Appendix C

Foundation Recommendation Memorandum

GANNETT FLEMING

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August 12, 2024

Mark Grossman, P.E.
GPD Group
520 S. Main Street, Suite 2531
Akron, OH 44311

Re: SUM-CR008-09.08 (PID 115383) High Level Bridge Replacement
Foundation Recommendation Memorandum

Dear Mr. Grossman,

The following memorandum discusses the preferred foundation recommendations for the proposed SUM-CR008-09.08 (PID 115383) High Level Bridge alternatives and fulfills the scope of the agreement signed on June 17, 2022. The bridge alternatives are described below, and the site plans can be found in Attachment 1: Preliminary Site Plans. The report recommendations include initial guidelines for the structural engineers to make a preliminary estimation of quantities for drilled shafts and spread footings at the piers and driven piles at the abutments. A preliminary slope stability analysis and shoring recommendations are also provided.

The 1989 exploration consisted of six borings. Boring B-1 was advanced at STA 479+01.37 and 23.19 ft. RT., B-02 was advanced at STA 479+64.42 and 32.09 ft. LT, B-3 was advanced STA 481+41.47 and 83.88 ft. LT., B-4 was advanced at STA 486+93.18 and 28.05 ft. RT., B-5 was advanced at STA 488+16.83 and 37.89 ft. LT., and B-6 was advanced at STA 488+96.75 and 23.60 ft. LT. Borings B-2 and B-5 were advanced for the south and north abutments, respectively. Although it is not stated on the boring log, B-2 appears to terminate at or near the top of rock at the end depth of 64.8 feet. Boring B-5 terminates in very dense granular soil at 40 feet below ground surface elevation (BGE). Borings B-3 and B-4 were advanced for existing Piers 1 and 2, respectively. Boring B-3 advanced significantly west of the existing foundation, due to the steep slopes and encountered seven feet of soil and penetrated ten feet into silty shale bedrock. Boring B-4 encountered ten feet of soil and severely weathered rock before encountering ten feet of silty shale. Groundwater was not noted on the historical boring logs. GF cannot assess the impact of groundwater; however, for preliminary design, groundwater does not appear to be a problem.

The three bridge alternatives include: a continuous span post-tension segmental box girder bridge on a reinforced concrete pier and reinforced concrete abutments; an open spandrel arch with plate girder ribs and composite reinforced concrete deck on reinforced concrete piers and reinforced concrete abutments; and a continuous welded steel plate girder bridge with composite reinforced concrete deck on reinforced

concrete piers and reinforced concrete abutments. The abutments will either comprise of full height reinforced concrete abutments founded on drilled shafts or MSE walls. All the proposed abutments and piers will bear on drilled shafts, while the open spandrel arch will bear on spread footing on bedrock. The segmental box girder will be a two-span structure, the open spandrel arch plate girder bridge will be a three-span structure and the continuous welded plate girder bridge will either be a two, three or four-span structure.

There is insufficient subsurface information and no loading information available to determine exact bearing elevations of the foundations; however, the available boring information indicates shallow competent bedrock. At this stage of plan development, we offer the following recommendations and assumptions. The bearing resistance should be based on the strength of the foundation's concrete (i.e., not limited by bedrock strength) for both drilled shafts and arch supports. In later phases of the project, borings should be advanced at the foundation locations to determine the rock and soil strength parameters for the analysis of the bearing, sliding, and overturning resistance. The bearing elevations of the proposed piers and arch supports are currently estimated and based on the geology of the site, the approximated elevations are shown on the site plans. The geology of the site indicates that the valley was cut through, more or less, horizontal stratigraphy. The valley walls are formed of shallow residuum and colluvium soil overlying bedrock. Field observations of nearby rock outcrops and the steep valley walls confirm these conclusions. GF anticipates that the overburden soil is generally less than ten feet thick and overlays the bedrock where the surface elevation (EL) is below 910 feet. For foundations located in areas above surface elevation 910, assume top of sound rock is EL 910. Given the height of the bridge, lateral forces will likely control the foundation design. The designer should assume the drilled shafts for the piers be socketed twenty feet into rock to provide sufficient lateral resistance. It is reasonable for this stage of the project to assume the spread footings are founded on sound bedrock (below the weathering zone) with a base adequately large enough to resist overturning. For this preliminary estimation and comparison, spread footings bearing fifteen feet below the surface elevation and drilled shafts with a tip elevation thirty feet below surface elevation are assumed. This does not remove the need for future project borings and borings at each substructure to determine bearing resistance and to perform a detailed scour analysis of the soil and rock. These recommendations and assumptions allow for the preliminary sizing of drilled shafts or spread footings. It should be noted that spread footings would require a larger work area and deeper excavations.

The abutments could be supported on H-piles driven to refusal; however, current plans show drilled shafts. This removes the need to mobilize multiple types of foundation equipment and is therefore expected to be more cost effective. By AASHTO standards, the abutments and pier drilled shafts should be socketed 1.5 times the diameter of the shafts into the bedrock to prevent the possibility of them bearing on highly weathered or weaker rock. Deeper socket lengths may be necessary for the piers which will experience a greater lateral load. Based on the historical data, bedrock is estimated to be sixty feet BGE at the south abutment and forty feet BGE at the north abutment. In the historical borings no cobbles were encountered, and groundwater appears to be controllable by standard means and methods of excavation of drilled shafts per ODOT Item 524.

The steep slopes and shallow depth to bedrock will present challenges during construction. Access road installation and temporary shoring for access roads will be difficult. Shoring will need to be socketed into

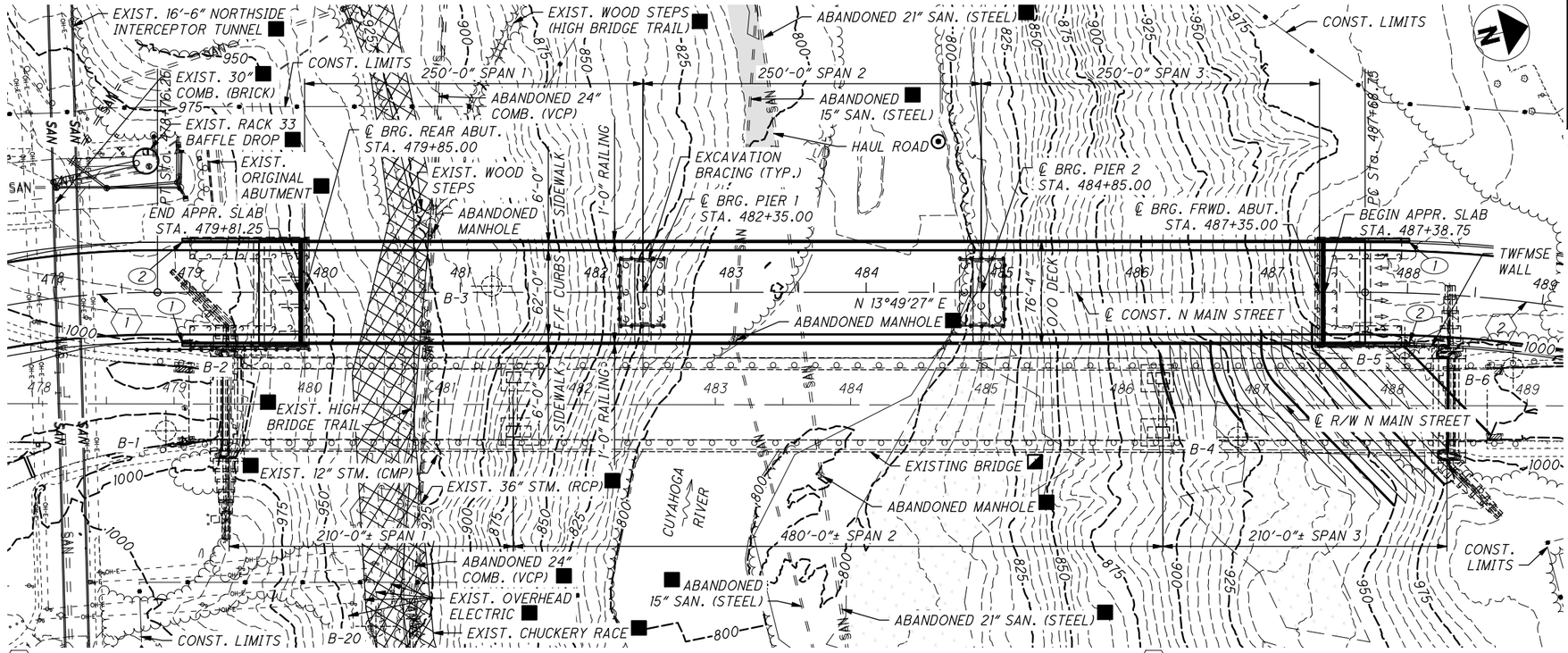
rock, for example, a soldier pile and lagging walls. However, these types of walls are more expensive than non-socketed walls, such as sheet piling.

Another challenge is the relative instability of the valley slopes. Multiple isolated, typically shallow, failures are observed along the valley walls indicating the slopes are marginally stable. A global stability analysis was performed on both the south and north existing slopes, using the existing topography provided by the GPD Group and the subsurface data from 1989. The slopes are nominally stable based on the model, with a factor of safety (FS) of 1.2, based on soil properties developed from historical borings. This does not meet design criteria for new slopes. Being marginally stable means changes to slope geometry, such as adding fill or removing the toe material, or intense rain events, could cause failure. Thus, when cutting back into the slope for access roads, the slopes may become unstable and will need to be shored. Shallow rock will prevent the use of sheeting and soldier pile walls should be assumed. At the abutments, sheeting may be a possibility for shallow shoring operations, but deeper excavations may require achieving resistance in bedrock, where soldier piles are then recommended. The results of the Global Stability Analysis are presented in Attachment 2.

Sincerely,
Gannett Fleming Engineers and Architects, P.C.

Thomas L. Monaco, P.E.
Principal Geotechnical Engineer

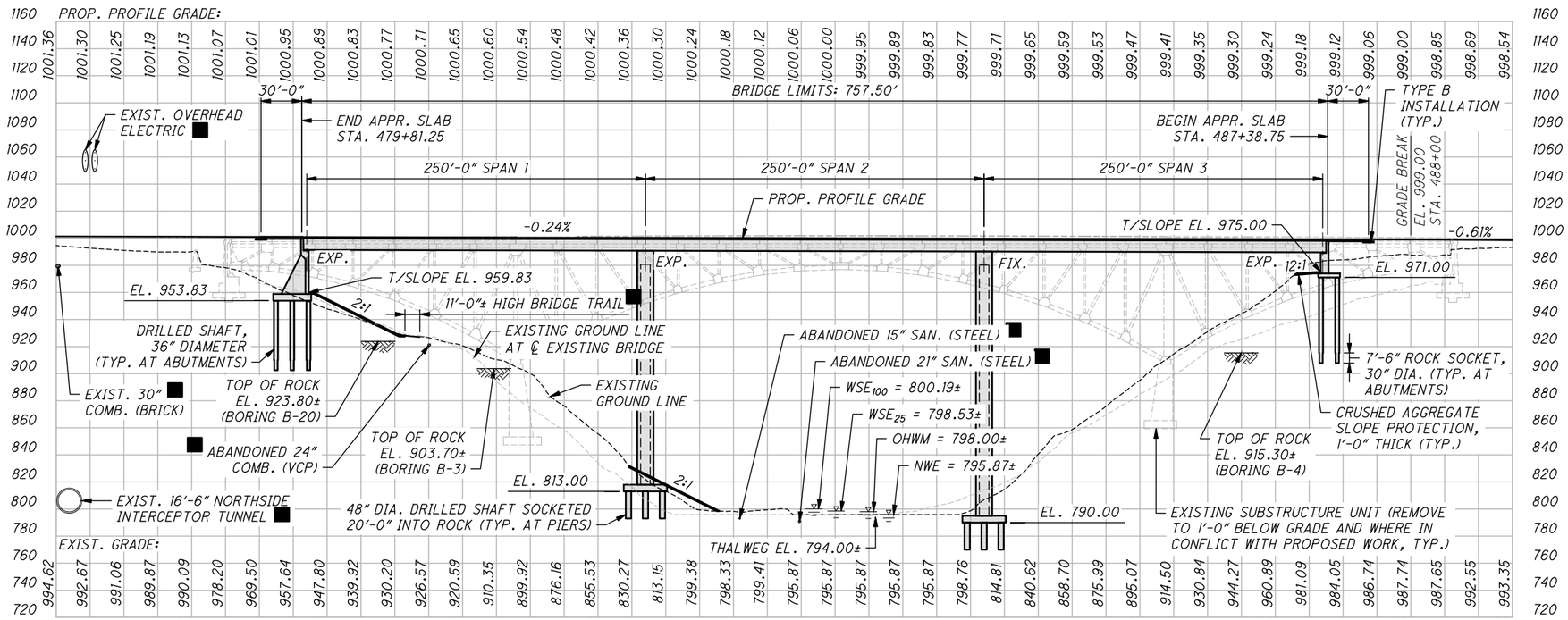
ATTACHMENT 1:
SITE PLANS



PLAN

1 HORIZONTAL CURVE DATA
P.I. = Sta. 477+53.37
D = 21° 56' 04"
Dc = 8° 48' 53"
R = 650.000
T = 125.96'
L = 248.84'
E = 12.09
C = 247.32
C. B. = N 2° 51' 25" E

2 HORIZONTAL CURVE DATA
P.I.= Sta. 489+08.80
D = 15° 56' 41"
Dc = 5° 43' 46"
R = 1000.000
T = 140.05'
L = 278.29'
E = 9.76
C = 277.39
C. B. = N 21° 47' 47" E



PROFILE ALONG ℄ CONST. N MAIN STREET C4

BENCHMARK DATA

NAME	STATION	OFFSET	ELEV.	DESCRIPTION
BM1	___+__.__	___.___ __'	___.___	_____
BM2	___+__.__	___.___ __'	___.___	_____
BM3	___+__.__	___.___ __'	___.___	_____
BM4	___+__.__	___.___ __'	___.___	_____

SEE ROADWAY PLANS FOR ADDITIONAL BENCHMARK INFORMATION.

NOTES:

EARTHWORK LIMITS SHOWN ARE APPROXIMATE. ACTUAL SLOPES SHALL CONFORM TO PLAN CROSS SECTIONS.

DESIGN TRAFFIC:
2029 ADT = 16,500 2029 ADTT = 170
2049 ADT = 17,500 2049 ADTT = 180
DIRECTIONAL DISTRIBUTION = 51%

LEGEND:

- PROJECT BORING LOCATION
- HISTORIC BORING LOCATION
- (#) MGS BTA, TYPE # FIRST POST LOCATION (SEE STD. DWG. MGS-3.1)
- END OF HAUL ROAD SHOWN. LOCATION OF TAF (NOT SHOWN) TO BE DETERMINED IN DETAIL DESIGN.
- TO REMAIN
- TO BE REMOVED

HYDRAULIC DATA:

DRAINAGE AREA = 336 SQ. MILES
Q(25) = 4,244 CFS V(25) = 9.55 FT/S
Q(100) = 5,600 CFS V(100) = 10.12 FT/S
STRUCTURE CLEARS THE 25 YEAR DESIGN HW BY 190.88 FEET.

EXISTING STRUCTURE

TYPE: STEEL CANTILEVER DECK TRUSS WITH REINFORCED CONCRETE DECK ON REINFORCED CONCRETE SUBSTRUCTURE UNITS FOUNDED ON SPREAD FOOTINGS.
SPANS: 210'-0"±, 480'-0"±, 210'-0"± C/C BEARINGS
ROADWAY: 52'-0"± F/F CURBS & 2-6'-0"± SIDEWALKS
LOADING: HS20-44 CASE II AND INTERSTATE ALTERNATE LOADING
SKEW: NONE
WEARING SURFACE: MONOLITHIC CONCRETE AND EPOXY OVERLAY
APPROACH SLABS: 25'-0"± LONG (AS-1-81)
ALIGNMENT: TANGENT
CROWN: 3/16"±/FT
STRUCTURE FILE NUMBER: 7730306
DATE BUILT: 1949
DISPOSITION: TO BE REPLACED.

