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RES

RUGGLES ENGINEERING SERVICES INC.

MIDDLESEX
BRF 024-1(37)

TEMPORARY BRIDGE
CRITICAL DESIGN CALCULATIONS
June 24, 2015

Previously designed for
MIDDLESEX
BRF 024-1(32)
APRIL 1, 2009

AND USED FOR:
CORNWALL BRS0172 (6)
HINESBURG STP 0199(2)
JOHNSON BRF 030-2(26)

THIS TEMPORARY BRIDGE IS THE MIDDLE (80') SPAN OF A THREE SPAN STRUCTURE THAT HAS BEEN SUCCESFULLY USED ON THE ABOVE PROJECTS. THE CALCULATIONS ENCLOSED HAVE BEEN MODIFIED TO REFLECT THE PROPOSED USE ON THIS PROJECT.

PREPARED FOR:

A.L. ST. ONGE CONTRACTOR, INC.
P.O. BOX 65
MONTGOMERY, VT 05470

ANALYSIS SHEETS	1-6/6
PLAN SHEETS (SEPARATE)	1-3/3
STANDARD SHEET	G-16

STATE OF VERMONT
TIMOTHY J. RUGGLES
NO. 6149
REGISTERED PROFESSIONAL ENGINEER

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RUGGLES ENGINEERING SERVICES INC.

Analysis Sheet

Date: 04/01/09 REV 6/24/15
By: T.R
Project: A.L. ST. ONGE - MIDDLESEX - TEMP. BRIDGE Sheet 1 of 6
REVISED 06/24/15 FOR MIDDLESEX BRF 024-1(37)

CRITICAL DESIGN CALCULATIONS FOR TWO-WAY, ~~THREE~~ ONE TR SPAN TEMPORARY BRIDGE, GIVEN:

~~1) END SPANS @ 70', USED W 33X201 GIRDERS (5)~~

~~$S_x = 684 \text{ in}^3$~~

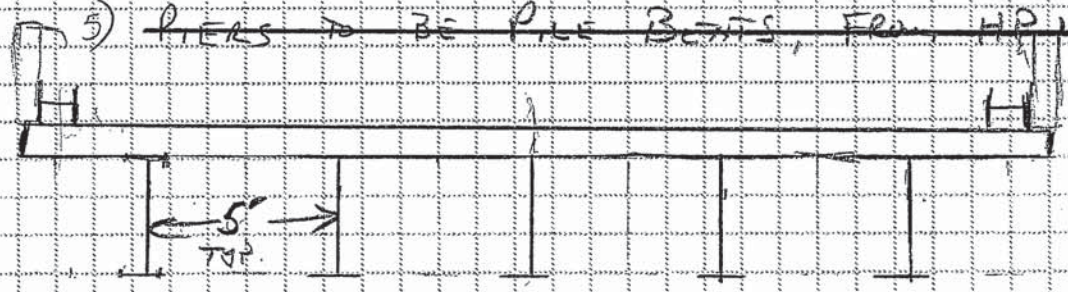
2) ~~MIDDLE~~ SPAN @ 80', USED W 36X245 GIRDERS (5)

$S_x = 895 \text{ in}^3$

3) DECK TO BE 27' PRECAST CONCREE, 8" THICK + 2" PAVEMENT - USE 0.83' THICK (PREVIOUSLY DESIGNED AND BUILT)

4) BRIDGE TO BE 24' RAIL TO RAIL

~~5) PIERS TO BE PILE BENTS, FROM HP 14X73~~



BEAMS @ 5' O.C.

ANALYZE BEAMS FOR WORTCASE, ONE WHEEL LOAD DIRECTLY OVER ON BEAM

DEAD LOAD DISTRIBUTED OVER 5 BEAMS

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Analysis Sheet

Date: 04/01/09 REV 6/24/15
By: T.R
Project: A.L. ST. ONGE – MIDDLESEX TEMP. BRIDGE Sheet 2 of 6

PAGE 2 DELETED TR

1) END SPANS: (70' LONG)

A) DEAD LOADS (ALL PER GIRDER)

- DECK: 27' X 1' X .83' X 150 lb/FT³ ÷ 5 = 0.67 K/FT
- BEAMS 201 lb/FT X 1.1 (DIAPHRAMS ETC) = 0.22 K/FT
- GUARD RAIL 2 X 200 lb/FT ÷ 5 = 0.08 K/FT

TOTAL DL = 0.97 K/FT

SO $M_{DC} = \frac{wL^2}{8} = \frac{(0.97) \times (70)^2}{8} = 594$ KIP-FT.

