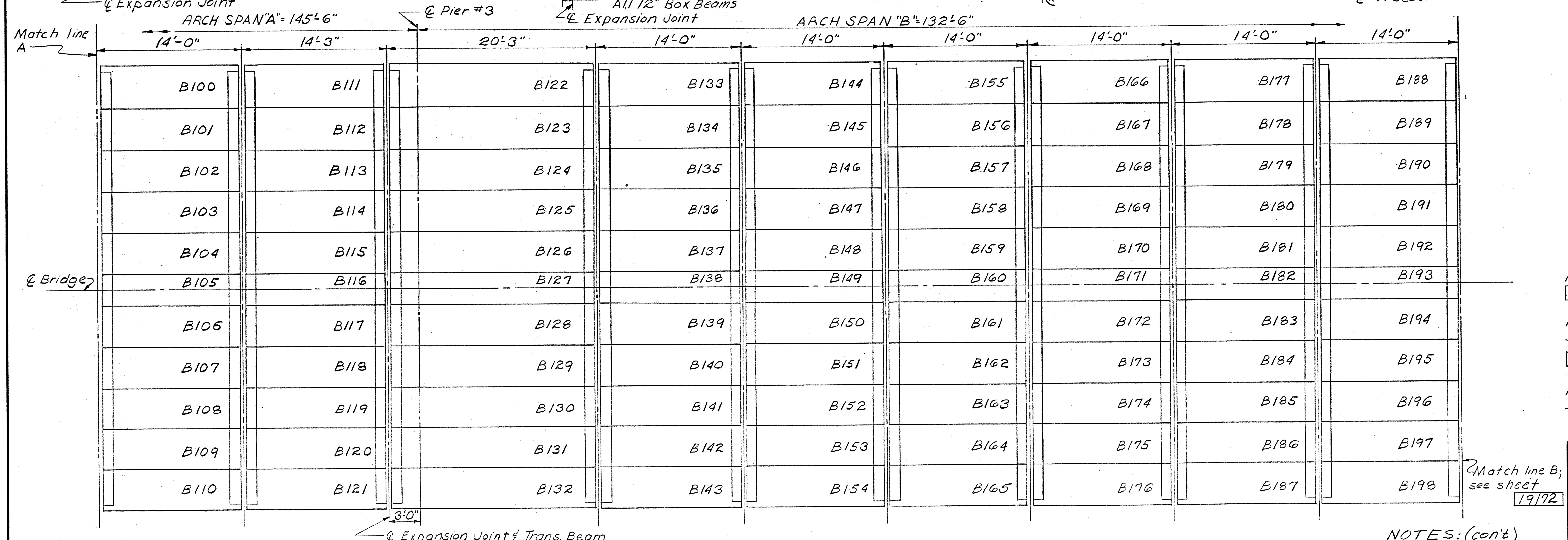
BEAMS shall be precast CONCRETE, Class S

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

17/72

TRANSVERSE BEAMS
C & C₁ 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	



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
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BUREAU OF BRIDGES AND STRUCTURAL DESIGN