PROPOSED STRUCTURE

TYPE: CONTINUOUS WELDED THREE-SPAN STEEL PLATE GIRDER BRIDGE WITH COMPOSITE REINFORCED CONCRETE DECK ON REINFORCED CONCRETE PIERS AND REINFORCED CONCRETE ABUTMENTS ALL FOUNDED ON DRILLED SHAFTS SOCKETED INTO BEDROCK.
SPANS: 250'-0", 250'-0", 250'-0" C/C BEARINGS
ROADWAY: 62'-0" T/T CURBS & TWO 6'-0" SIDEWALKS 76'-4" O/O DECK
LOADING: HL93 & 0.060 KSF FUTURE WEARING SURFACE
WEARING SURFACE: 1" MONOLITHIC CONCRETE
SKEW: NONE
APPROACH SLABS: 30'-0" LONG, TYPE B INSTALLATION (AS-1-15, AS-2-15)
ALIGNMENT: TANGENT
CROWN: 0.016 FT/FT
COORDINATES: LATITUDE N 41°07'19.62"
LONGITUDE W 81°30'35.42"
DECK AREA: 57,479 SF

PRELIMINARY SITE PLAN (ALTERNATIVE 2B - 3-SPAN STEEL PG)
BRIDGE NO. SUM-8-09.080
N MAIN STREET OVER THE CUYAHOGA RIVER

SFN 7730306 (EX.)
DESIGN AGENCY
GPD GROUP
Gibus, Pyle, Schomer, Burns & Deneen, Inc.
DESIGNER MOJ | CHECKER TJW
REVIEWER DGN 4-5-24
PROJECT ID 115383
SUBSET 1 | TOTAL 4
SHEET A1 | TOTAL 11

SUM-CR8-9.08 (High Level Bridge)
12/08/2024
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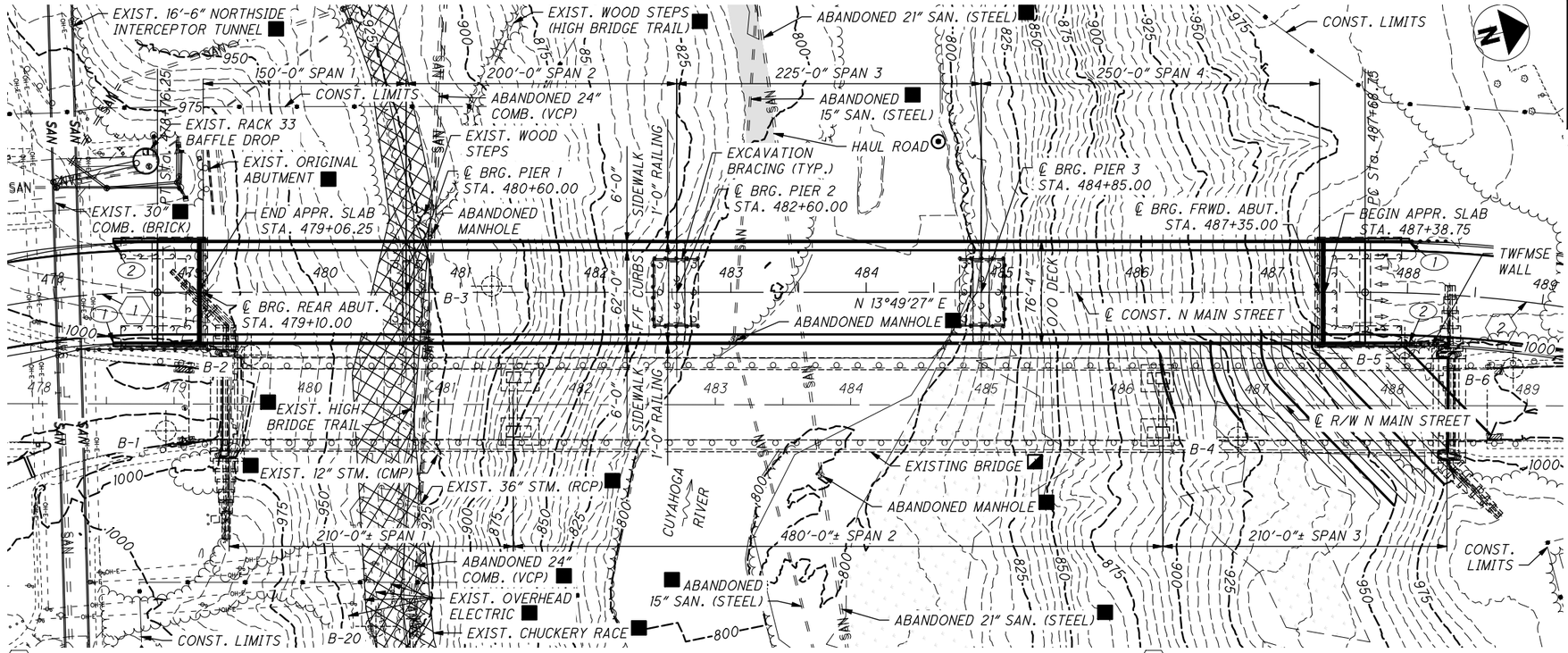
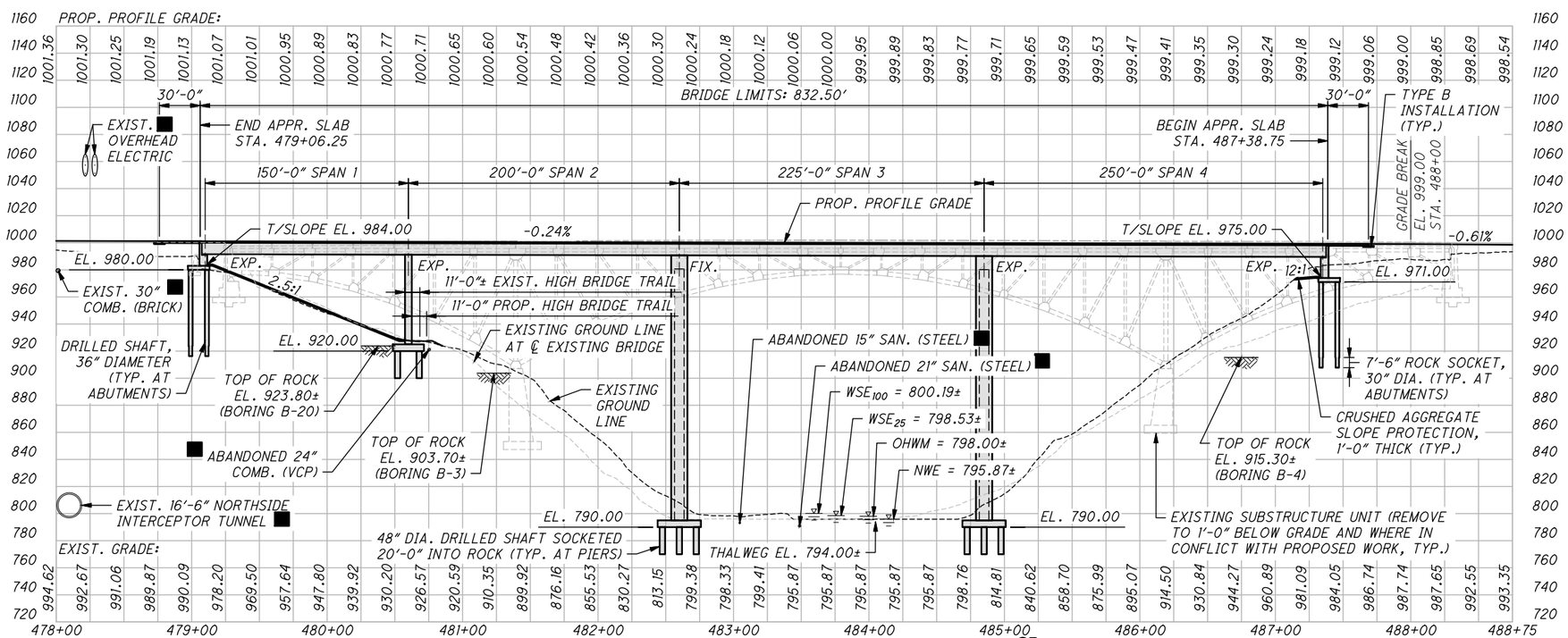


PLAN

1 HORIZONTAL CURVE DATA
P.I. = Sta. 477+53.37
D = 21° 56' 04"
Dc = 8° 48' 53"
R = 650.000
T = 125.96'
L = 248.84'
E = 12.09
C = 247.32
C. B. = N 2° 51' 25" E

2 HORIZONTAL CURVE DATA
P.I.= Sta. 489+08.80
D = 15° 56' 41"
Dc = 5° 43' 46"
R = 1000.000
T = 140.05'
L = 278.29'
E = 9.76
C = 277.39
C. B. = N 21° 47' 47" E



PROFILE ALONG ℄ CONST. N MAIN STREET C5

BENCHMARK DATA

NAME	STATION	OFFSET	ELEV.	DESCRIPTION
BM1	___+__.__	___.___ __.__'	___.___	_____
BM2	___+__.__	___.___ __.__'	___.___	_____
BM3	___+__.__	___.___ __.__'	___.___	_____
BM4	___+__.__	___.___ __.__'	___.___	_____

SEE ROADWAY PLANS FOR ADDITIONAL BENCHMARK INFORMATION.

NOTES:

EARTHWORK LIMITS SHOWN ARE APPROXIMATE. ACTUAL SLOPES SHALL CONFORM TO PLAN CROSS SECTIONS.

DESIGN TRAFFIC:
2029 ADT = 16,500 2029 ADTT = 170
2049 ADT = 17,500 2049 ADTT = 180
DIRECTIONAL DISTRIBUTION = 51%

LEGEND:

- PROJECT BORING LOCATION
- HISTORIC BORING LOCATION
- (#) MGS BTA, TYPE # FIRST POST LOCATION (SEE STD. DWG. MGS-3.1)
- END OF HAUL ROAD SHOWN. LOCATION OF TAF (NOT SHOWN) TO BE DETERMINED IN DETAIL DESIGN.
- TO REMAIN
- TO BE REMOVED

HYDRAULIC DATA:

DRAINAGE AREA = 336 SQ. MILES
Q(25) = 4,244 CFS V(25) = 9.55 FT/S
Q(100) = 5,600 CFS V(100) = 10.12 FT/S
STRUCTURE CLEARS THE 25 YEAR DESIGN HW BY 190.88 FEET.

EXISTING STRUCTURE

TYPE: STEEL CANTILEVER DECK TRUSS WITH REINFORCED CONCRETE DECK ON REINFORCED CONCRETE SUBSTRUCTURE UNITS FOUNDED ON SPREAD FOOTINGS.
SPANS: 210'-0"±, 480'-0"±, 210'-0"± C/C BEARINGS
ROADWAY: 52'-0"± F/F CURBS & 2-6'-0"± SIDEWALKS
LOADING: HS20-44 CASE II AND INTERSTATE ALTERNATE LOADING
SKEW: NONE
WEARING SURFACE: MONOLITHIC CONCRETE AND EPOXY OVERLAY
APPROACH SLABS: 25'-0"± LONG (AS-1-81)
ALIGNMENT: TANGENT
CROWN: 3/16"±/FT
STRUCTURE FILE NUMBER: 7730306
DATE BUILT: 1949
DISPOSITION: TO BE REPLACED.

PROPOSED STRUCTURE

TYPE: CONTINUOUS WELDED FOUR-SPAN STEEL PLATE GIRDER BRIDGE WITH COMPOSITE REINFORCED CONCRETE DECK ON REINFORCED CONCRETE PIERS AND REINFORCED CONCRETE ABUTMENTS ALL FOUNDED ON DRILLED SHAFTS SOCKETED INTO BEDROCK.
SPANS: 150'-0", 200'-0", 225'-0", 250'-0" C/C BEARINGS
ROADWAY: 62'-0" T/T CURBS & TWO 6'-0" SIDEWALKS 76'-4" O/O DECK
LOADING: HL93 & 0.060 KSF FUTURE WEARING SURFACE
WEARING SURFACE: 1" MONOLITHIC CONCRETE
SKEW: NONE
APPROACH SLABS: 30'-0" LONG, TYPE B INSTALLATION (AS-1-15, AS-2-15)
ALIGNMENT: TANGENT
CROWN: 0.016 FT/FT
COORDINATES: LATITUDE N 41°07'18.90"
LONGITUDE W 81°30'35.66"
DECK AREA: 63,548 SF

PRELIMINARY SITE PLAN (ALTERNATIVE 2C - 4-SPAN STEEL PG)
N MAIN STREET OVER THE CUYAHOGA RIVER
BRIDGE NO. SUM-8-09.080

SFN 7730306 (EX.)
DESIGN AGENCY
GPD GROUP
DESIGNER MOJ | CHECKER TJW
REVIEWER DGN 4-5-24
PROJECT ID 115383
SUBSET 2 | TOTAL 4
SHEET A2 | TOTAL 11

SUM-CR8-9.08 (High Level Bridge)
12/08/2024
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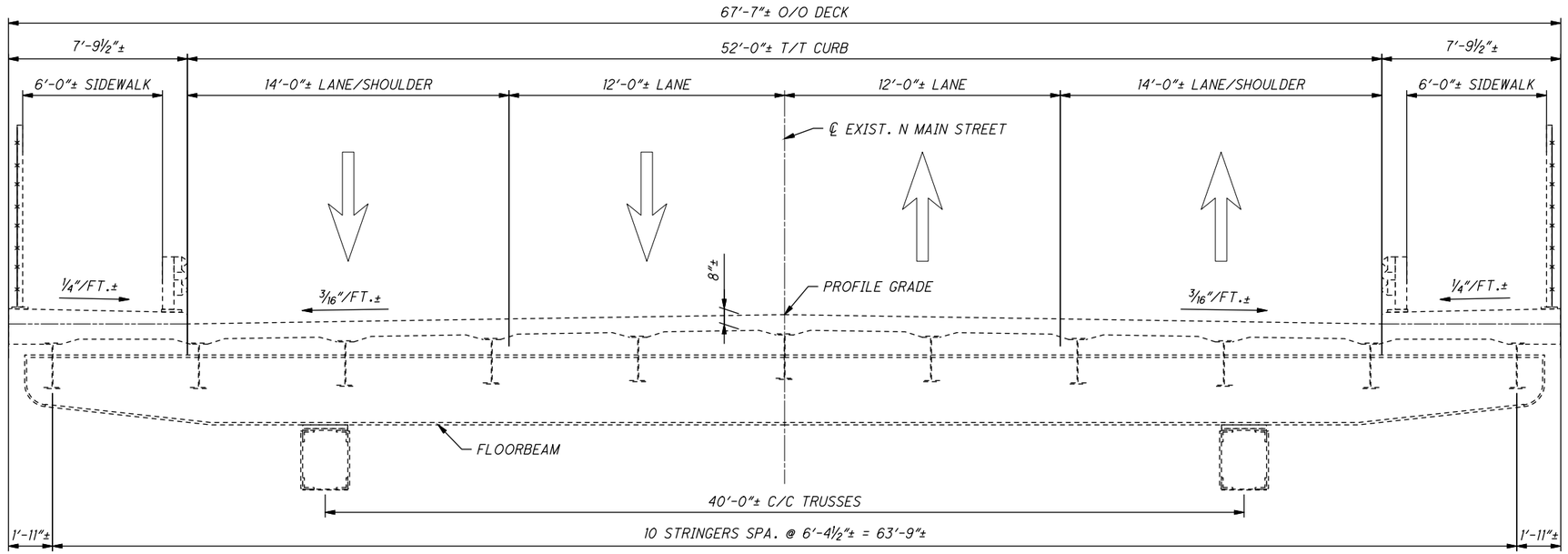
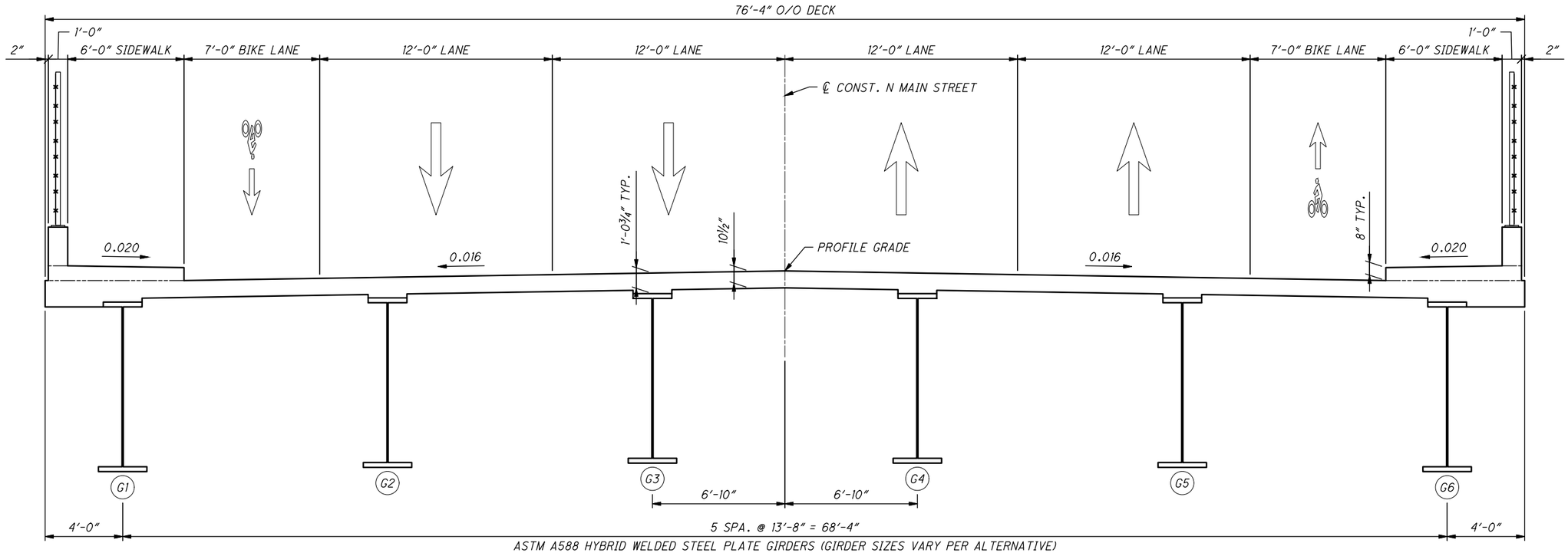


EXISTING TRANSVERSE SECTION

CONCRETE DECK PORTION (SPANS 1 & 3) SHOWN. CONCRETE FILLED STEEL GRID DECK PORTION (SPAN 2) SIMILAR.