B) LIVE LOAD

4528

(AASHTO APP A) LANE LOAD (HS-20) TO HS25 = 985.6 X 1.25 = 1232 K-FT

SO 1/2 LANE LOAD ON GIRDER = 616 K-FT

$I = \frac{50}{4+125} = \frac{50}{70+125} = 0.26$ ✓

DIST FACTOR $= \frac{S}{5.5} = \frac{5}{5.5} = 0.91 = (D.F)$ ✓

SO $M_{LL} = 616 \times \underset{(I)}{1.26} \times \underset{(DF)}{0.91} = 706.3$ K-FT

C) $M_{TOTAL} = \underset{M_{DC}}{594.0} + \underset{M_{LL}}{706.3} = 1300.3$ K-FT

D) $S_{x(REQD)} = \frac{M_{max}}{F_b} = \frac{1300.3 \times 12 \text{ IN/FT}}{24 \text{ K/IN}^2} = 650.1 \text{ IN}^3$

E) S_x W 33X201 = 684 IN³ > 650.1 IN³ ∴ O.K.

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Analysis Sheet

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Project:

2) ~~MIDDLE~~ SPAN: (80' LONG)

A) DEAD LOADS (ALL PER GIRDER (SAME AS END)

- DECK 0.67 K/FT
- BEAMS 0.22 K/FT
- GUARDRAIL 0.08 K/FT

TOTAL 0.97 K/FT

So $M_{DL} = \frac{0.97 \times (80)^2}{8} = 776$ K-FT ✓

B) LIVE LOAD:

(AASHTO APP A) LANE LOAD = 1164.9 (HS-20) × 1.25 (TO HS-25) = 1456.1 K-FT/LANE ✓

So 1/2 LANE LOAD = 728.1 K-FT

USE I = 0.26 ; DF = 0.91 (FROM PAGE 2) TR

So $M_{LL} = 728.1 \times 1.26 \times 0.91 = 834.8$ ✓

C) $M_{TOTAL} = \overset{M_{DL}}{776} + \overset{M_{LL}}{834.8} = 1610.8$ K-FT

D) $S_{x\,REQ'D} = \frac{M_{max}}{F_b} = \frac{1610.8 \times 12 \text{ IN/FT}}{24 \text{ K/IN}^2} = 805.4 \text{ IN}^3$ ✓

E) W 36 x 201 $S_x = 895 \text{ IN}^3 > 805.4 \text{ IN}^3$ ∴ OK ✓

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Analysis Sheet

Date: 04/01/09 REV. 6/24/15
By: T.R
Project:

3) CALCULATE END REACTIONS:

~~A) END SPANS = 70'~~

~~AASHTO APP A - REACTION = 62.4 X 1.25/LANE X 2 LANE = 156 K~~

~~D.L. = 0.97 K/FT X 70' X 5 BEAMS / 2 = 170 K~~

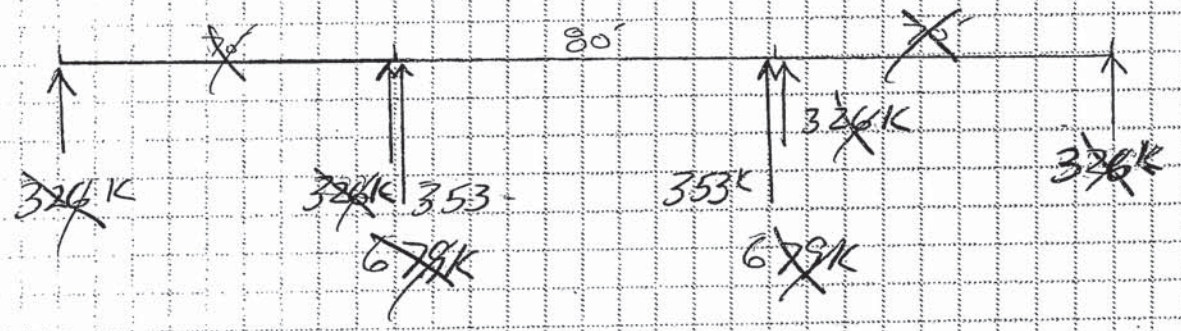
~~326 K EACH END~~

B) ~~MID~~ SPAN = 80'