18/72

BOX BEAM LAYOUT

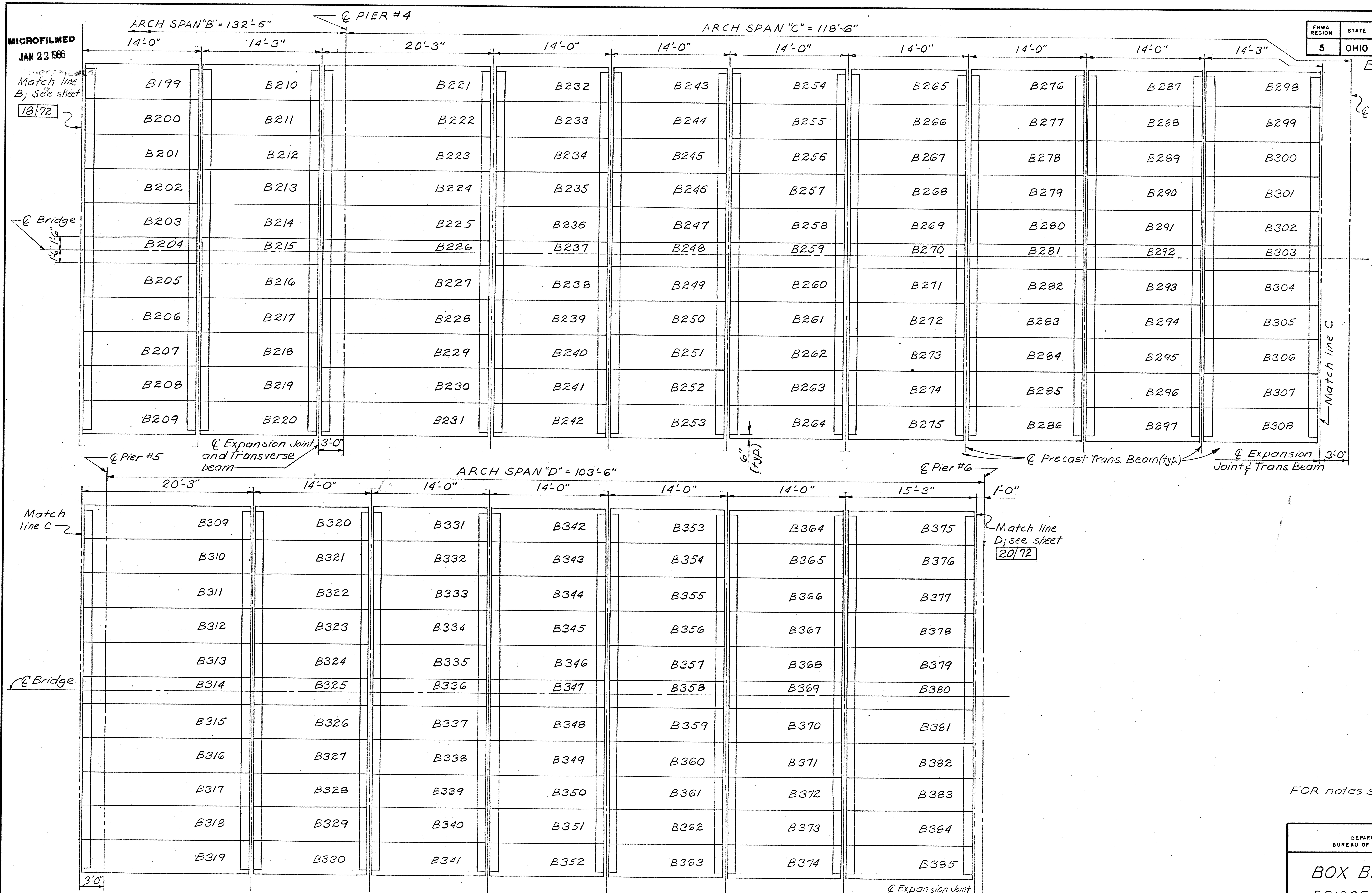
BRIDGE NO. BEL-40-2338
OVER THE B. & O. RAILROAD
AND WHEELING CREEK

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			

20/74

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

19/72

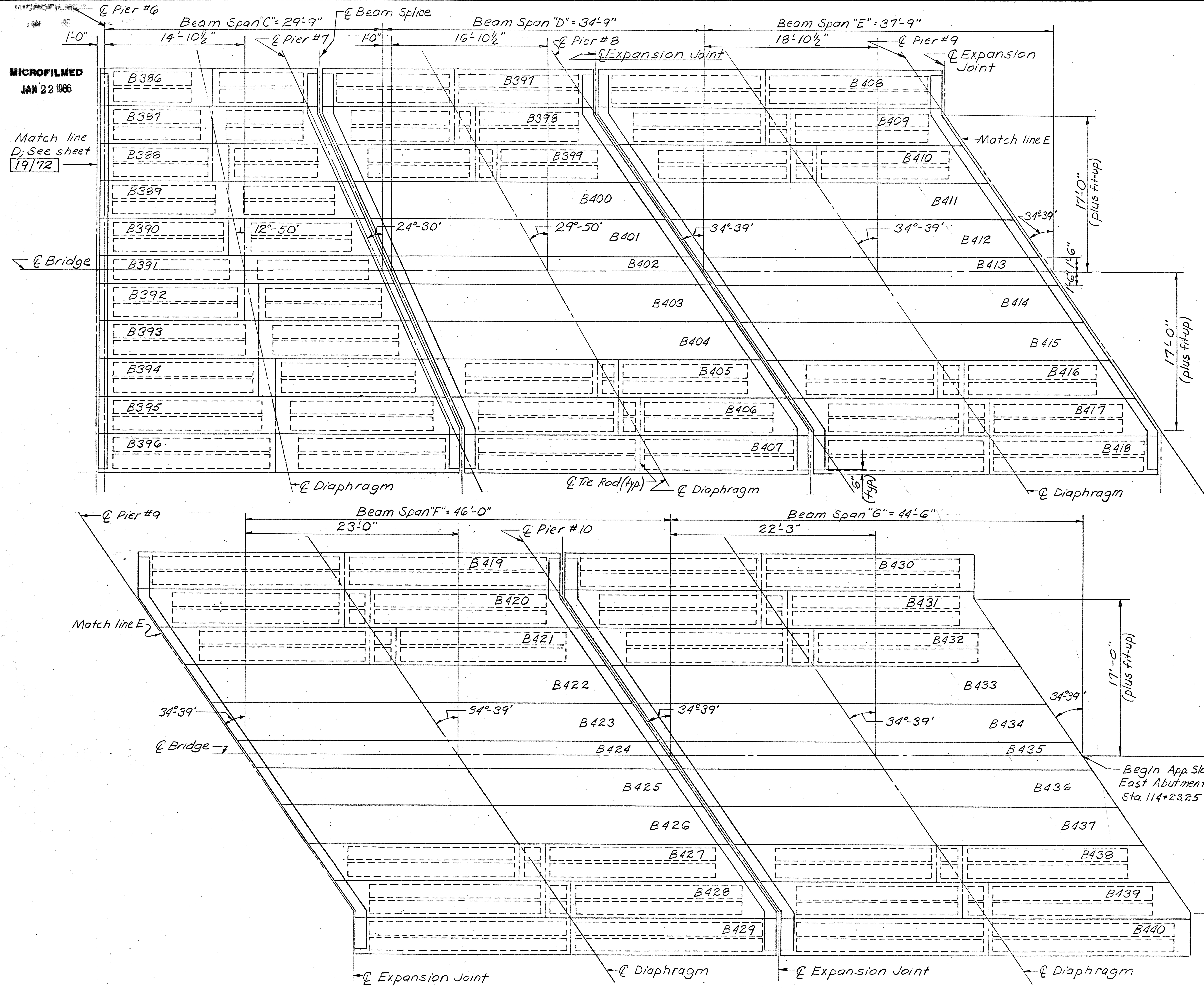
BOX BEAM LAYOUT

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

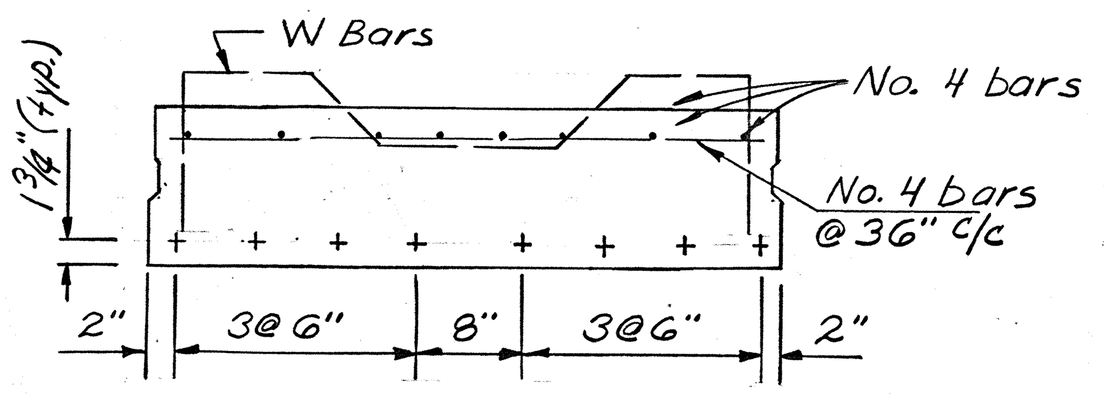
For notes see sheet 18/72