ASTM A588 HYBRID WELDED STEEL PLATE GIRDERS (GIRDER SIZES VARY PER ALTERNATIVE)

PROPOSED TRANSVERSE SECTION

LEGEND:

(G#) GIRDER NUMBER

NOTES:

1. CROSSFRAMES AND CATWALKS/INSPECTION HANDRAILS NOT SHOWN.

TRANSVERSE SECTION (ALTERNATIVE 2 - STEEL PG)
BRIDGE NO. SUM-8-09.080
N MAIN STREET OVER THE CUYAHOGA RIVER

SFN 7730306 (EX.)

DESIGN AGENCY

GPD GROUP
Glaus, Pyle, Schomer, Burns & DeHaven, Inc.

DESIGNER	CHECKER
MOJ	TJW

REVIEWER: DGN 4-5-24

PROJECT ID: 115383

SUBSET	TOTAL
3	4

SHEET	TOTAL
A3	11

SUM-CR8-9.08 (High Level Bridge)

14/12/2023
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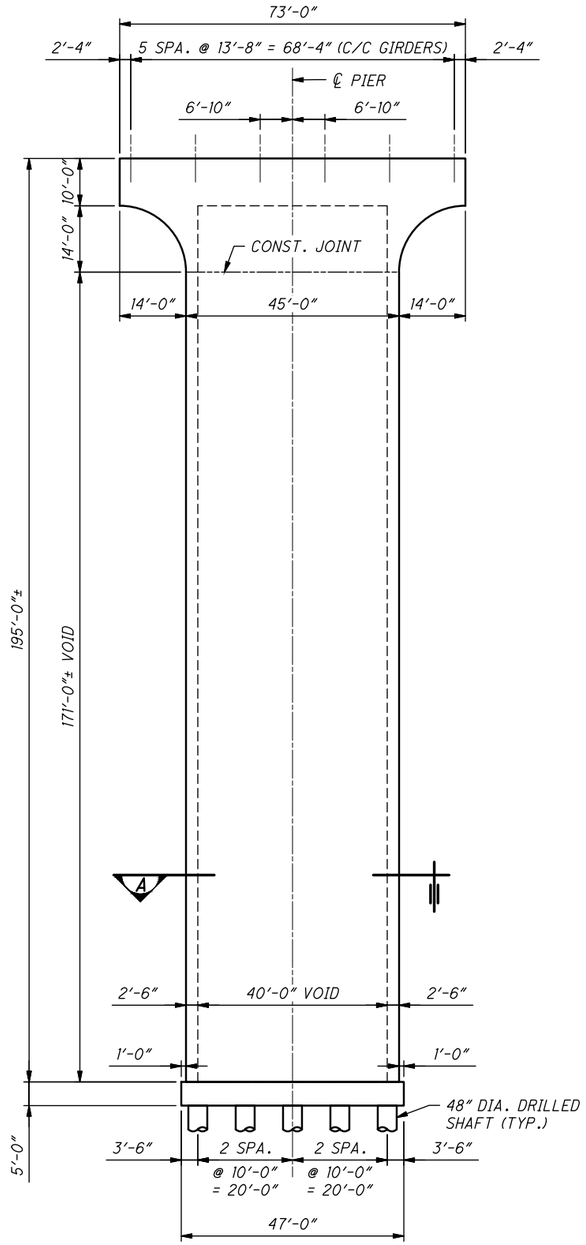
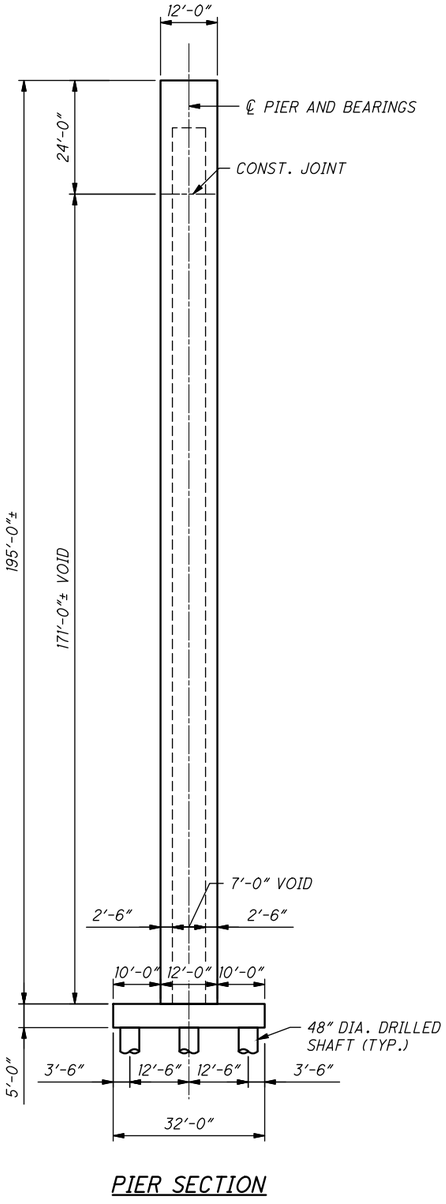
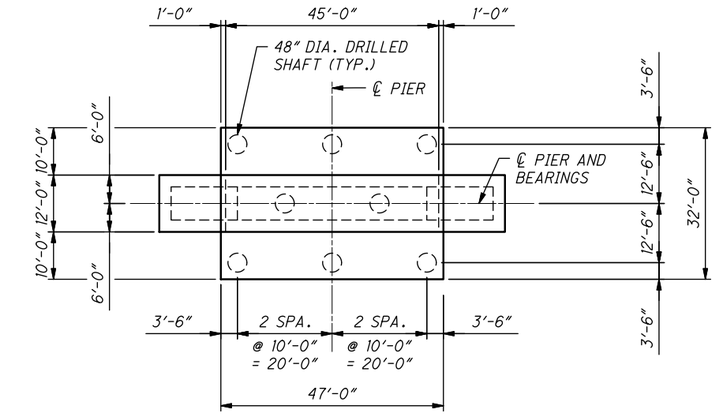


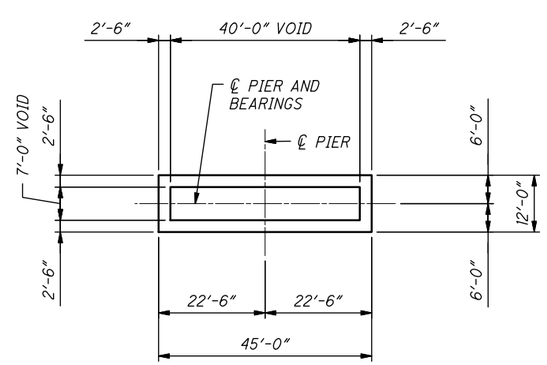
PIER ELEVATION



PIER SECTION



PIER PLAN



SECTION A

NOTES:

1. THE PER SHOWN IS APPROXIMATELY SIZED FOR ALTERNATIVE 2B PIERS 1 & 2 AND ALTERNATIVE 2C PIERS 2 & 3. ALTERNATIVE 2A PIER 1 WOULD BE LARGER TO ACCOMMODATE LARGER LOADS. ALTERNATIVE 2C PIER 1 WILL BE SMALLER SINCE IT IS NOT AS TALL.

PIER DETAILS (ALTERNATIVE 2 - STEEL PG)
BRIDGE NO. SUM-8-09.080
N MAIN STREET OVER THE CUYAHOGA RIVER

SFN 7730306 (EX.)

DESIGN AGENCY

GPD GROUP
Glaus, Pyle, Schomer, Burns & DeHaven, Inc.

DESIGNER	CHECKER
MOJ	TJW

REVIEWER
DGN 4-5-24

PROJECT ID
115383

SUBSET	TOTAL
4	4

SHEET	TOTAL
A4	11

SUM-CR8-9.08 (High Level Bridge)

14/12/2023
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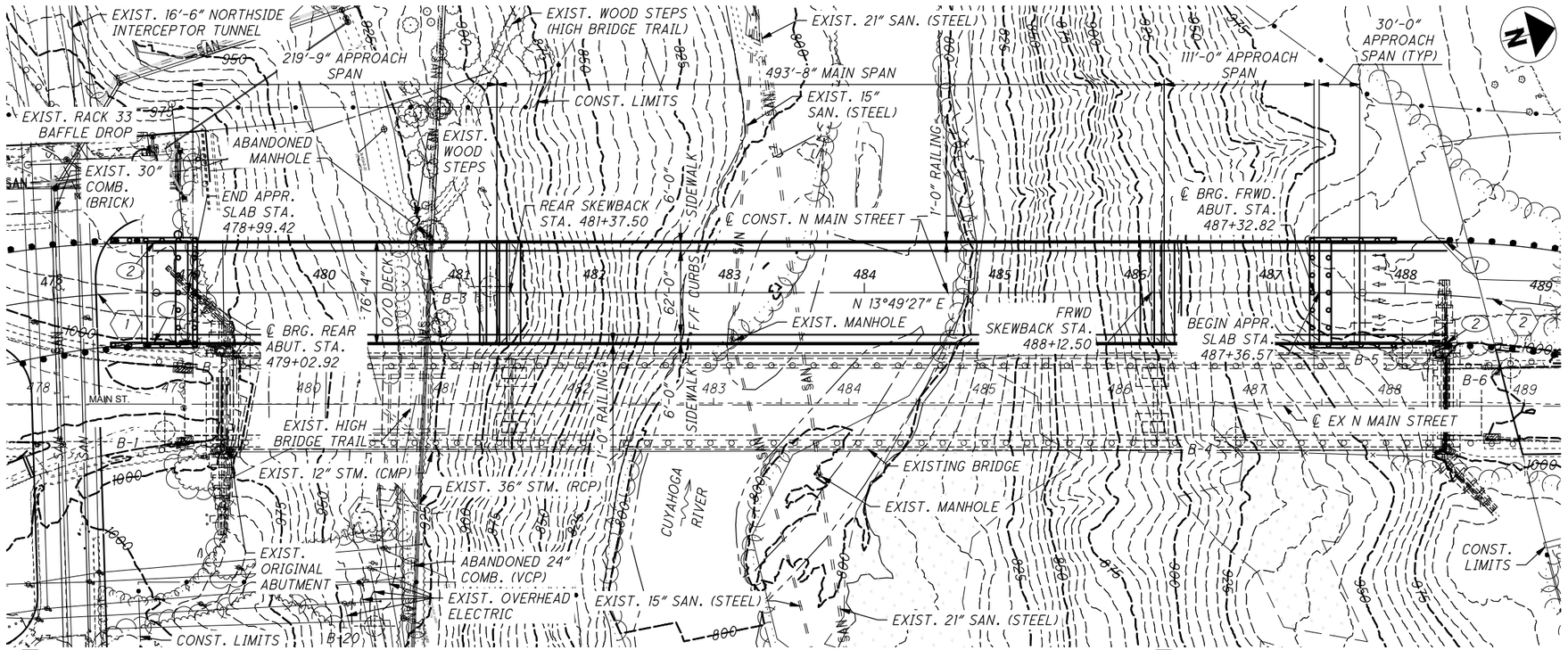

PLAN

1 HORIZONTAL CURVE DATA
P.I. = Sta. 477+53.37
D = 21° 56' 04"
Dc = 8° 48' 53"
R = 650.000
T = 125.96'
L = 248.84'
E = 12.09
C = 247.32
C. B. = N 2° 51' 25" E

2 HORIZONTAL CURVE DATA
P.I.= Sta. 489+08.80
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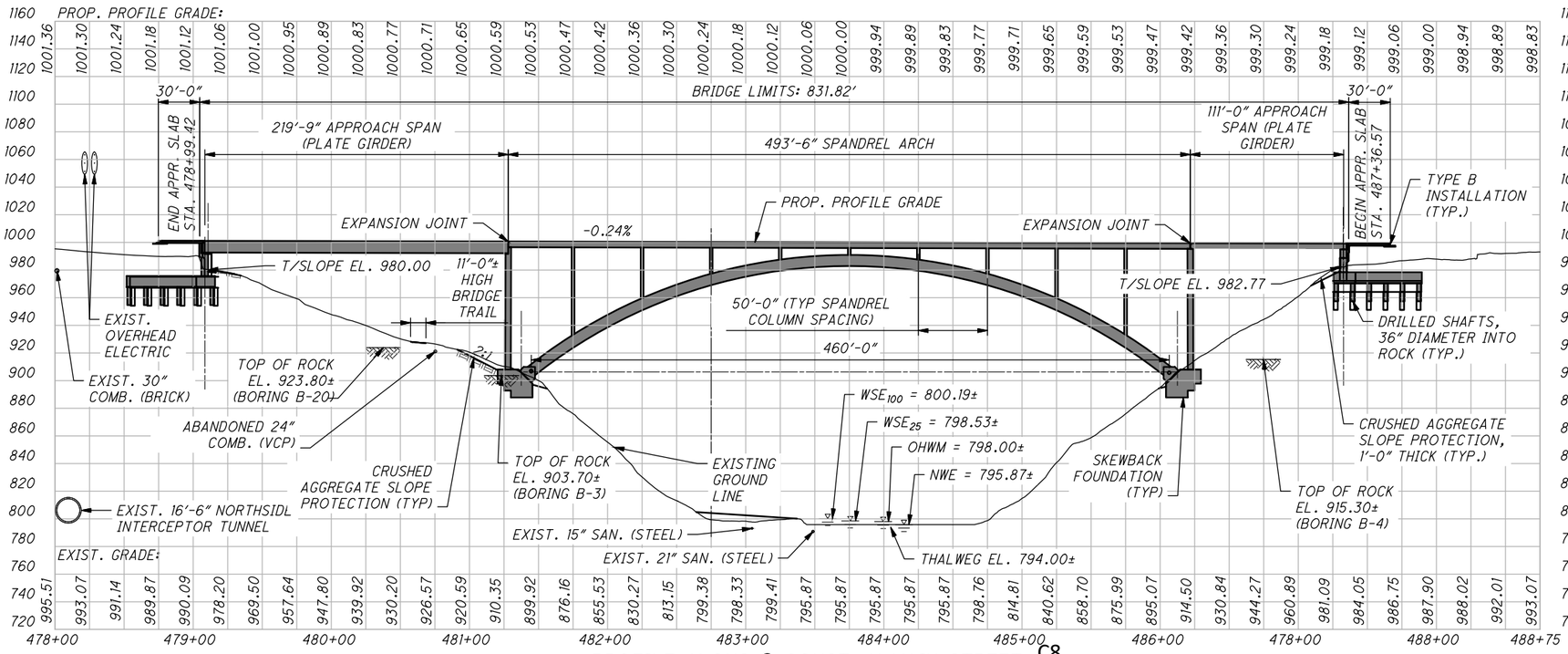
C. B. = N 21° 47' 47" E



PROFILE ALONG ℄ CONST. N MAIN STREET

BENCHMARK DATA

NAME	STATION	OFFSET	ELEV.	DESCRIPTION
BM1	___+__.___	___.___ __.__	___.___	_____
BM2	___+__.___	___.___ __.__	___.___	_____
BM3	___+__.___	___.___ __.__	___.___	_____
BM4	___+__.___	___.___ __.__	___.___	_____

SEE ROADWAY PLANS FOR ADDITIONAL BENCHMARK INFORMATION.