AASHTO APP. A - REACTION = 63.6 X 1.5/LANE X 2 LANE = 159 K

D.L. = 0.97 K/FT X 80' X 5 BEAMS / 2 = 194 K

353 K EACH END.



~~SO PILE BENTS MUST SUPPORT 679 K~~

ABUTMENTS MUST SUPPORT ~~326 K~~ 353 K TR

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Analysis Sheet

Date: 04/01/09 REV. 6/24/15
By: T.R
Project:

4) CHECK PILES FOR BENTS

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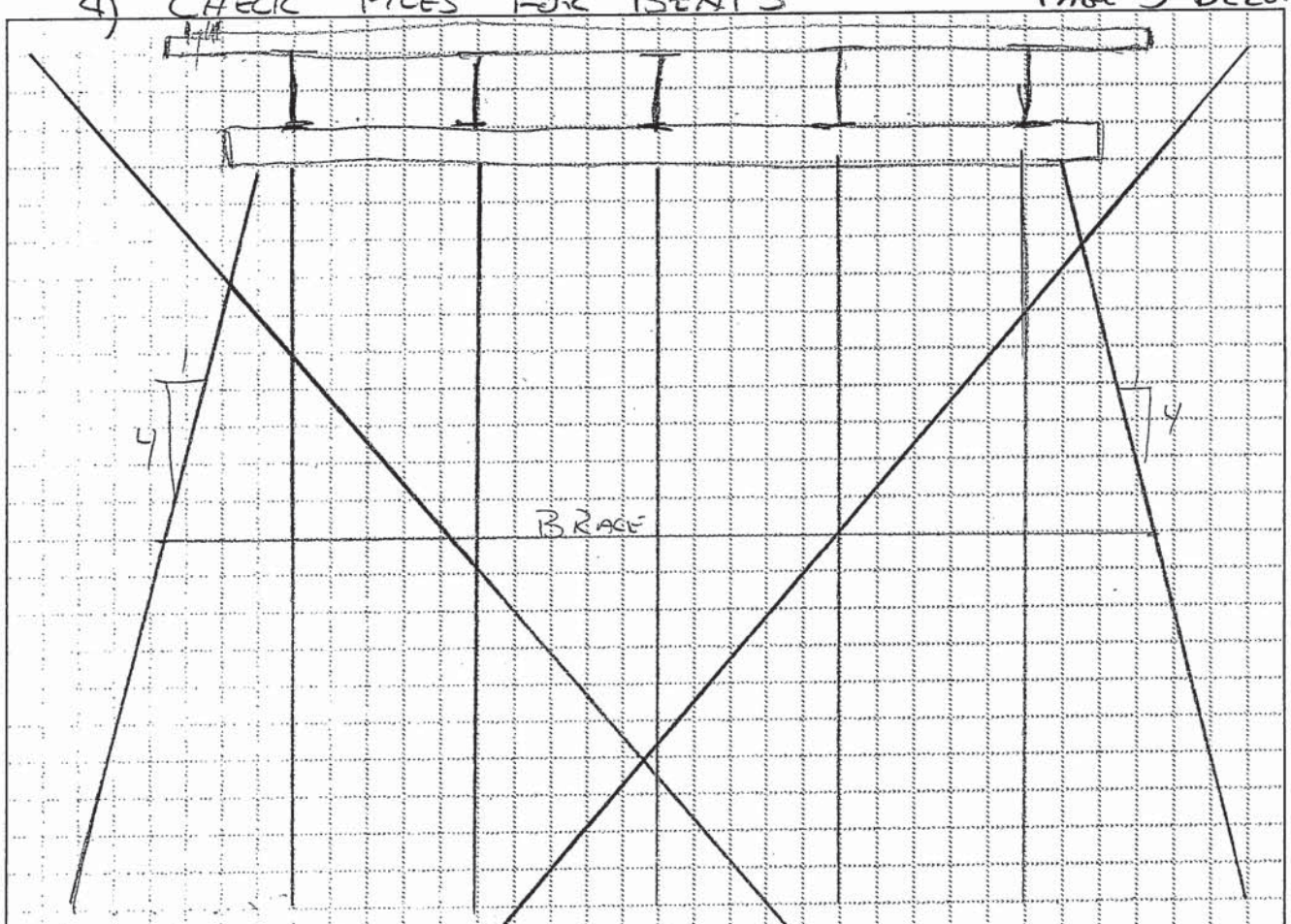