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

BOX BEAM LAYOUT

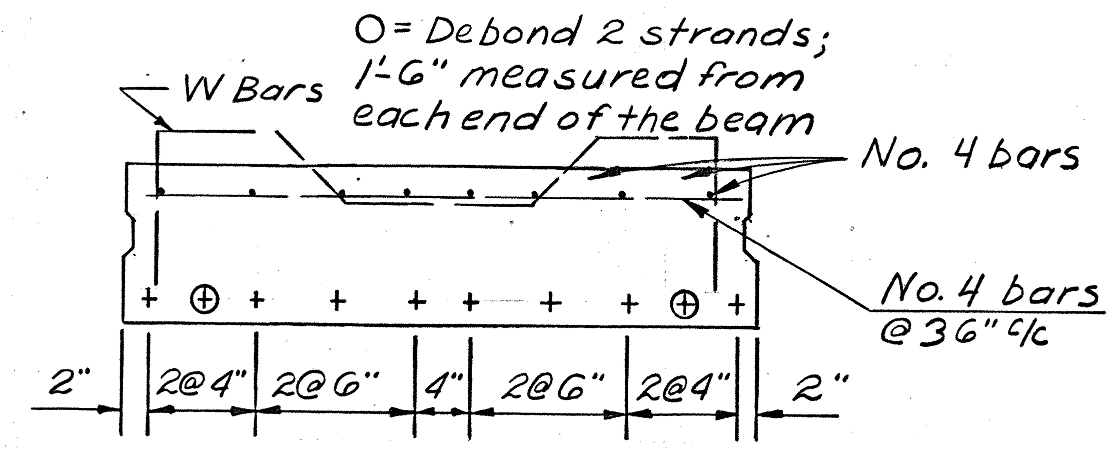
BRIDGE NO. BEL-40-23.38
OVER THE B. & O. RAILROAD
AND WHEELING CREEK

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



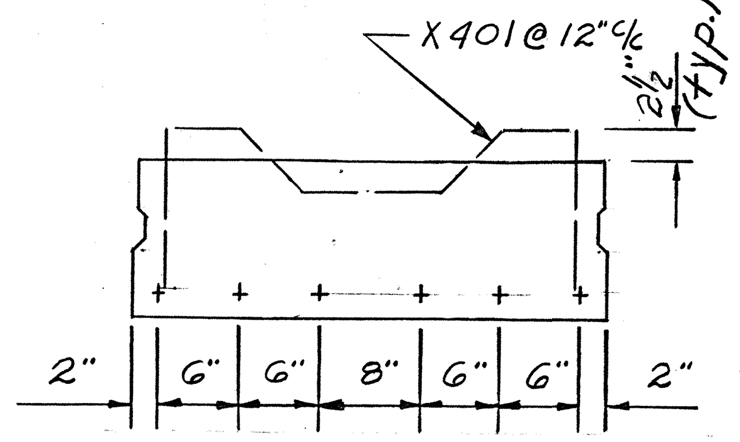
CB 12-48
(8 Strands)

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, B237, B248, B259, B270, B281, B292, B303, B325, B336, B347, B358, B369, B380



CB 12-48
(10 Strands)