NOTES:

EARTHWORK LIMITS SHOWN ARE APPROXIMATE. ACTUAL SLOPES SHALL CONFORM TO PLAN CROSS SECTIONS.

DESIGN TRAFFIC:
2029 ADT = 16,500 2029 ADTT = 170
2049 ADT = 17,500 2049 ADTT = 180
DIRECTIONAL DISTRIBUTION = 51%

LEGEND:

PROJECT BORING LOCATION
HISTORIC BORING LOCATION
TO REMAIN
TO BE REMOVED
MGS BTA, TYPE # FIRST POST LOCATION (SEE STD. DWG. MGS-3.1)

HYDRAULIC DATA:

DRAINAGE AREA = 336 SQ. MILES
Q(25) = 4,244 CFS V(25) = 9.55 FT/S
Q(100) = 5,600 CFS V(100) = 10.12 FT/S
STRUCTURE CLEARS THE 25 YEAR DESIGN HW BY 190.88 FEET.

EXISTING STRUCTURE

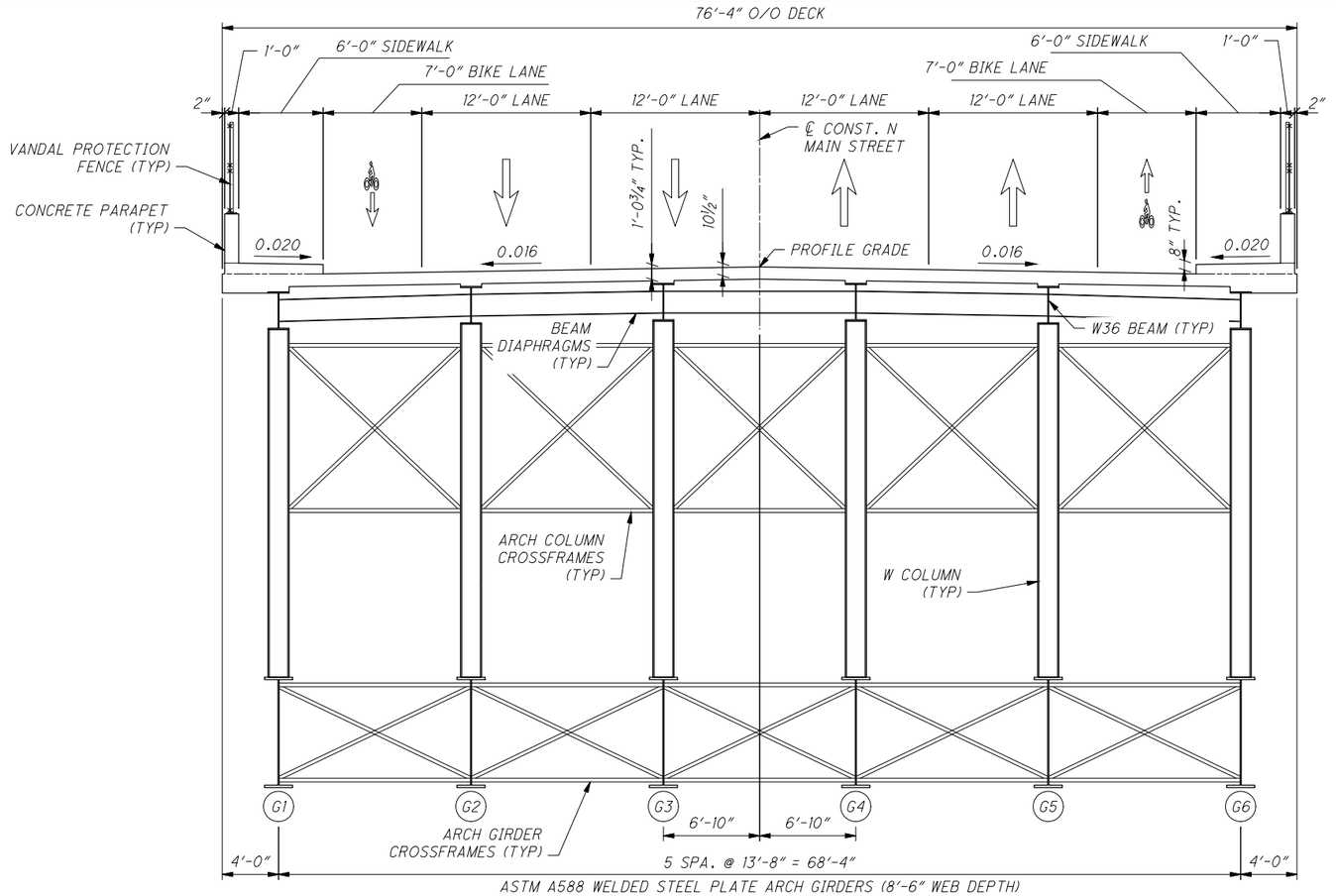
TYPE: STEEL CANTILEVER DECK TRUSS WITH REINFORCED CONCRETE DECK ON REINFORCED CONCRETE SUBSTRUCTURE UNITS FOUNDED ON SPREAD FOOTINGS.
SPANS: 210'-0"±, 480'-0"±, 210'-0"± C/C BEARINGS
ROADWAY: 52'-0"± F/F CURBS & 2-6'-0"± SIDEWALKS
LOADING: HS20-44 CASE II AND INTERSTATE ALTERNATE LOADING
SKEW: NONE
WEARING SURFACE: MONOLITHIC CONCRETE AND EPOXY OVERLAY
APPROACH SLABS: 25'-0"± LONG (AS-1-81)
ALIGNMENT: TANGENT
CROWN: 3/16"±/FT
STRUCTURE FILE NUMBER: 7730306
DATE BUILT: 1949
DISPOSITION: TO BE REPLACED.

PROPOSED STRUCTURE

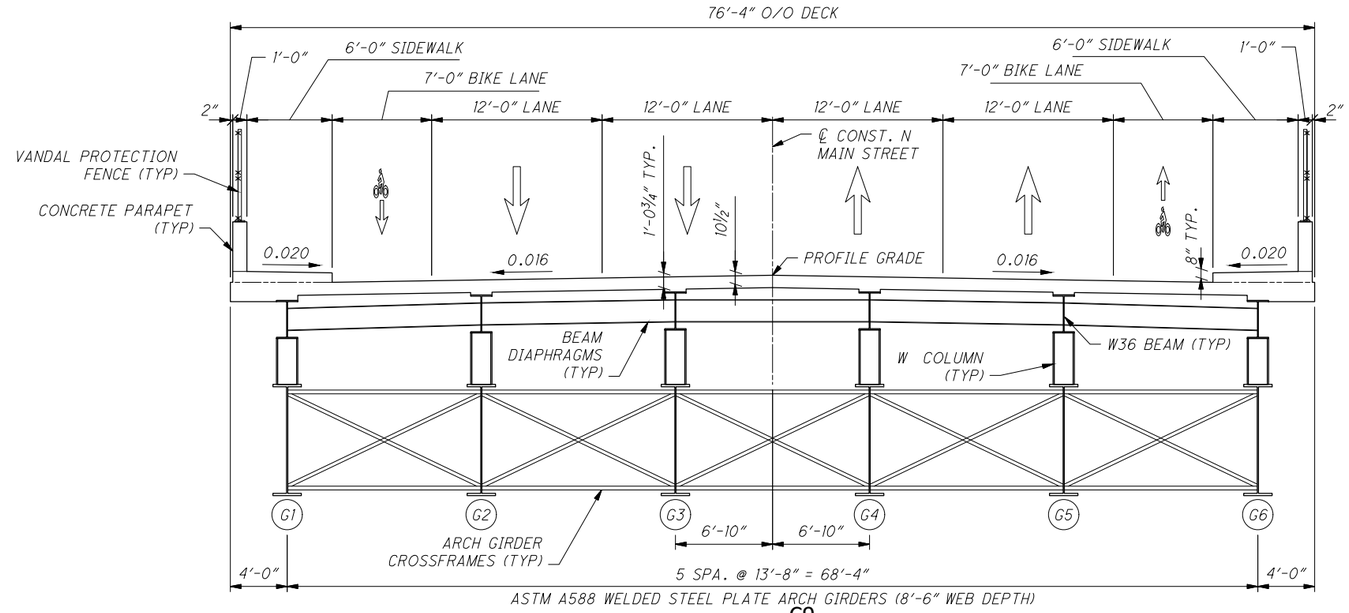
TYPE: OPEN SPANDREL ARCH WITH PLATE GIRDER RIBS WITH COMPOSITE REINFORCED CONCRETE DECK ON REINFORCED CONCRETE PIERS AND REINFORCED CONCRETE ABUTMENTS FOUNDED ON DRILLED SHAFTS SOCKETED INTO BEDROCK SUPPORTED BY MSE WALLS.
SPANS: 234'-0", 493'-8", 111'-0" C/C BEARINGS
ROADWAY: 62'-0" T/T CURBS & 2-6'-0" SIDEWALKS
LOADING: HL93 & 0.060 KSF FUTURE WEARING SURFACE
WEARING SURFACE: 1" MONOLITHIC CONCRETE
SKEW: NONE
APPROACH SLABS: 30'-0" LONG, TYPE B INSTALLATION (AS-1-15, AS-2-15)
ALIGNMENT: TANGENT
CROWN: 0.016 FT/FT
COORDINATES: LATITUDE N 41°07'19.62"
LONGITUDE W 81°30'35.42"
DECK AREA: 58,887 SF

SPANDREL ARCH PLAN AND PROFILE - ALT 3
BRIDGE NO. SUM-0008-0908
N MAIN STREET OVER THE CUYAHOGA RIVER

SFN	7730306
DESIGN AGENCY	
DESIGNER	MSM
CHECKER	---
REVIEWER	--- ---
PROJECT ID	115383
SUBSET	1
TOTAL	3
SHEET	A5
TOTAL	11



TRANSVERSE SECTION AT TALL SPANDREL COLUMNS



TRANSVERSE SECTION AT MIDSPAN

NOTE:

APPROACH SPANS ARE COMPRISED OF SIMPLE SPAN BEAM/PLATE GIRDER CONFIGURATIONS. TYPICAL SECTIONS NOT SHOWN.

SPANDREL ARCH TYPICAL SECTIONS - ALT 3

BRIDGE NO. SUM-0008-0908

N MAIN STREET OVER THE CUYAHOGA RIVER

SFN	7730306
DESIGN AGENCY	
DESIGNER	MSM
CHECKER	---
REVIEWER	--- / ---
PROJECT ID	115383
SUBSET	2
TOTAL	3
SHEET	A6
TOTAL	11

P.A7

22/04/2024

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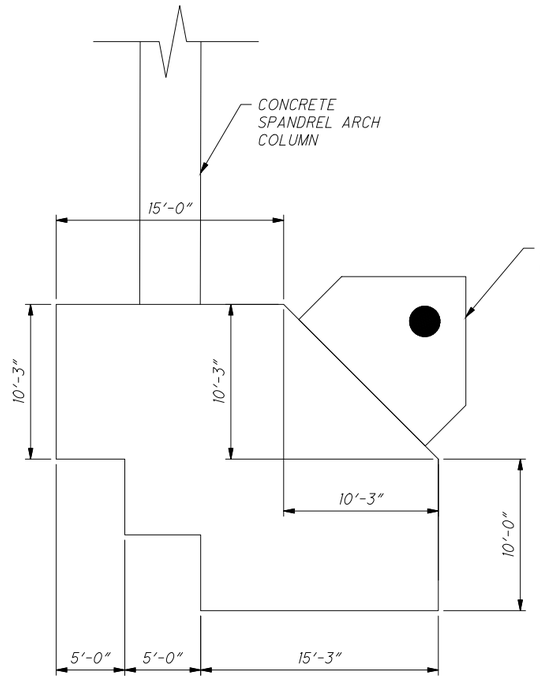
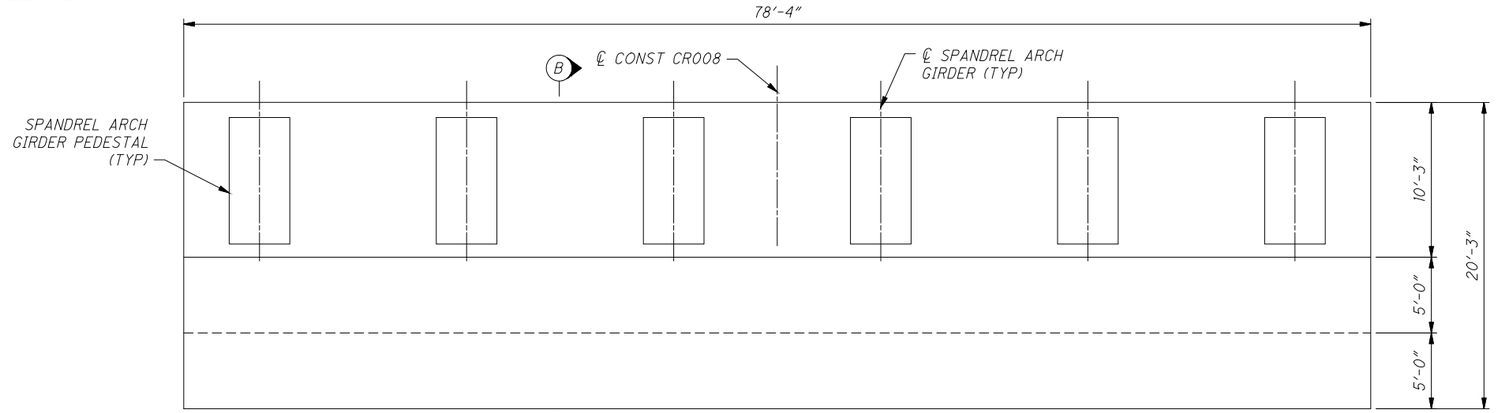