PLACE PILES DIRECTLY BELOW GIRDERS
SAY LOAD IS DISTRIBUTED OVER 5 PILES

∴ $LOAD_{/PILE}$ = 679 K / 5 = 135.8 K - SAY 150 K

SAY EACH COLUMN ≈ 25' LONG SO

USE K = 1.2 r = 3.49 A_s = 21.4 in² C_c = 126.1
l = 300"

Kl/r = 103.2

$$F_a = \frac{[1-(Kl/r)^2/2C_c^2]F_y}{FS}$$

103.2 126.1 36 K 1.91

F_a = 12.54 K/in²

SO ALLOWABLE LOAD = 21.4 × 12.54 = 268.3 K > 150 K ∴ OK

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Analysis Sheet

Date: 04/01/09 REV. 6/24/15
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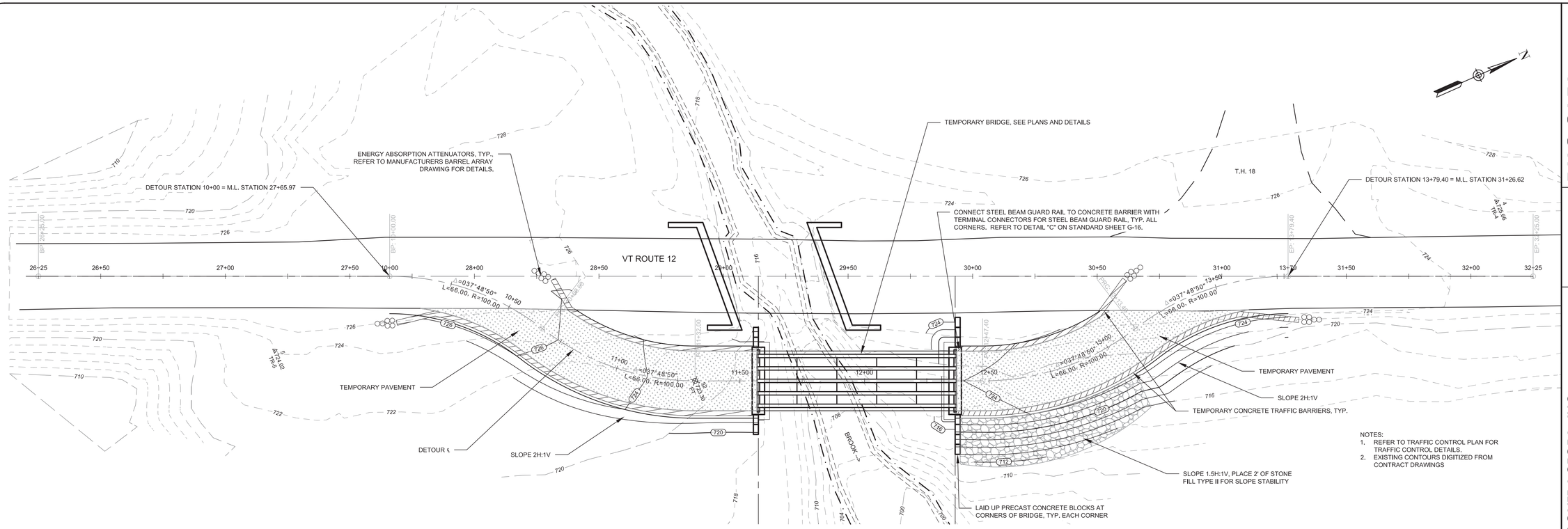
Project:

5) CHECK ABUTMENT END LOAD CONDITIONS

- LOAD ON ABUTMENT ENDS = ~~326~~ 353 K TR
- USE A 5' x 27' x 8" THICK PRECAST DECK SECTION UNDER THE GIRDERS
- TOTAL AREA = 5 x 27 = 135 SQ FT
- LOAD = $\frac{\cancel{326K}\ 353}{135 FT^2}$ = ~~2.4~~ 2.6 K/FT² SAY ~~2.6~~ 2.6 K/FT²
- USING STRUCTURAL FILL, SO ~~2.5~~ 2.6 K/FT² IS REASONABLE FOR TEMPORARY USE.
- ~~USE 2.5 K/FT² SURCHARGE LOAD WHEN DESIGNING SHEETING FOR ABUTMENTS~~

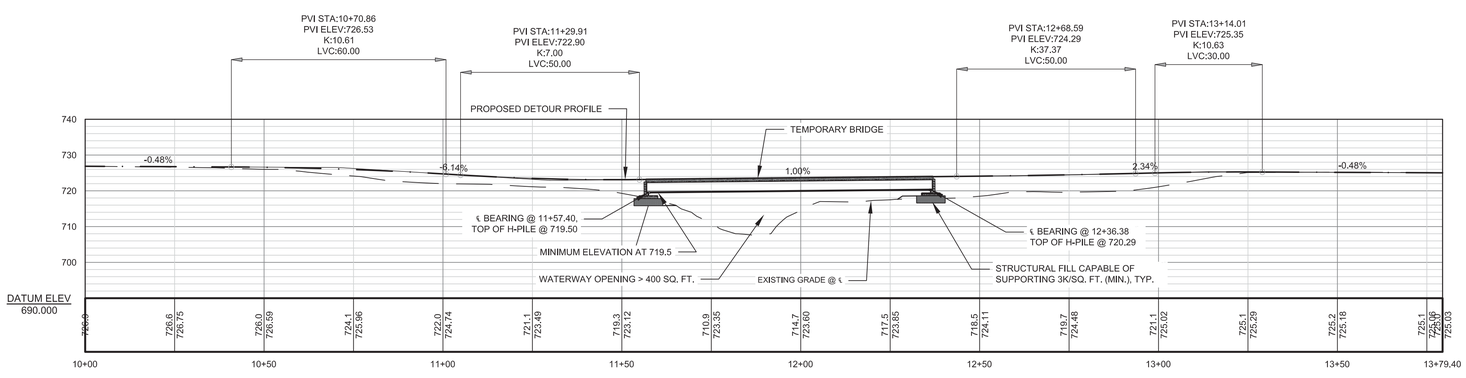
6) NOTE:
PRECAST BRIDGE DECK PANELS HAVE BEEN DESIGNED PREVIOUSLY BY OTHERS, AND HAVE BEEN USED SUCCESSFULLY ON OTHER PROJECTS
– NO ANALYSIS PERFORMED –

7) NOTE THE H-PICE GUARDRAIL CONFIGURATION HAS BEEN DESIGNED PREVIOUSLY BY OTHERS, AND HAS BEEN USED SUCCESSFULLY ON OTHER PROJECTS
– NO ANALYSIS PERFORMED –

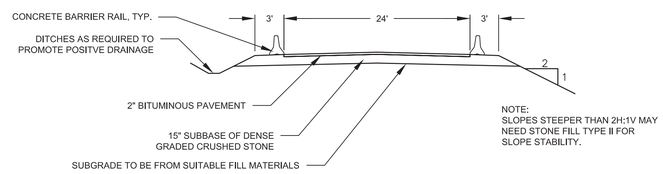


DETOUR LAYOUT PLAN
1" = 20'
0 20' 40'

NOTES:
1. REFER TO TRAFFIC CONTROL PLAN FOR TRAFFIC CONTROL DETAILS.
2. EXISTING CONTOURS DIGITIZED FROM CONTRACT DRAWINGS



DETOUR PROFILE
1" = 20'
0 20' 40'



DETOUR TYPICAL SECTION
N.T.S.