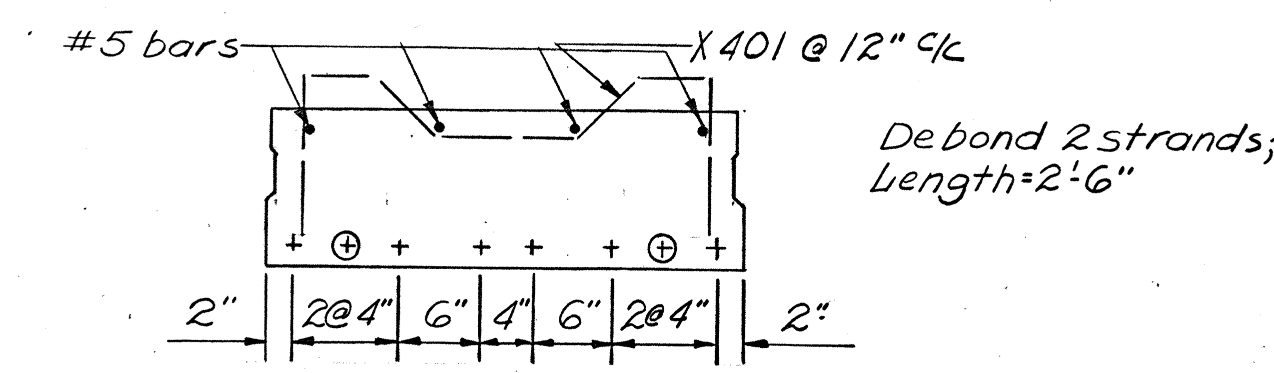
Beams B122 to B126 Incl.; B128 to B132 Incl.; B221 to B225 Incl.; B227 to B231 Incl.; B309 to B313 Incl.; B315 to B319



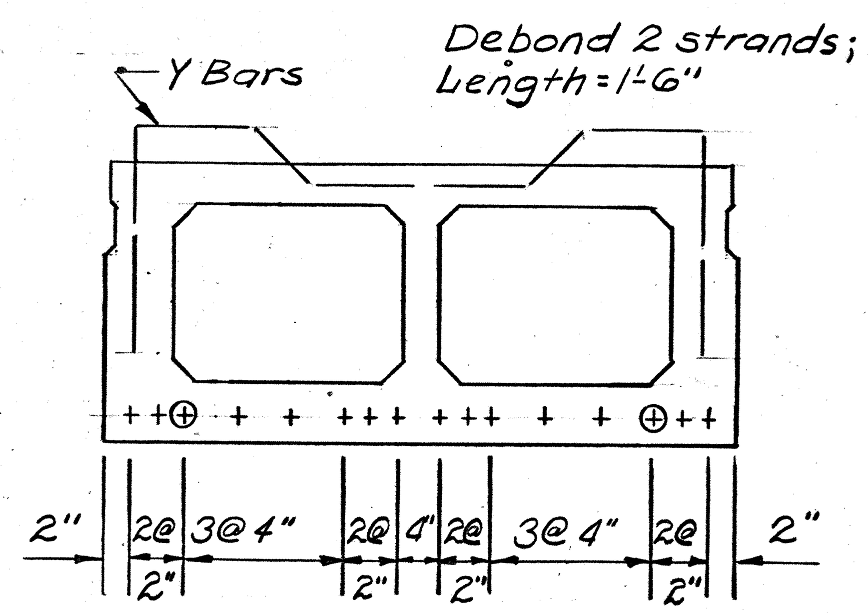
B 12-36
(6 Strands)

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)

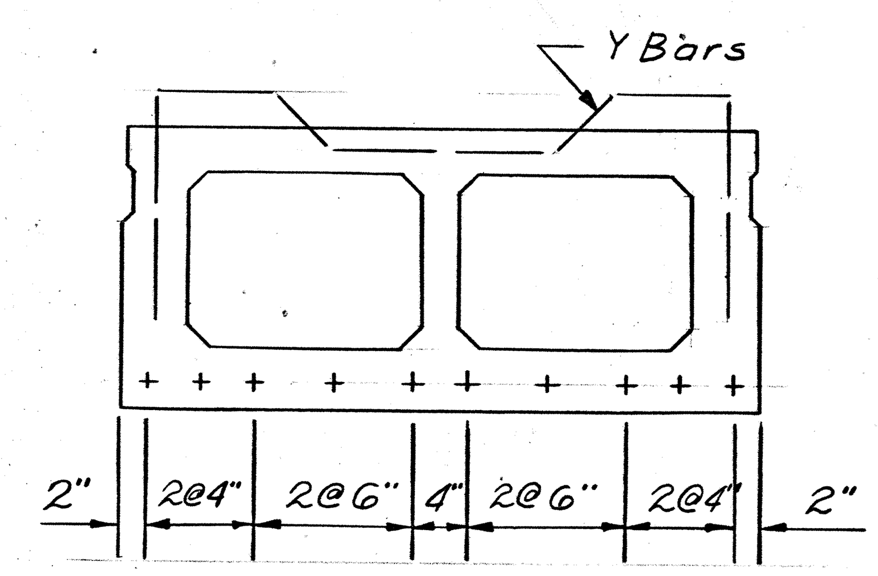


B 12-36
(8 Strands)
Beams B127, B226, B314
(modified for composite construction)