SECTION B-B



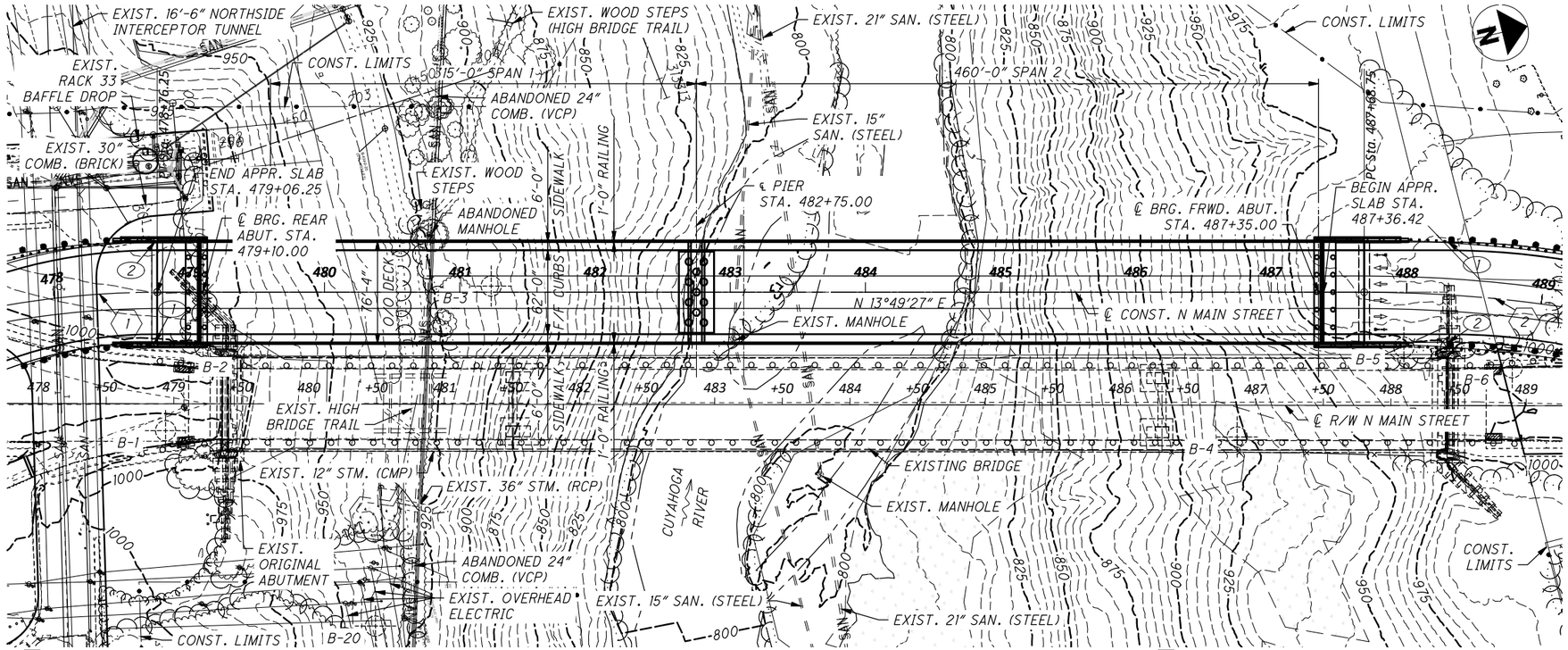
SKEWBACK ELEVATION

SPANDREL ARCH SKEWBACK DETAILS - ALT 3

BRIDGE NO. SUM-0008-0908

N MAIN STREET OVER THE CUYAHOGA RIVER

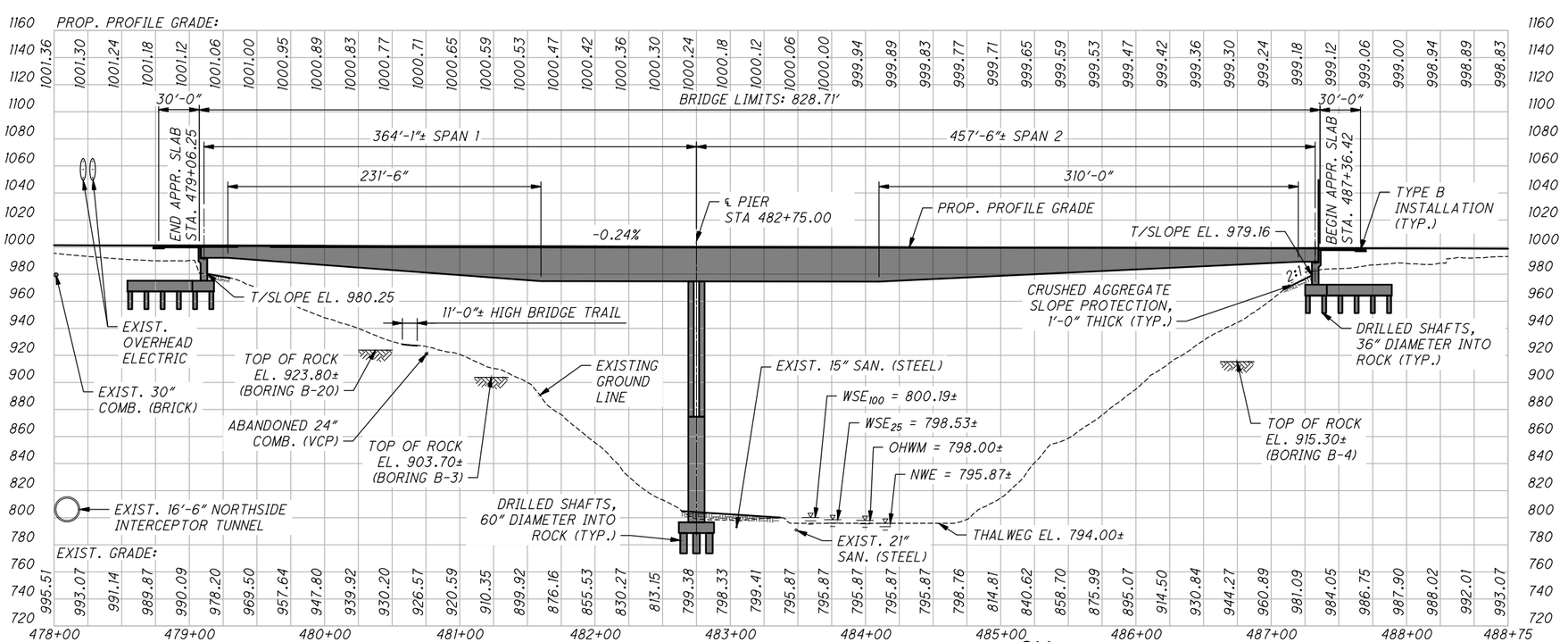
SFN	7730306
DESIGN AGENCY	
DESIGNER	MSM
CHECKER	---
REVIEWER	--- ---
PROJECT ID	115383
SUBSET / TOTAL	3 / 3
SHEET / TOTAL	A7 / 11



PLAN

1 HORIZONTAL CURVE DATA
P.I. = Sta. 477+53.37
D = 21° 56' 04"
Dc = 8° 48' 53"
R = 650.000
T = 125.96'
L = 248.84'
E = 12.09
C = 247.32
C. B. = N 2° 51' 25" E

2 HORIZONTAL CURVE DATA
P.I.= Sta. 489+08.80
D = 15° 56' 41"
Dc = 5° 43' 46"
R = 1000.000
T = 140.05'
L = 278.29'
E = 9.76
C = 277.39
C. B. = N 21° 47' 47" E



PROFILE ALONG ℄ CONST. N MAIN STREET

BENCHMARK DATA				
NAME	STATION	OFFSET	ELEV.	DESCRIPTION
BM1	___+__.__	___.__ __.	___.__	_____
BM2	___+__.__	___.__ __.	___.__	_____
BM3	___+__.__	___.__ __.	___.__	_____
BM4	___+__.__	___.__ __.	___.__	_____

SEE ROADWAY PLANS FOR ADDITIONAL BENCHMARK INFORMATION.

NOTES:

EARTHWORK LIMITS SHOWN ARE APPROXIMATE. ACTUAL SLOPES SHALL CONFORM TO PLAN CROSS SECTIONS.

DESIGN TRAFFIC:
2029 ADT = 16,500 2029 ADTT = 170
2049 ADT = 17,500 2049 ADTT = 180
DIRECTIONAL DISTRIBUTION = 51%

LEGEND:

PROJECT BORING LOCATION
TO REMAIN
TO BE REMOVED
HISTORIC BORING LOCATION
MGS BTA, TYPE # FIRST POST LOCATION (SEE STD. DWG. MGS-3.1)

HYDRAULIC DATA:

DRAINAGE AREA = 336 SQ. MILES
Q(25) = 4,244 CFS V(25) = 9.55 FT/S
Q(100) = 5,600 CFS V(100) = 10.12 FT/S
STRUCTURE CLEARS THE 25 YEAR DESIGN HW BY 190.88 FEET.

EXISTING STRUCTURE

TYPE: STEEL CANTILEVER DECK TRUSS WITH REINFORCED CONCRETE DECK ON REINFORCED CONCRETE SUBSTRUCTURE UNITS FOUNDED ON SPREAD FOOTINGS.
SPANS: 210'-0"±, 480'-0"±, 210'-0"± C/C BEARINGS
ROADWAY: 52'-0"± F/F CURBS & 2-6'-0"± SIDEWALKS
LOADING: HS20-44 CASE II AND INTERSTATE ALTERNATE LOADING
SKEW: NONE
WEARING SURFACE: MONOLITHIC CONCRETE AND EPOXY OVERLAY
APPROACH SLABS: 25'-0"± LONG (AS-1-81)
ALIGNMENT: TANGENT
CROWN: 3/16"±/FT
STRUCTURE FILE NUMBER: 7730306
DATE BUILT: 1949
DISPOSITION: TO BE REPLACED.

PROPOSED STRUCTURE

TYPE: CONTINUOUS POST TENSIONED SEGMENTAL BOX GIRDER BRIDGE ON REINFORCED CONCRETE PIERS AND REINFORCED CONCRETE ABUTMENTS SUPPORTED ON DRILLED SHAFTS SOCKETED INTO BEDROCK.
SPANS: 364'-1", 457'-6" C/C BEARINGS
ROADWAY: 62'-0" T/T CURBS & 2-6'-0" SIDEWALKS
LOADING: HL93 & 0.060 KSF FUTURE WEARING SURFACE
WEARING SURFACE: 1" MONOLITHIC CONCRETE
SKEW: NONE
APPROACH SLABS: 30'-0" LONG, TYPE B INSTALLATION (AS-1-15, AS-2-15)
ALIGNMENT: TANGENT
CROWN: 0.016 FT/FT
COORDINATES: LATITUDE N 41°07'19.62"
LONGITUDE W 81°30'35.42"
DECK AREA: 58,897 SF

CONCRETE SEGMENTAL BOX PLAN AND PROFILE - ALT 4
BRIDGE NO. SUM-0008-0908
N MAIN STREET OVER THE CUYAHOGA RIVER

SFN 7730306
DESIGN AGENCY
DESIGNER MSM | CHECKER ---
REVIEWER --- ---
PROJECT ID 115383
SUBSET 1 | TOTAL 4
SHEET A8 | TOTAL 11

22/04/2024
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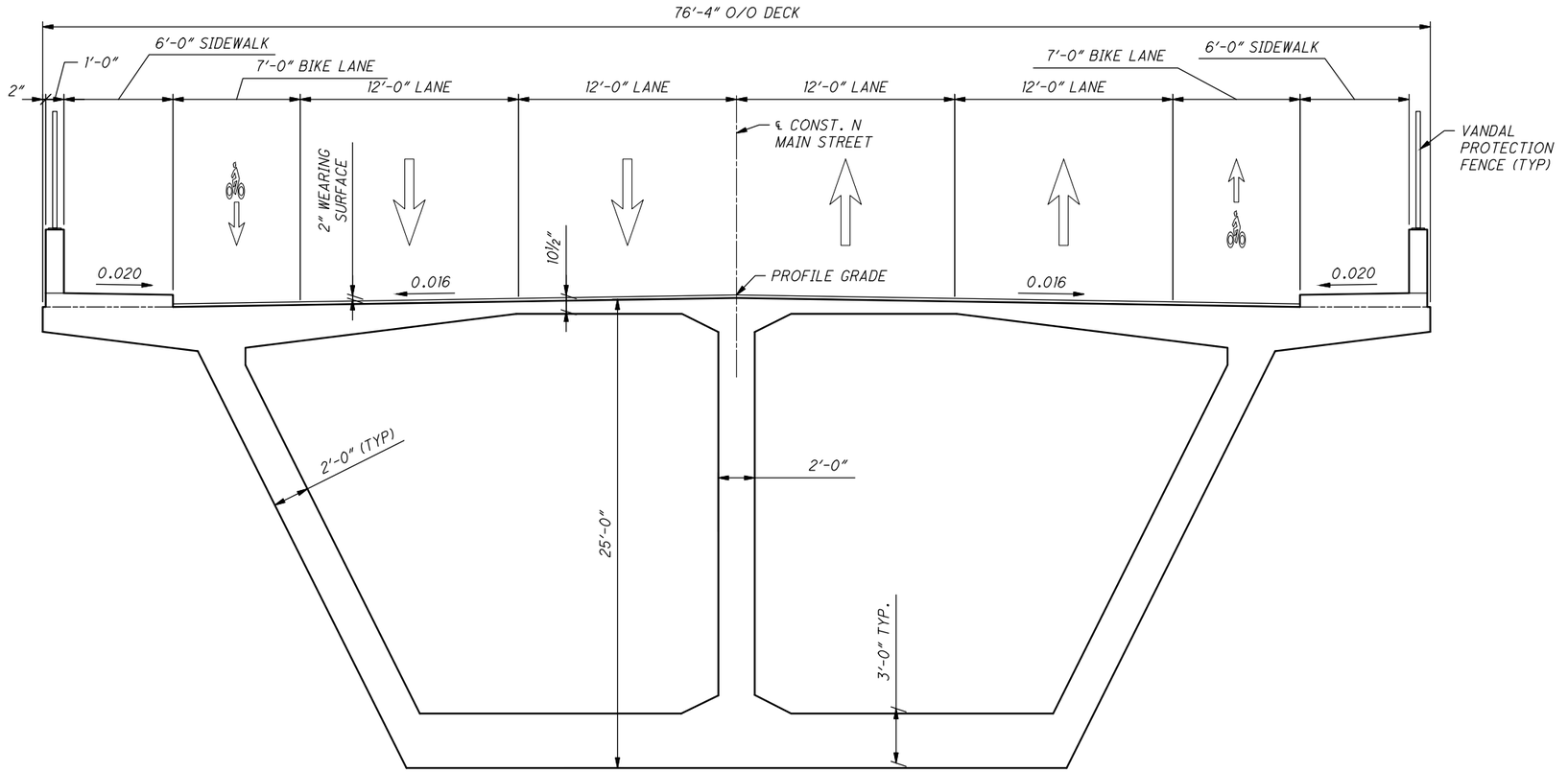
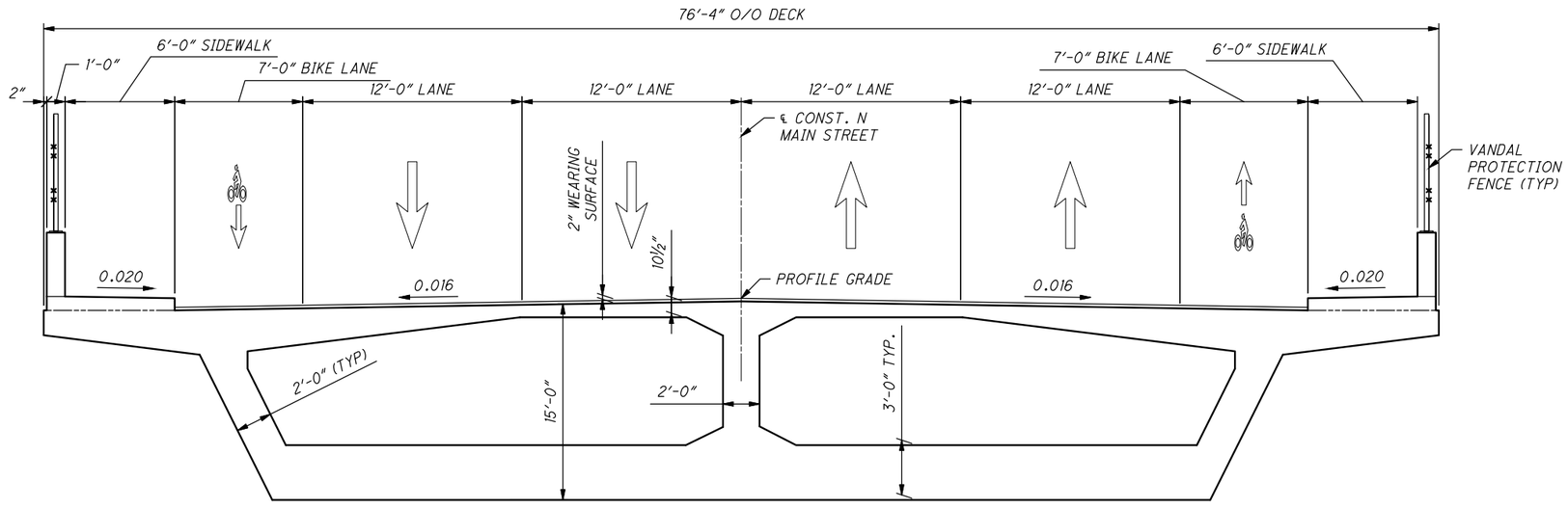


TRANSVERSE SECTION NEAR PIER



TRANSVERSE SECTION NEAR ABUTMENTS

C12

CONCRETE SEGMENTAL BOX TYPICAL SECTIONS - ALT 4
BRIDGE NO. SUM-0008-0908
N MAIN STREET OVER THE CUYAHOGA RIVER

SFN 7730306
DESIGN AGENCY
DESIGNER MSM | CHECKER ---
REVIEWER --- | ---
PROJECT ID 115383
SUBSET 2 | TOTAL 4
SHEET A9 | TOTAL 11