RUGGLES ENGINEERING SERVICES, INC.
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Civil Engineering-Site Development
Septic System Design-Soils Analysis

JOB No. 15030

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Address

DETOUR PLAN AND PROFILE
MIDDLESEX BRF 024-1(37)

REVISIONS

No.	Description	Date

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DATE: 07/13/15

DTR 1

Sheet of

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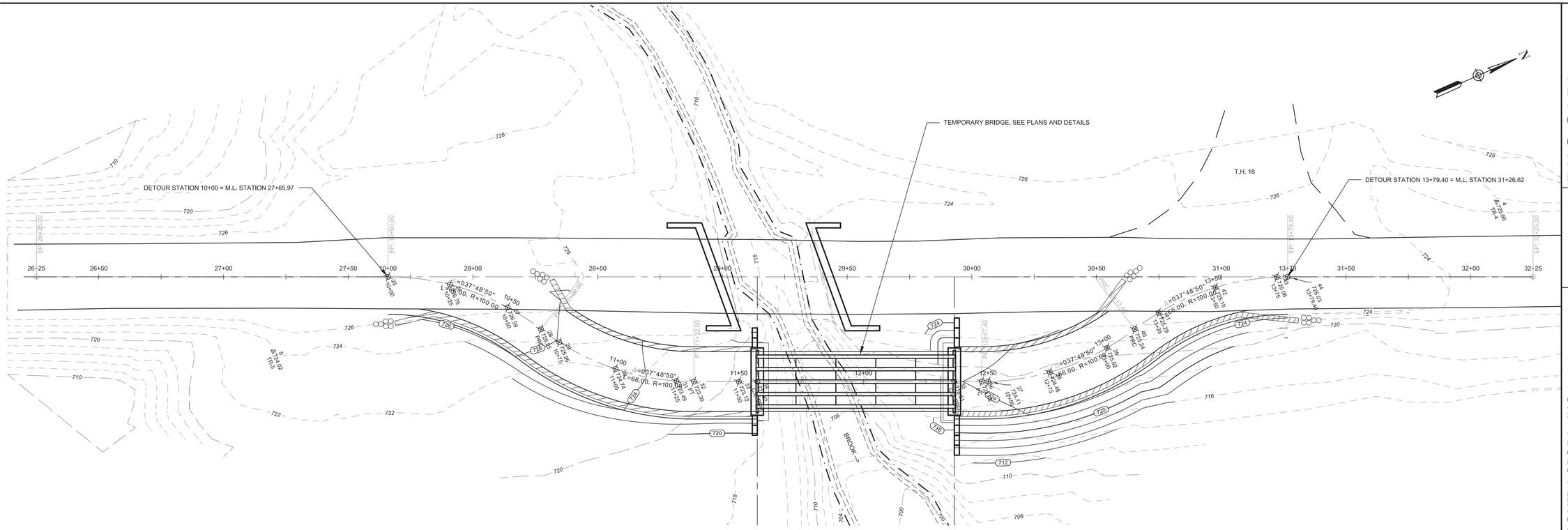

DETOUR LAYOUT PLAN
1" = 20'
0 20' 40'

Point Table				
Point #	Raw Description	Elevation	Northing	Easting
3	TR-3	728.39	660343.699	1619763.487
4	TR-4	725.66	661038.506	1620017.348
5	TR-5	724.02	660565.676	1619873.812
25	10+00		660619.921	1619865.135
26	10+25	726.75	660641.291	1619877.984
27	10+50	726.59	660658.817	1619895.720
28	PRC	726.25	660667.501	1619909.137
29	10+75	725.96	660672.123	1619916.857
30	11+00	724.74	660688.366	1619935.776
31	11+25	723.49	660708.785	1619950.088
32	PT	723.30	660715.081	1619953.139
33	11+50	723.12	660731.545	1619960.420
34	C.L. BRG	717.82	660738.313	1619963.413
35	C.L. BRG	718.61	660810.547	1619995.356
36	PC	724.08	660820.625	1619999.812