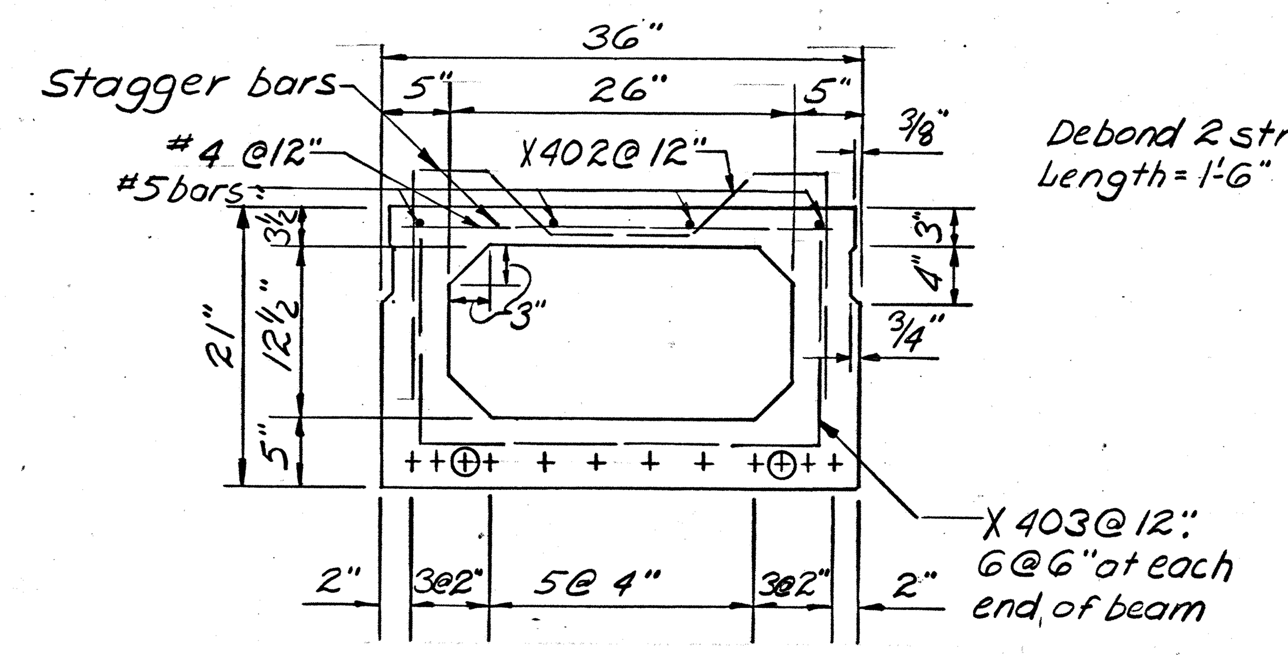
CB 21-48
(16 Strands)

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.

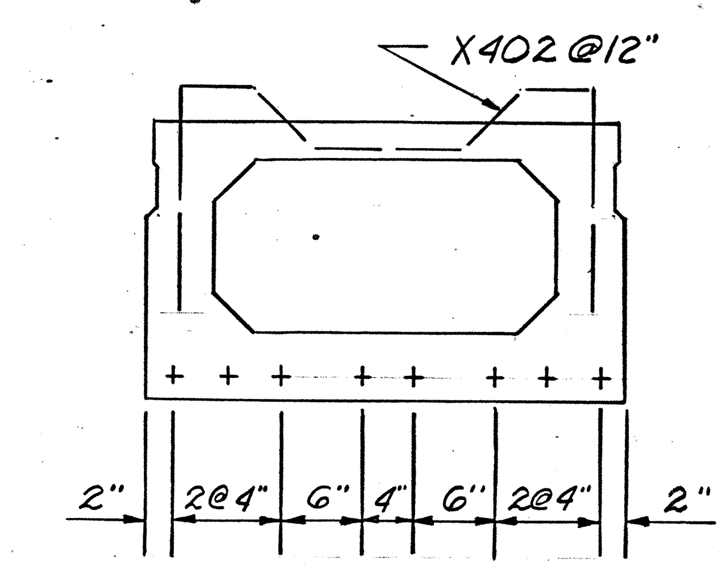


CB 21-48
(10 Strands)

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.