P.A10

22/04/2024
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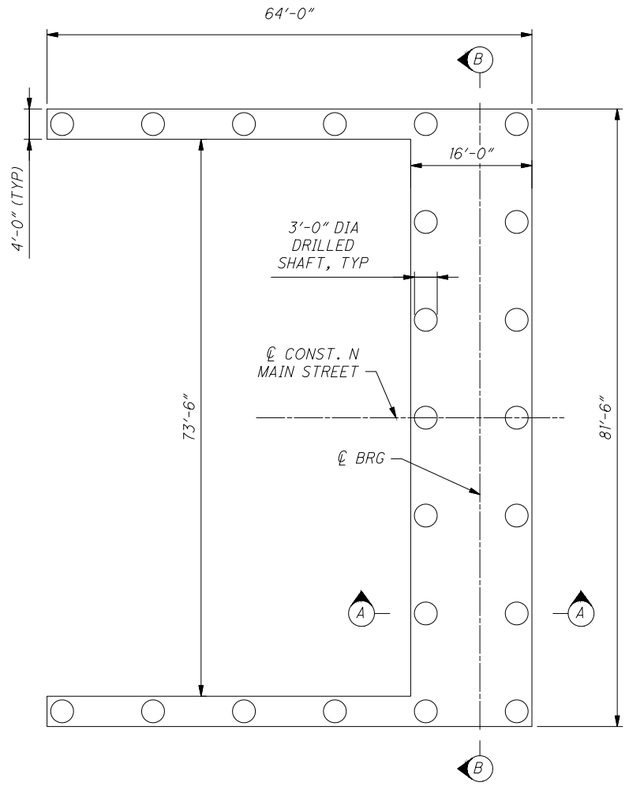
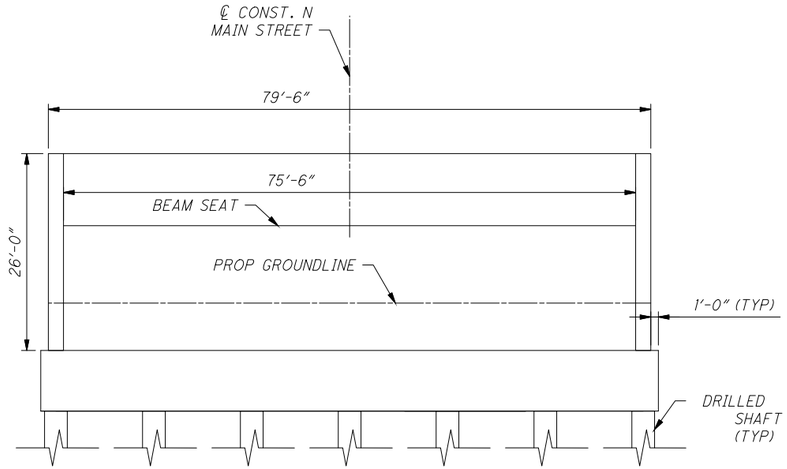
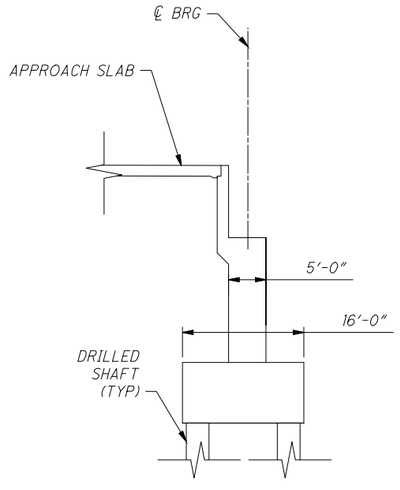


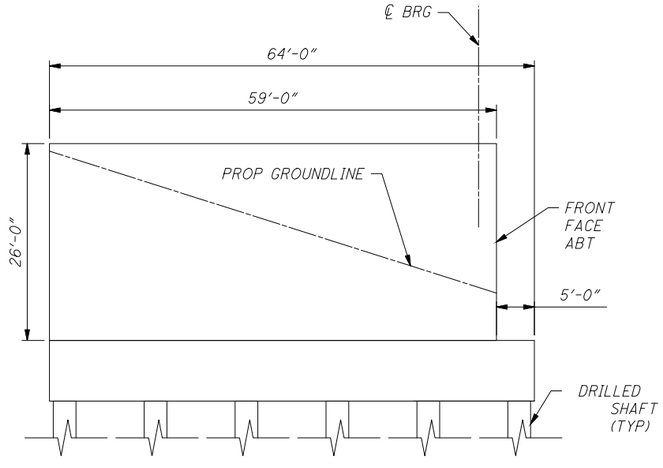
ABUTMENT PLAN



SECTION B-B



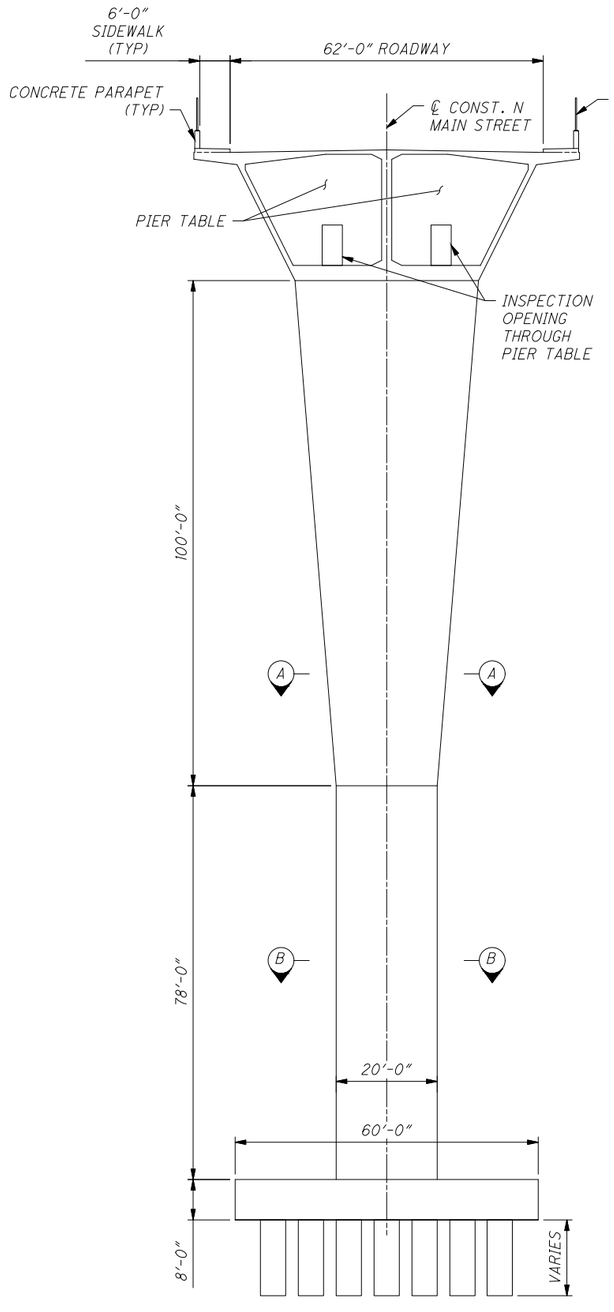
SECTION A-A



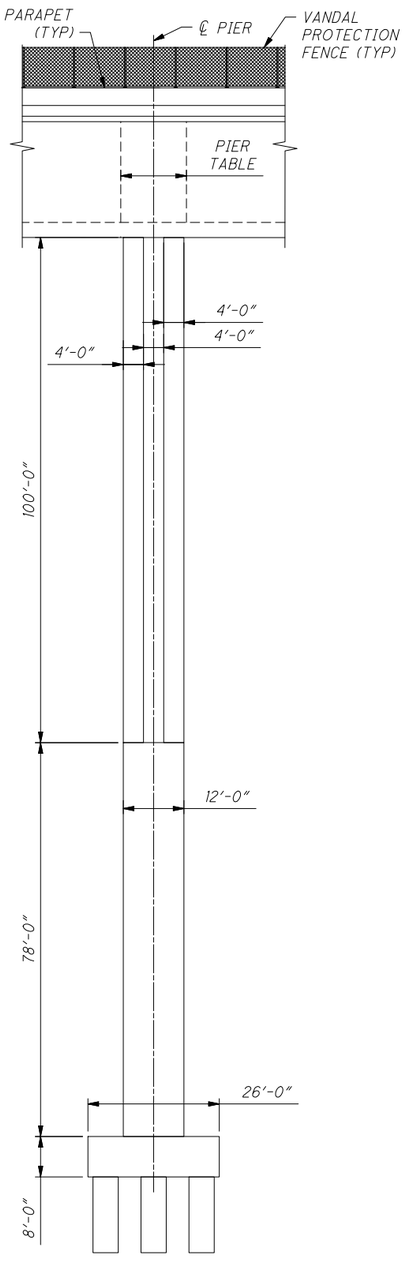
ABUTMENT SIDE ELEVATION

ABUTMENT DETAILS - ALTS 3 AND 4
BRIDGE NO. SUM-0008-0908
N MAIN STREET OVER THE CUYAHOGA RIVER

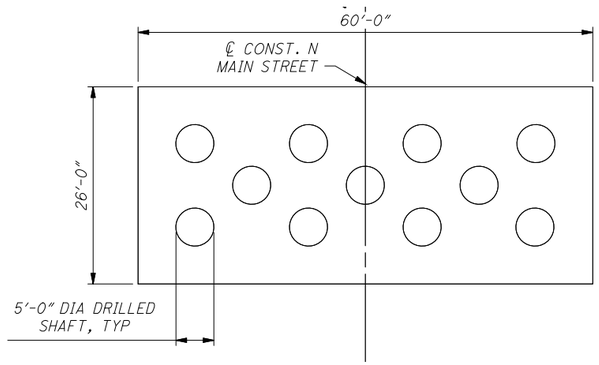
SFN	7730306
DESIGN AGENCY	
DESIGNER	MSM
CHECKER	---
REVIEWER	--- ---
PROJECT ID	115383
SUBSET	3
TOTAL	4
SHEET	A10
TOTAL	11



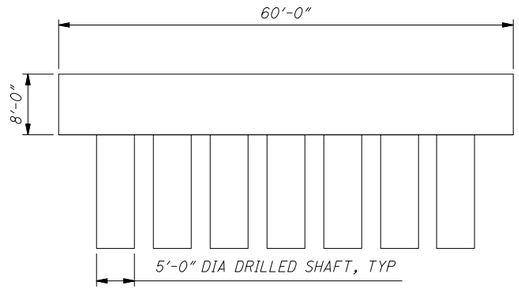
ELEVATION PIER



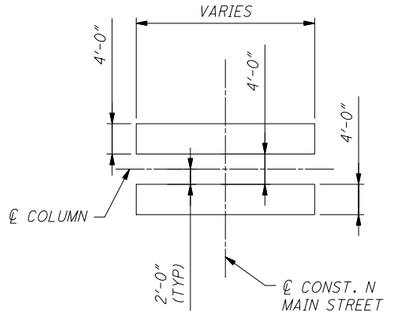
SIDE VIEW PIER



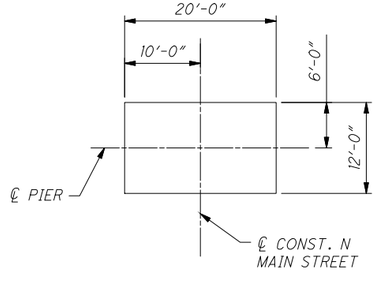
FOUNDATION PLAN



ELEVATION



SECTION A-A



SECTION B-B

CONCRETE SEGMENTAL BOX PIER DETAILS - ALT 4
BRIDGE NO. SUM-0008-0908
N MAIN STREET OVER THE CUYAHOGA RIVER

SFN	7730306
DESIGN AGENCY	
DESIGNER	MSM
CHECKER	---
REVIEWER	---
PROJECT ID	115383
SUBSET	4
TOTAL	4
SHEET	A11
TOTAL	11

22/04/2024
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ATTACHMENT 2:
SLOPE STABILITY CALCULATION

PURPOSE:

The purpose of this calculation is to analyze the overall stability of the existing north and south embankments for SUM-CR008-09.08. The analysis was performed on the existing embankments along the centerline from the profile provided by the GPD Group.

CODES/STANDARDS:

The code used in these analyses generally followed *AASHTO LRFD Bridge Design Specifications* Ninth Edition 2020 (LRFD) and the Ohio Department of Transportation Geotechnical Design Manual, published July 21, 2023.

SOURCE OF DATA

- Based on the boring logs from 1989, subsurface materials for the South Embankment mainly consist of:
    1. Medium Dense S&G: Medium dense to dense brown Sand and Gravel with concrete (fill), moist to dry with an average N_{60} = 38 bpf.
    2. Hard Silt: Hard brown to gray silt, some to little sand, moist with an average N_{60} = 53 bpf.
    3. V. Dense S&G: Very dense, brown to gray sand, some gravel, trace silt, moist with average N_{60} = 67 bpf.
    4. Residuum: Hard gray silt and clay with shale fragments with average N_{60} = 54 bpf.
    5. Shale: Gray Silty Shale, moderately weathered, firm, thin bedded, with thin siltstone interbeds.
- Based on the boring logs, subsurface materials for the North Embankment mainly consist of:
    1. Medium Dense S&G: Medium dense to dense brown Sand and Gravel with concrete (fill), moist to dry with an average N_{60} = 38 bpf.
    2. V. Stiff Sandy Silt: Very stiff brown to gray sandy silt, little gravel, moist with an average N_{60} = 18 bpf.
    3. V. Dense S&G: Very dense, brown to gray sand, some gravel, trace silt, moist with average N_{60} = 67 bpf.

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4. M. Stiff S&C: Medium stiff brown sandy silt and brown and gray mottled silt and clay, some gravel, moist with average N_{60} = 7 bpf.
5. Shale: Gray Silty Shale, moderately weathered, firm, thin bedded, with thin siltstone interbeds.

The design geotechnical parameters for each stratum were developed based on AASHTO LRFD Table 10.4.6.2.4-1 according to the average N_{60}, the ODOT Geotechnical Manual Section 400-Engineering Properties of Soil and Rock and NAVFAC Foundations and Earth Structures Design Manual 7.02. The values are summarized as the table below:

Table 1. Summary of Geotechnical Parameters: South Embankment

Strata	γ_m (pcf)	γ_{sat} (pcf)	N_{60}	C (psf)	φ (^{0})	C′ (psf)	φ′ (^{0})
1. M. Dense S&G	130.0	140.0	38	0	36	0	36
2. Hard SILT	140.0	150.0	53	6200	0	6200	0
3. Dense S&G	140.0	150.0	67	0	42	0	42
4. RESIDUUM	140.0	150.0	54	6200	38	500	38
5. SHALE	150.0	150.0	--	20000	0	20000	0

Table 2. Summary of Geotechnical Parameters: North Embankment

Strata	γ_m (pcf)	γ_{sat} (pcf)	N_{60}	C (psf)	φ (^{0})	C′ (psf)	φ′ (^{0})
1. M. Dense S&G	130.0	140.0	38	0	36	0	36
2. V. Stiff SILT	122.0	132.0	18	2000	30	200	30
3. V. Dense S&G	140.0	150.0	67	0	42	0	42
4. M. Stiff S&C	118.0	128.0	7	875	27	85	27
5. SHALE	150.0	150.0	--	20000	0	20000	0

072477-GPD_SUM-CR008-09.08 Bridge Replacement\5_Working\05_Design_Support\Geo\Calcs\SLIDE

ASSUMPTIONS/PROJECT BACKGROUND:

SLIDE MODELS

- The Overall Stability was examined in long term condition with drained soil parameters for both the existing North and South Embankments.
- The saturated unit weight of all soil is assumed to be the moist unit weight plus 10 pcf, according to ODOT'S GDM; however, no water was present in any of the borings.
- All the analyses were performed via circular, auto refine search, as well as with cuckoo non-circular to check the lowest possible Factor of Safety when compared to others. The factor of safety was calculated via simplified bishop method.