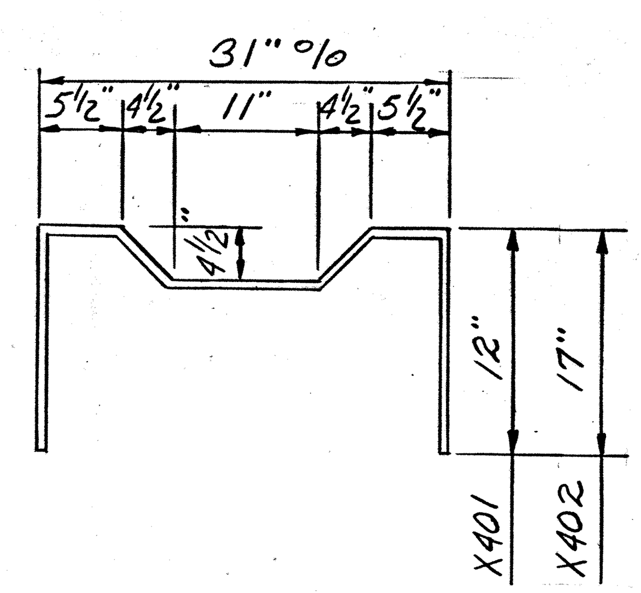


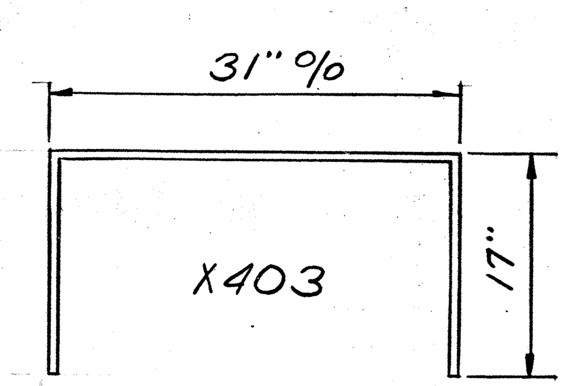
B 21-36
(12 Strands)
(modified for composite construction)
Beams B6, B424, B435



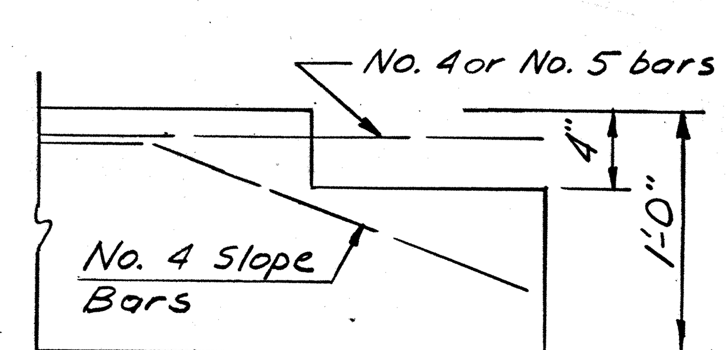
B 21-36
(8 Strands)
(modified for composite construction)
Beams B391, B402, B413

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, 26A/72, 49/72.

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

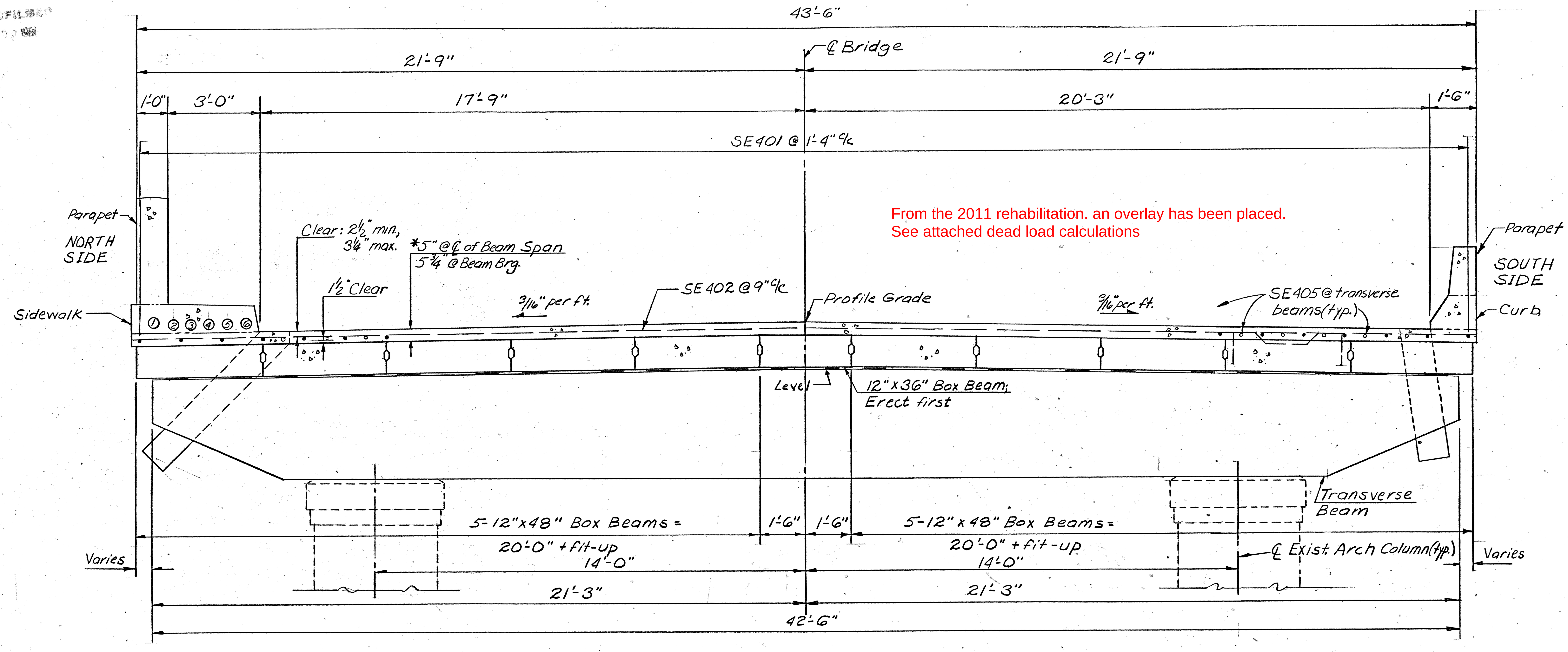
DESIGNED	DRAWN	TRACED	CHECKED	REVIEWED	DATE	REVISED
J.A.M.	J.A.M.		R.L.D.	WJJ	12-1-80	

FHWA REGION	STATE	PROJECT	
5	OHIO		

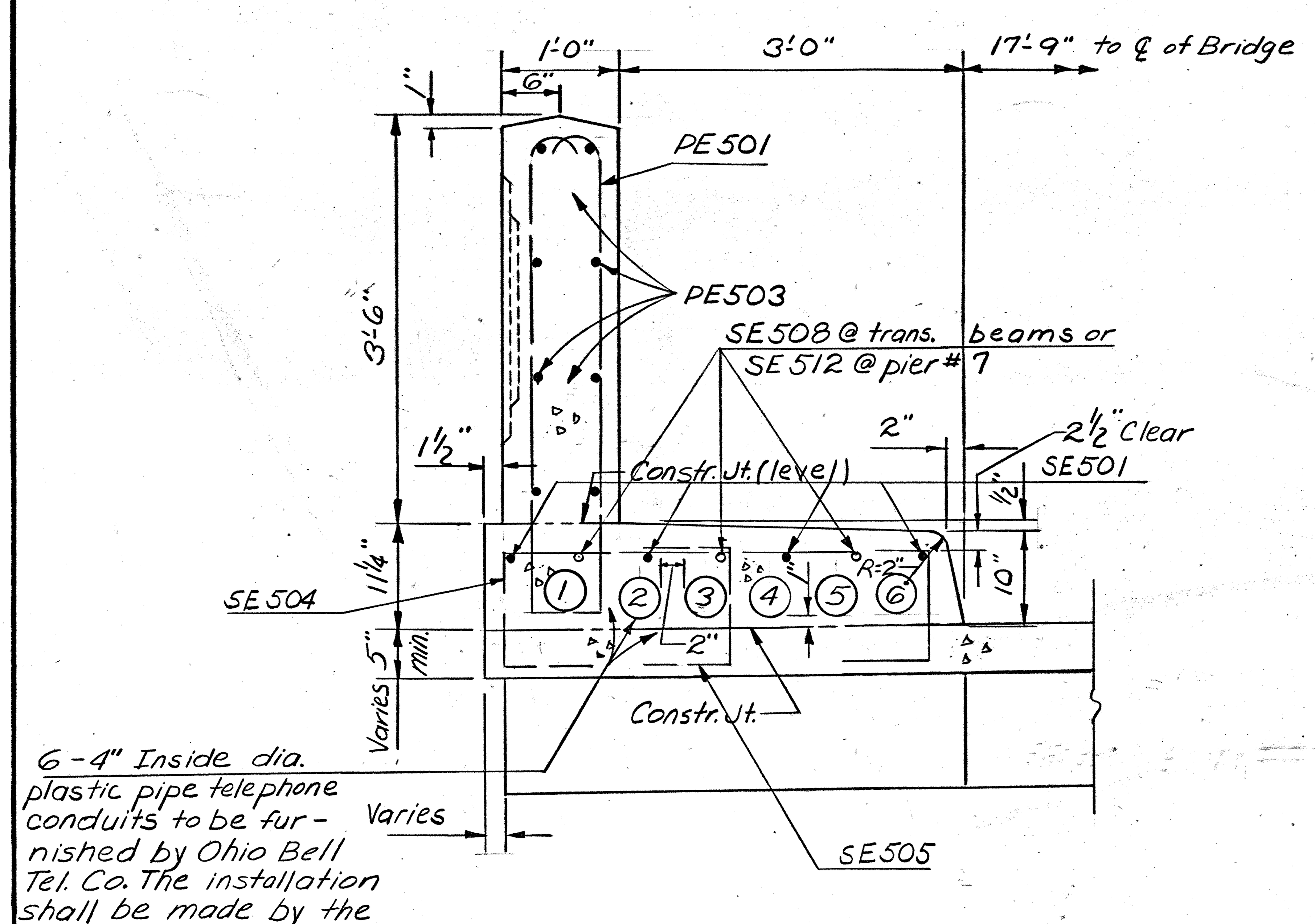
BEL-40-23.38

23/74

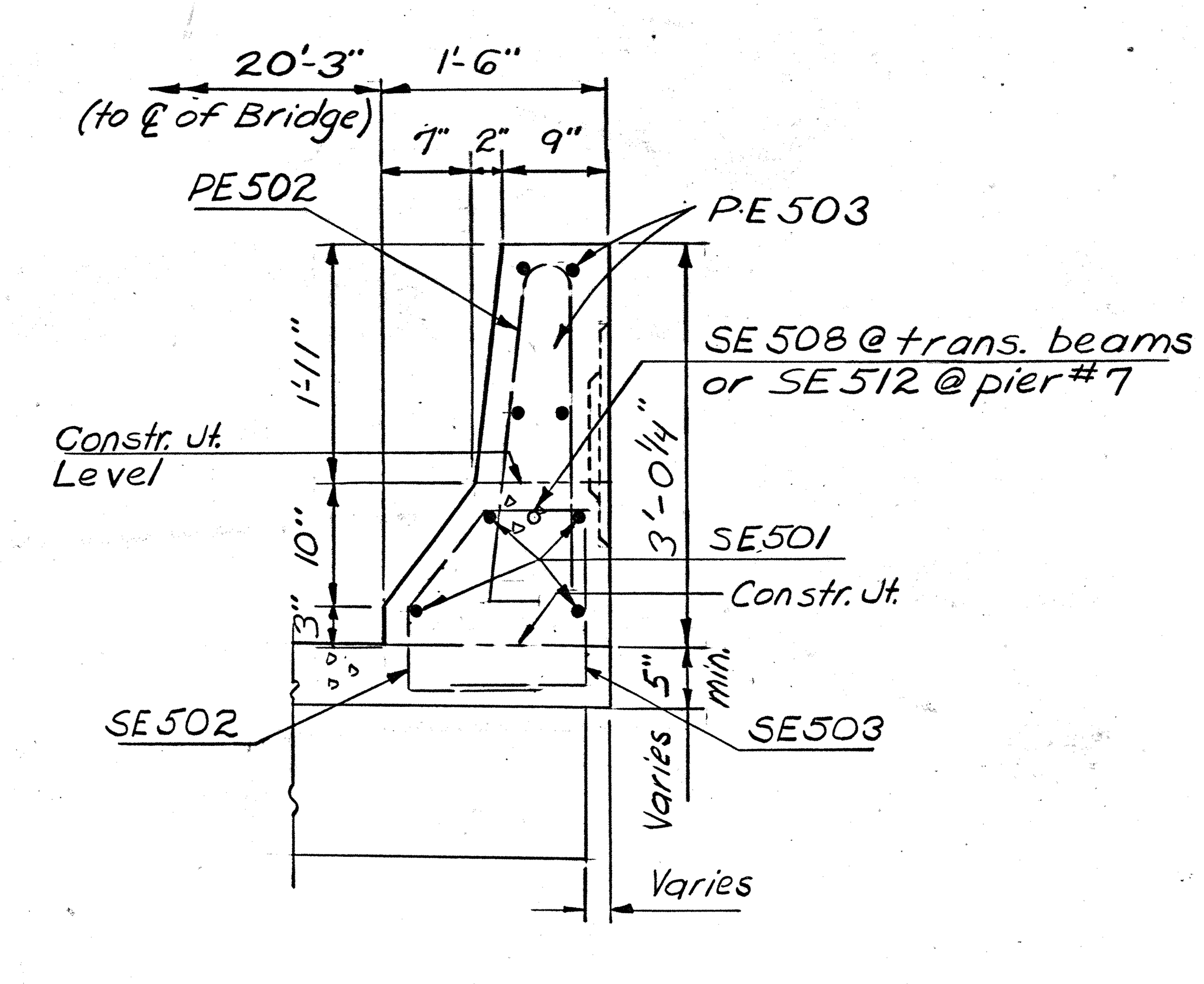
From the 2011 rehabilitation. an overlay has been placed.
See attached dead load calculations



TRANSVERSE DECK SECTION
THRU ARCH SPANS



NORTH SIDE - SECTION



SOUTH SIDE - SECTION

NOTES:

*This is the nominal dimension. The pay quantity of that portion of the deck concrete over the beams shall be based on the average of this dimension and the depth at beam bearings even though deviation from this average may occur because the top of the beam may not have the camber anticipated in the design; i.e., 3/4". The camber of beams shall be measured in the field before the deck is placed. The actual depth at mid-span shall be the nominal dimension plus or minus the difference between actual and anticipated camber.

NOTES:

For slab steel plan see sheet 22/72.
For parapet steel spacing see sheet 28/72 thru 35/72.
Scupper location on sheet 14/72.
Scupper details on sheet 48/72.
Field cut reinforcing steel at the scuppers.

For Beam Plan see sheets 18/72; 19/72

Calculated camber for all 12" box beams = 3/4"

For additional notes see sheet 23/72