Computer Programs Used:

SLIDE2 Version 9.023 May 25, 2022

Calculations and Attached References:

- Historical Soil Profile
- Parameters Development:
  - Historical Boring Logs with marked strata
- SLIDE Analysis:
  - Graphic SLIDE Output

Results:

Table 3: Summary of FoS of Overall Stability

Sections & Case	Factor of Safety
Long Term Condition	
➢ **South Embankment Slope**	1.7
➢ **North Embankment Slope**	1.2

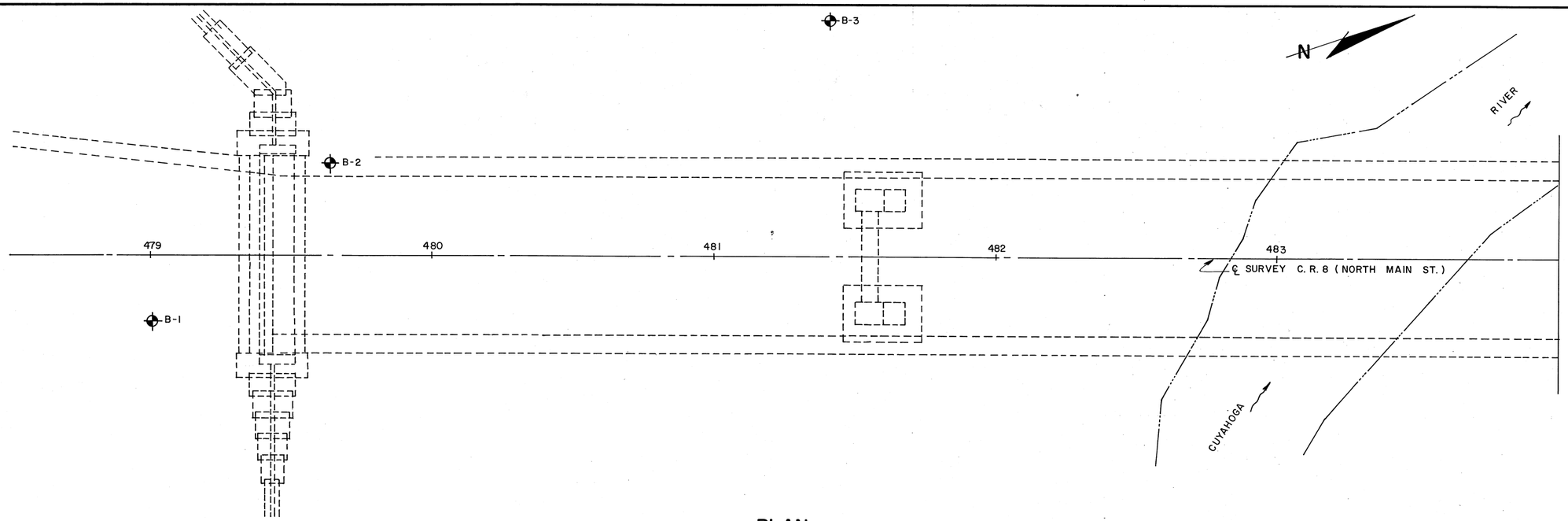
Based on the above stated criteria and the slope geometry, both safety factors are greater than 1.2 for the existing sections, indicating the slopes are currently stable.

REFERENCES

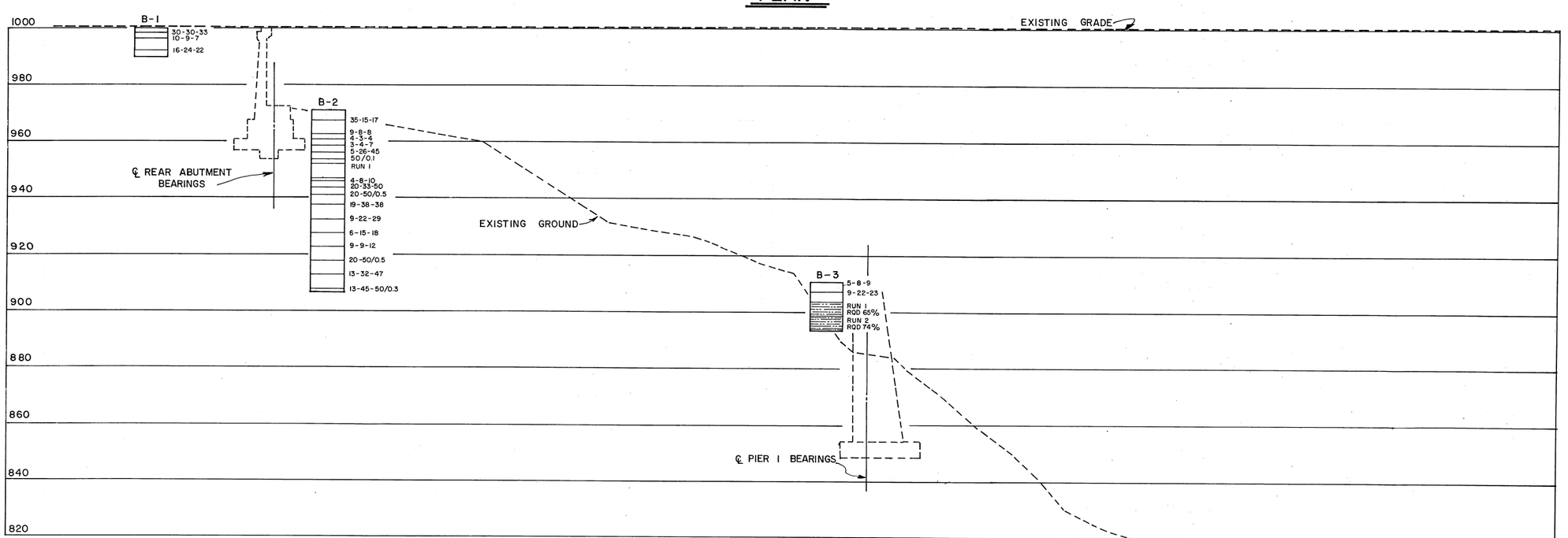
HISTORICAL SOIL PROFILE

FHWA REGION	STATE	PROJECT

SOIL PROFILE
SUM-NORTH MAIN ST. 2/6



PLAN



SUBSURFACE INVESTIGATION
BRIDGE NO. SUM-CR8-0908
OVER THE CUYAHOGA RIVER

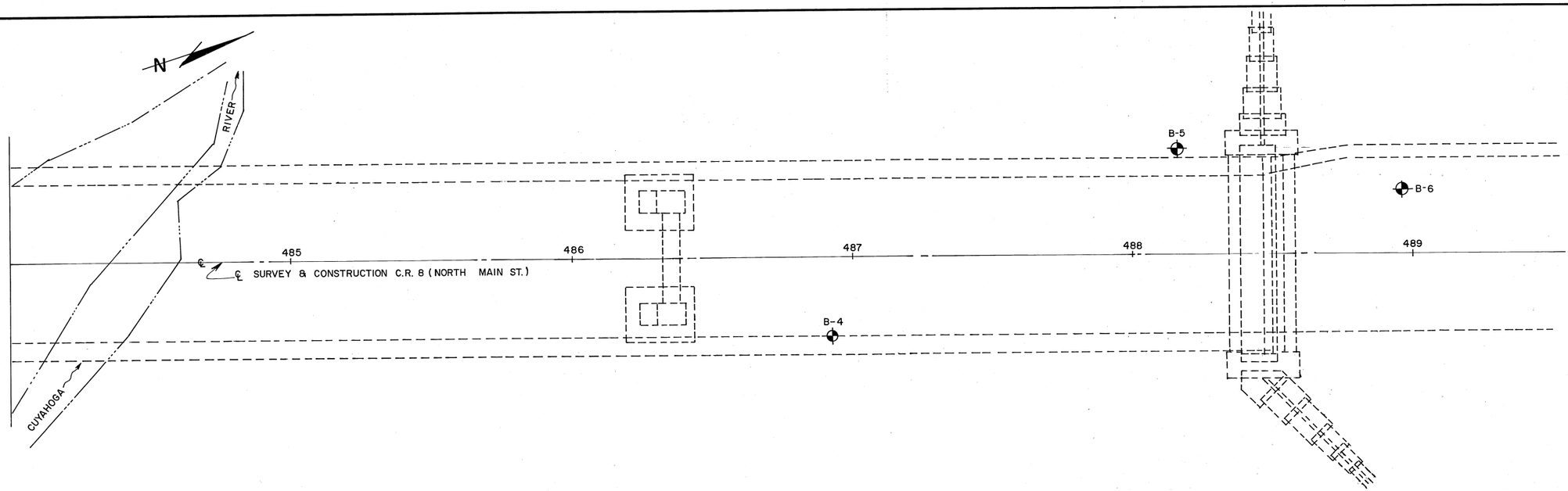
R&R INTERNATIONAL INC.
Geotechnical Engineers • Geologists
1234 S. CLEVELAND-MASSILLON ROAD
P.O. BOX 4383
AKRON, OH 44321

DRAWN BY	CHECKED BY	REVIEWED BY	DATE
Y. K.	S. C. R.	G. M. R.	2/14/90

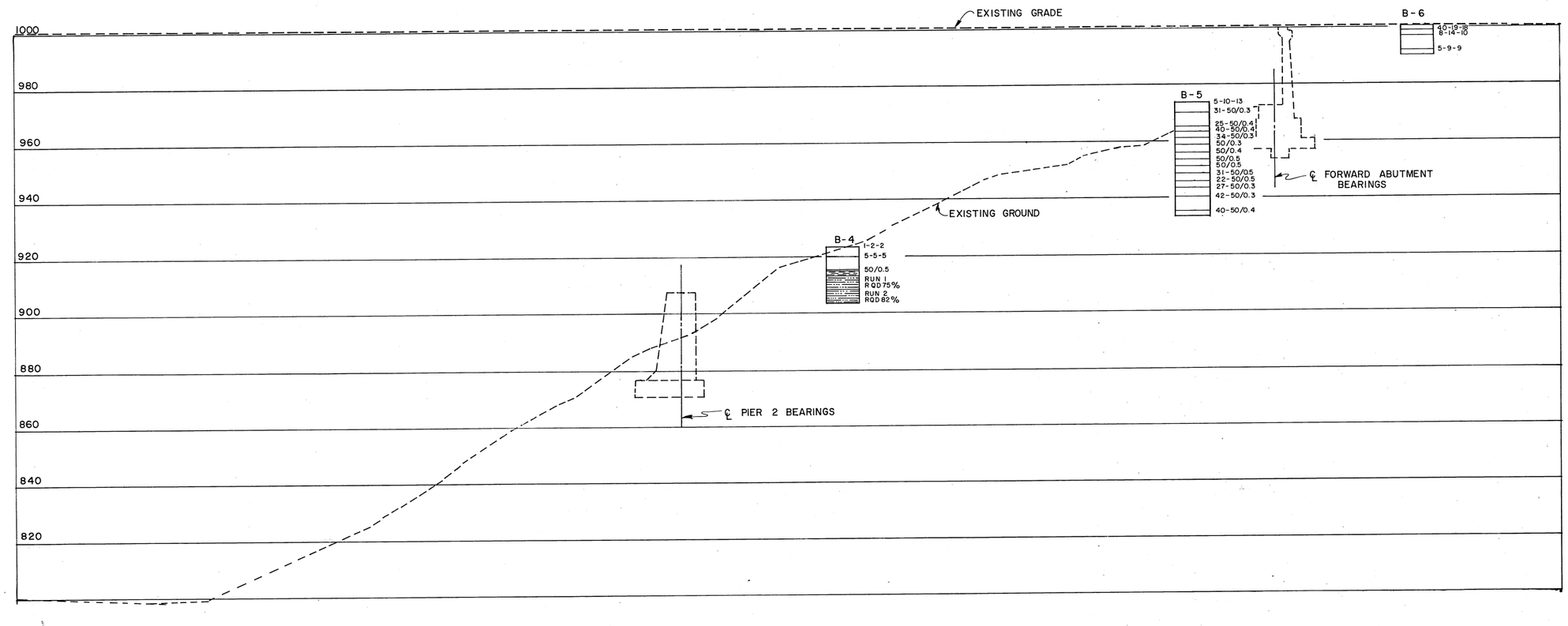
SFN: 7720306

FHWA REGION	STATE	PROJECT

SOIL PROFILE
SUM-NORTH MAIN ST (3/6)



PLAN



SUBSURFACE INVESTIGATION
BRIDGE NO. SUM-CR8-0908
OVER THE CUYAHOGA RIVER

R&R INTERNATIONAL, INC.
Geotechnical Engineers • Geologists
1234 S. CLEVELAND-MASSILLON ROAD
P.O. BOX 4383
AKRON, OH 44321

DRAWN BY	CHECKED BY	REVIEWED BY	DATE
V.K.	S.C.R.	G.M.R.	12/14/90

SFN: 7730306

HISTORICAL BORING LOGS

LOG OF BORING

Date Started 11-13-89 Sampler Type Split Spoon Dia. 2.0 Water Elev. Dry
Date Completed 11-13-90 Casing: Length -- Dia. 3.25
Boring No. B-1 Station & Offset Sta. 479 + 01.37 23.19' RT. Surface Elev. 1000.0

ELEV.	DEPTH	STD. PEN. (N)	REC. Ft.	LOSS Ft.	DESCRIPTION	SAMPLE NO.	SAMPLE TYPE	PHYSICAL CHARACTERISTICS % AGG.	% C. SAND	% F. SAND	% SILT	% CLAY	L.L.	P.L.	P.I.	W.C.	SHTL CLASS.
1000.0	0																
999.7					ASPHALT												
999.2		30-30-33	1.5		CONCRETE	1	SS	19.7	25.2	41.0	*	14.1	--	--	--	5.8	A-3a
		10-9-7	1.5		Very dense to medium dense, brown SAND, little to trace gravel, trace to little silt, moist.	2	SS	4.0	18.5	46.9	*	30.6	--	--	--	12.3	A-3a
992.0		16-24-22	1.3		Dense, brown SAND AND GRAVEL, trace silt, moist.	3	SS	26.6	30.6	29.5	*	13.3	--	--	--	5.0	A-1-b
990.0					TERMINATION DEPTH 10.0 FEET												

* SILT AND CLAY COMBINED

LOG OF BORING

Date Started 10-31-89 Sampler Type Split Spoon Dia. 2.0 Water Elev. Dry
Date Completed 10-31-89 Casing: Length -- Dia. 3.25
Boring No. B-2 Station & Offset Sta. 479 + 64.42 32.90' LT. Surface Elev. 971.3

ELEV.	DEPTH	STD. PEN. (N)	REC. Ft.	LOSS Ft.	DESCRIPTION	SAMPLE NO.	SAMPLE TYPE	PHYSICAL CHARACTERISTICS % AGG.	% C. SAND	% F. SAND	% SILT	% CLAY	L.L.	P.L.	P.I.	W.C.	SHTL CLASS.
971.3	0																
		35-15-17	1.4		Dense, brown SAND AND GRAVEL, trace silt, moist (Fill).	1	SS										
965.3																	
		9-8-8	1.3			2	SS										
		4-3-4	1.0			3	SS	0.8	62.9	32.7	*	3.6	--	--	--	5.9	A-1-b
		3-4-7	1.0		Medium dense to very dense, brown SAND AND GRAVEL WITH CONCRETE FRAGMENTS, trace silt, dry (Fill).	4	SS										
		5-26-45	1.4			5	SS	33.4	27.2	28.7	*	10.7	--	--	--	3.1	A-1-b
		50/0.1	0.1			6	SS										
952.3		RQD	1.4	3.6	AUGER REFUSAL AT 19.0 FEET	Run	NXW										
950.5		0%			CONCRETE	1											
		4-8-10	1.0		Medium dense, brown SAND AND GRAVEL, trace silt, moist.	7	SS										
943.8		20-33-50	1.5			8	SS										
		20-50/0.5	1.0			9	SS										
		19-38-38	1.4			10	SS										
		9-22-29	1.5		Hard, brown to gray SILT, some to little sand, trace gravel, moist.	11	SS										
		6-15-18	1.5			12	SS										
924.3		9-9-12	1.5			13	SS										
		20-50/0.5	1.0		Very dense, brown to gray SAND, some gravel, trace silt, moist.	14	SS										
		13-32-47	1.5			15	SS										
911.3		13-45-50/0.3	1.3		Hard, gray SILT AND CLAY WITH SHALE FRAGMENTS, moist.												
906.5					TERMINATION DEPTH 64.8 FEET												

* SILT AND CLAY COMBINED

1. M.DENSE TO DENSE SAND AND GRAVEL WITH CONCRETE (FILL)

2. HARD SILT

3. V.DENSE TO DENSE SAND

RESIDUUM

SHALE

FHWA REGION	STATE	PROJECT

SUM-NORTH MAIN ST. 4/6

SUBSURFACE INVESTIGATION
BRIDGE NO. SUM-CR8-0908
OVER THE CUYAHOGA RIVER

R&R INTERNATIONAL INC.
Geotechnical Engineers • Geologists
1234 S. CLEVELAND-MASSILLON ROAD
P.O. BOX 4383
AKRON, OH 44321

TYPED BY	CHECKED BY	REVIEWED BY	DATE
M.M.R.	S.C.R.	G.M.R.	2/14/90

SFN: 7730306

FHWA REGION	STATE	PROJECT

SUM–NORTH MAIN ST.