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

24/72

SUPERSTRUCTURE
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	

PROJECT : *Belmont 40*			
TASK : *Load Rating Supporting Calculations*		PROJECT NO : *195987*	
SUBJECT : *Dead Load Calculations*			
CALCULATED BY : *ETB*	DATE : *6/5/2023*	CHECKED BY : *JTB*	DATE : *7/12/2023*

DEAD LOADS CALCULATIONS

DESCRIPTION:

-Dead load computations include a 5% self weight increase factor
-No concrete is subtracted for the formliners

REFERENCES:

-BEL 40 2283_Original Plans 1932.pdf
-BEL 40 2338 1981 Box Beam Install.pdf
-D11-22815-BEL-00040-23.38-2010-00.pdf

DEAD LOAD COMPUTATIONS		
Concrete density	**0.15**	kcf
DEFLECTOR TYPE PARAPET		
Cross sectional area	**429.00**	in^2
Base width	**1.50**	ft
Deflector type parapet pressure load	**0.31**	ksf
SIDEWALK PARAPET		
Cross sectional area	**504.00**	in^2
Base width	**1.00**	ft
Sidewalk parapet pressure load	**0.55**	ksf
SIDEWALK		
Height	**10.63**	in
Width	**4.13**	ft
Sidewalk pressure load	**0.14**	ksf
DECK + BOX BEAM		
Deck Thickness	**5.38**	in
Box Beam Height	**12.00**	in
Deck + box beam pressure load	**0.23**	ksf
MICROSILICA OVERLAY		
Overlay Thickness	**1.25**	in
Overlay pressure load	**0.02**	ksf