5
6

LOG OF BORING

Date Started 11-11-89 Sampler Type Split Spoon Dia. 2.0 Water Elev. Dry

Date Completed 11-1-89 Casing: Length -- Dia. 3.25

Boring No. B-3 Station & Offset Sta. 481 + 41.47 83.88' LT. Surface Elev. 910.7

ELEV.	DEPTH	STD. PEN. (N)	REC. Ft.	LOSS Ft.	DESCRIPTION	SAMPLE NO.	SAMPLE TYPE	PHYSICAL CHARACTERISTICS % AGG.	% C. SAND	% F. SAND	% SILT	% CLAY	L.L.	P.L.	P.I.	W.C.	SHTL CLASS.
910.7	0																
909.7		5-8-9	0.8		TOPSOIL	1	SS										
		9-22-23	1.0		Hard, brown and gray mottled SILT AND CLAY, trace sand, moist.	2	SS										
903.7					AUGER REFUSAL AT 7.0 FEET												
		RQD 65%	5.0	0.0		Run 1	NXW										
		RQD 74%	5.0	0.0	Gray SILTY SHALE, moderately weathered, firm, thin bedded, thin siltstone interbeds.	Run 2	NXW										
893.7					TERMINATION DEPTH 17.0 FEET												

RESIDUUM

SHALE

LOG OF BORING

Date Started 11-2-89 Sampler Type Split Spoon Dia. 2.0 Water Elev. 916.3±

Date Completed 11-2-89 Casing: Length -- Dia. 3.25

Boring No. B-4 Station & Offset Sta. 486 + 93.18 28.05' RT. Surface Elev. 923.3

ELEV.	DEPTH	STD. PEN. (N)	REC. Ft.	LOSS Ft.	DESCRIPTION	SAMPLE NO.	SAMPLE TYPE	PHYSICAL CHARACTERISTICS % AGG.	% C. SAND	% F. SAND	% SILT	% CLAY	L.L.	P.L.	P.I.	W.C.	SHTL CLASS.
923.3	0																
922.7		1-2-2	1.0		TOPSOIL Medium stiff, brown SANDY SILT, some gravel, moist.	1	SS	22.5	17.2	21.0	*	39.3	--	--	--	18.2	A-4a
921.3		5-5-5	1.0		Stiff, brown and gray mottled SILT AND CLAY, some gravel, little sand, moist.	2	SS	35.5	10.7	11.3	*	42.5	32.0	18.8	13.2	20.8	A-6a
915.3		50/0.5	0.5			3	SS										
913.3		RQD 75%	5.0	0.0	Extremely weathered, gray SHALE, friable.	Run 1	NXW										
		RQD 82%	5.0	0.0	Gray SILTY SHALE, moderately weathered, firm, thin bedded, thin siltstone, interbeds.	Run 2	NXW										
903.3					TERMINATION DEPTH 20.0 FEET												

SHALE

* SILT AND CLAY COMBINED

medium stiff to stiff sandy silt and silt and clay

SUBSURFACE INVESTIGATION
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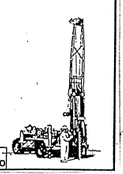

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SFN: 7130306

FHWA REGION	STATE	PROJECT

SUM-NORTH MAIN ST. 6/6

LOG OF BORING

Date Started 11-2-89 Sampler Type Split Spoon Dia. 2.0 Water Elev. Dry
Date Completed 11-2-89 Casing: Length -- Dia. 3.25
Boring No. B-5 Station & Offset Sta. 488 + 16.83 37.89' LT. Surface Elev. 973.5

2. V. STIFF SANDY SILT

3. V.DENSE TO DENSE SAND AND GRAVEL

ELEV.	DEPTH	STD. PEN. (N)	REC. Ft.	LOSS Ft.	DESCRIPTION		PHYSICAL CHARACTERISTICS									SHTL CLASS.
											% SILT	% CLAY	L.L.	P.L.	P.I.	W.C.	
973.5	0																
971.5		5-10-13	0.6		Very stiff, brown SANDY SIL gravel, moist.												
		31-50/0.3	1.0			2	SS										
		25-50/0.4	1.0			3	SS										
		40-50/0.4	1.0			4	SS	44.9	20.6	21.8	*	12.7	--	--	--	4.8	A-1-b
		34-50/0.3	0.8			5	SS										
		50/0.3	0.3			6	SS	28.8	22.4	30.9	*	17.9	--	--	--	5.9	A-1-b
		50/0.4	0.3			7	SS										
		50/0.5	0.3		Very dense, brown SAND AND GRAVEL, trace to little silt, trace sandstone fragments, moist to dry.	8	SS	49.8	12.5	20.7	*	17.0	--	--	--	3.7	A-1-b
		50/0.5	0.3			9	SS										
		31-50/0.5	1.0			10	SS										
		22-50/0.5	1.0			11	SS										
		27-50/0.3	0.8			12	SS										
		42-50/0.3	1.0			13	SS										
		40-50/0.4	1.0			14	SS										
933.5					TERMINATION DEPTH 40.0 FEET												

* SILT AND CLAY COMBINED

LOG OF BORING

Date Started 11-13-89 Sampler Type Split Spoon Dia. 2.0 Water Elev. Dry
Date Completed 11-13-89
Boring No. B-6 Surface Elev. 1000.2

1. M.DENSE TO DENSE SAND AND GRAVEL

2. V. STIFF SANDY SILT

ELEV.	DEPTH	STD. PEN. (N)	REC. Ft.	LOSS Ft.		PHYSICAL CHARACTERISTICS											SHTL CLASS.
						NO.	TYPE	% AGG.	% C.SAND	% F.SAND	% SILT	% CLAY	L.L.	P.L.	P.I.	W.C.	
1000.2	0																
999.9					ASPHALT												
999.2					CONCRETE												
998.2		40-19-18	1.5		Dense, brown SAND AND GRAVEL, little silt, moist.	1	SS	38.2	15.0	22.9	*	23.9	--	--	--	8.3	A-1-b
		8-14-10	1.5		Medium dense, brown SAND, some gravel, little silt, moist.	2	SS	31.4	17.7	25.6	*	25.3	--	--	--	9.3	A-3a
993.2																	
		5-9-9	1.5		Very stiff, gray SANDY SILT, little gravel, moist.	3	SS	19.1	14.4	17.2	*	49.3	22.8	20.9	1.9	15.2	A-4a
990.2					TERMINATION												

* SILT AND CLAY COMBINED

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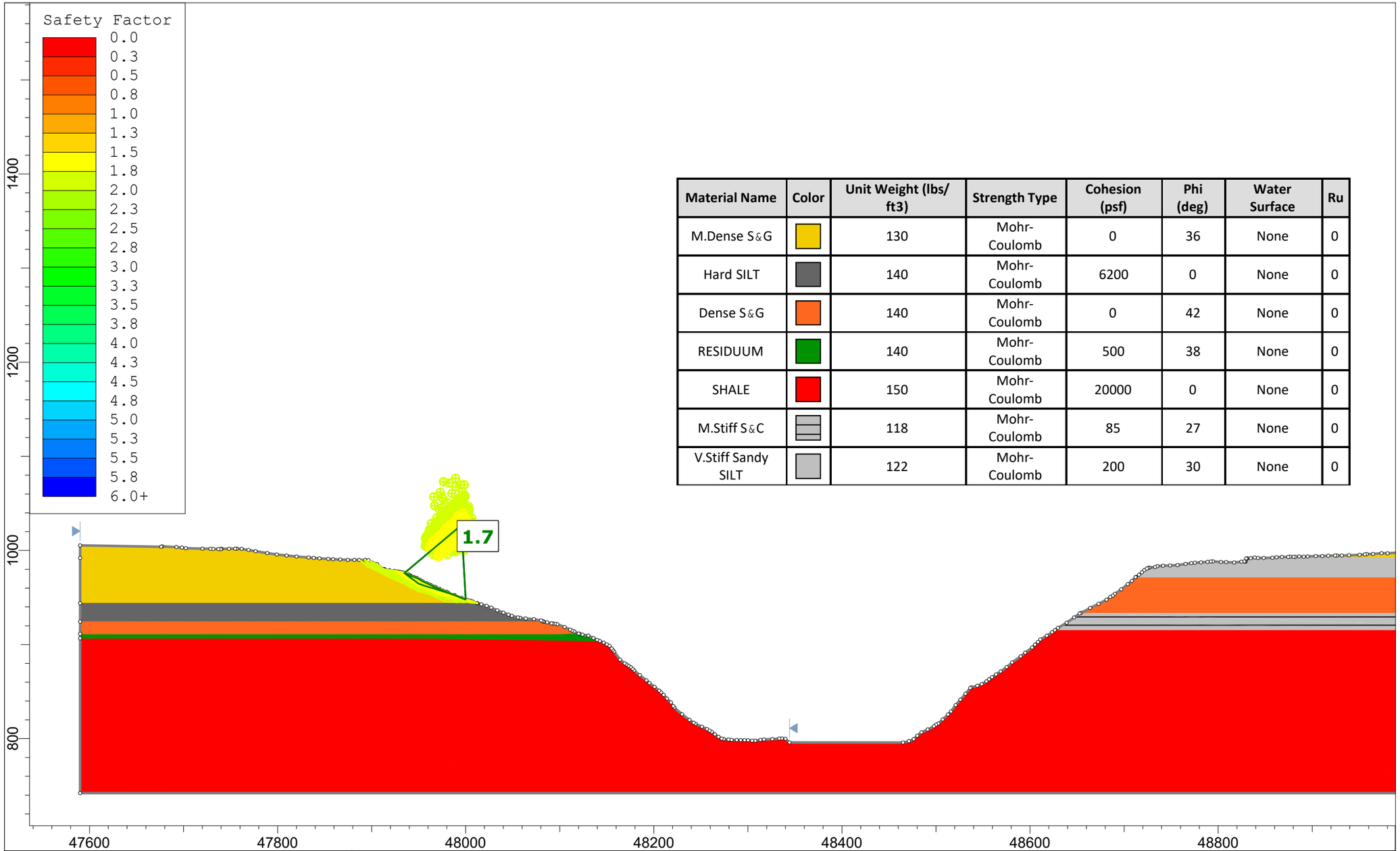
SFN: 7720306

110 DC2 SUM-NORTH MAIN ST. 12.96

SLIDE OUTPUT



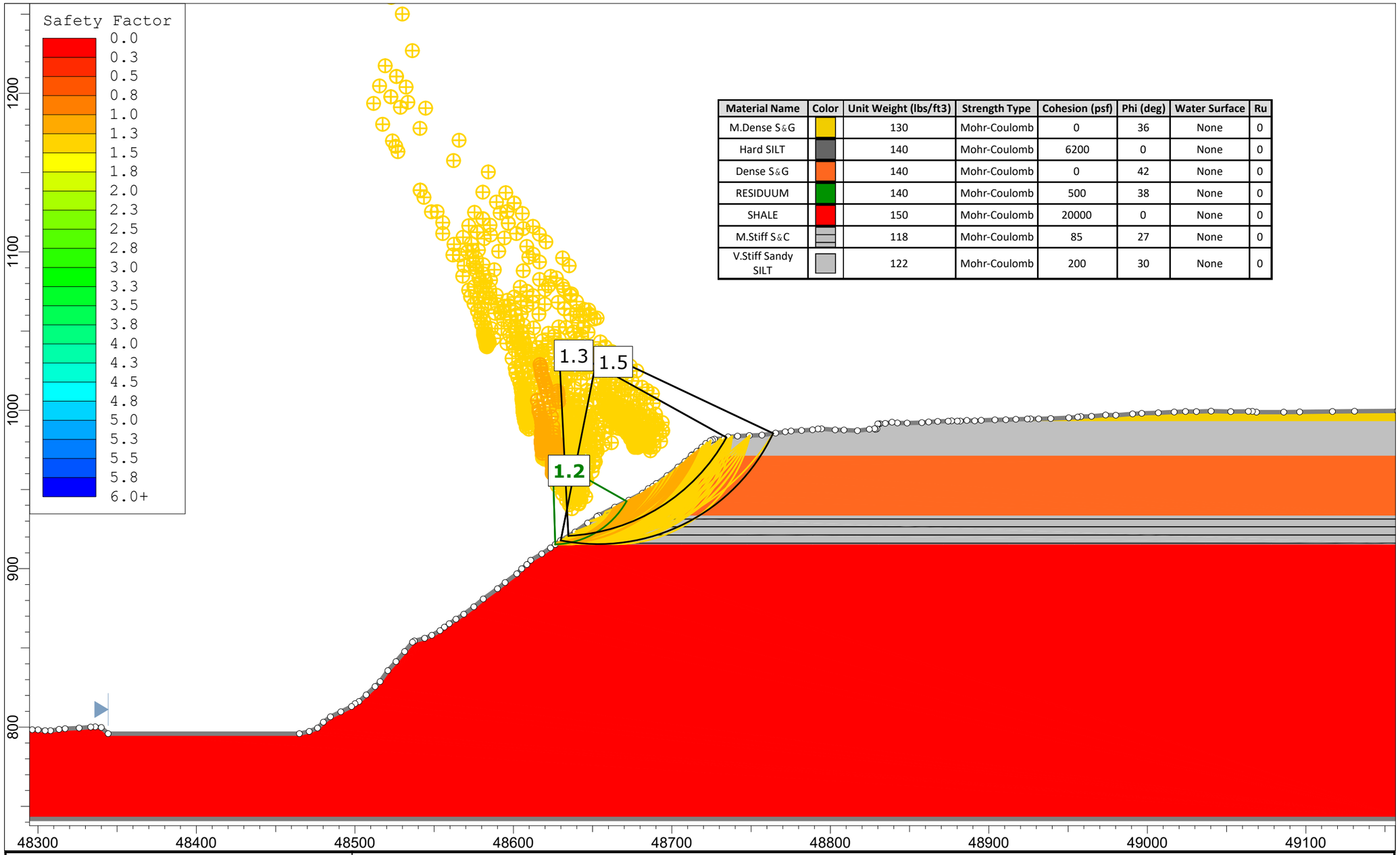
Material Name	Color	Unit Weight (lbs/ ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface	Ru
M.Dense S&G		130	Mohr-Coulomb	0	36	None	0
Hard SILT		140	Mohr-Coulomb	6200	0	None	0
Dense S&G		140	Mohr-Coulomb	0	42	None	0
RESIDUUM		140	Mohr-Coulomb	500	38	None	0
SHALE		150	Mohr-Coulomb	20000	0	None	0
M.Stiff S&C		118	Mohr-Coulomb	85	27	None	0
V.Stiff Sandy SILT		122	Mohr-Coulomb	200	30	None	0

Gannett Fleming

SLIDEINTERPRET 9.023

SUM-CR008-09.08

Analysis Description	South Embankment Master Scenario		
Analysis By	Julia Yeakley	*Checked By*	TLM
Client	Gannett Fleming		
Analysis Date	5/10/2023, 1:31:27 PM	*Checked Date*	5/12/2023
File Name	Slide1.slmd		



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface	Ru
M.Dense S&G		130	Mohr-Coulomb	0	36	None	0
Hard SILT		140	Mohr-Coulomb	6200	0	None	0
Dense S&G		140	Mohr-Coulomb	0	42	None	0
RESIDUUM		140	Mohr-Coulomb	500	38	None	0
SHALE		150	Mohr-Coulomb	20000	0	None	0
M.Stiff S&C		118	Mohr-Coulomb	85	27	None	0
V.Stiff Sandy SILT		122	Mohr-Coulomb	200	30	None	0

Gannett Fleming

SLIDEINTERPRET 9.023

SUM-CR008-09.08

Analysis Description: North Embankment Master Scenario

Analysis By	*Checked By*	*Client*
Julia Yeakley	TLM	Gannett Fleming
Analysis Date	*Checked Date*	*File Name*
5/10/2023, 1:31:27 PM	5/12/2023	Slide1.slmd