Point Table				
Point #	Raw Description	Elevation	Northing	Easting
37	12+50	724.11	660823.015	1620000.832
38	12+75	724.48	660847.077	1620007.372
39	13+00	725.02	660872.009	1620007.755
40	PRC	725.24	660885.191	1620005.402
41	13+25	725.29	660896.585	1620003.263
42	13+50	725.18	660921.520	1620003.197
43	13+75	725.06	660945.696	1620009.303
44	13+79.40	725.03	660949.756	1620010.992

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DETOUR LAYOUT PLAN
MIDDLESEX BRF O24-1(37)

REVISIONS

No.	Description	Date
-	-	-
-	-	-
-	-	-
-	-	-

Designed: T.R.
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DTR 2

Sheet of

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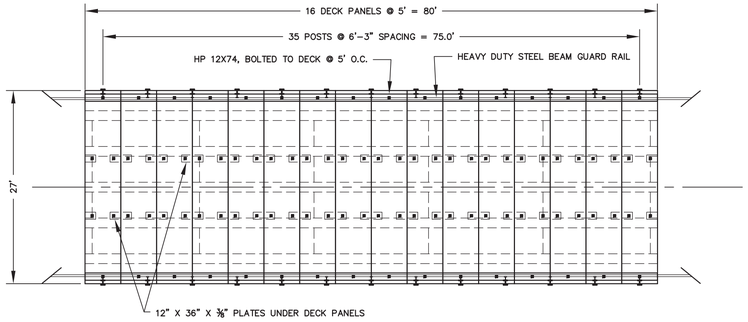
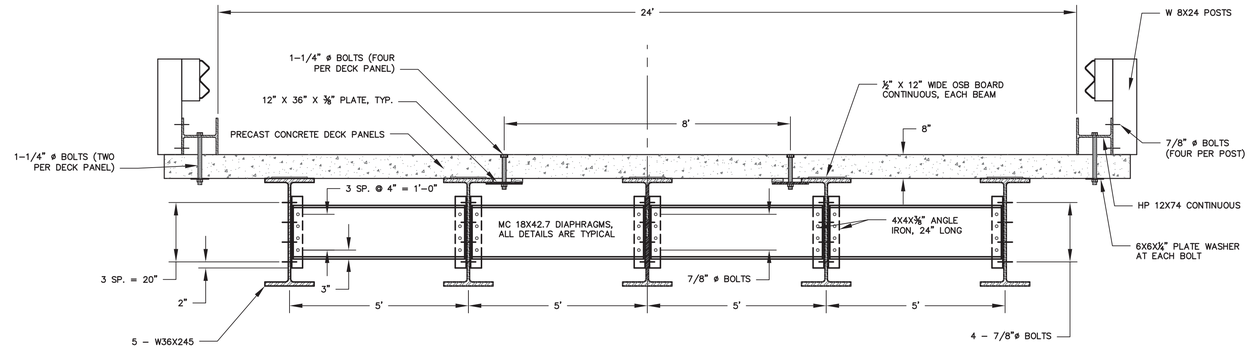


BRIDGE DECK PLAN
1" = 10'

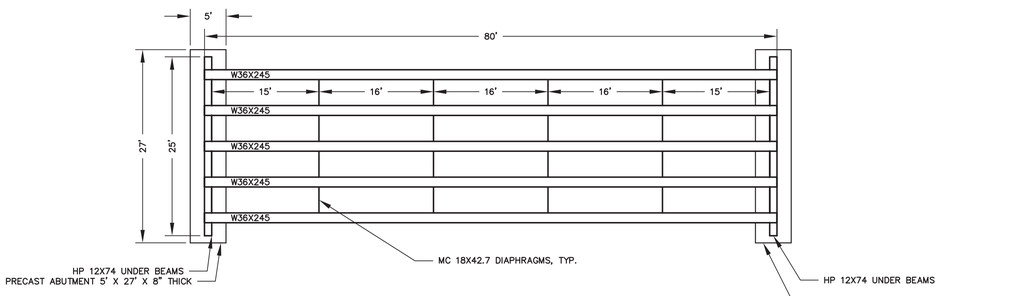


TYPICAL BRIDGE SECTION
1" = 2'

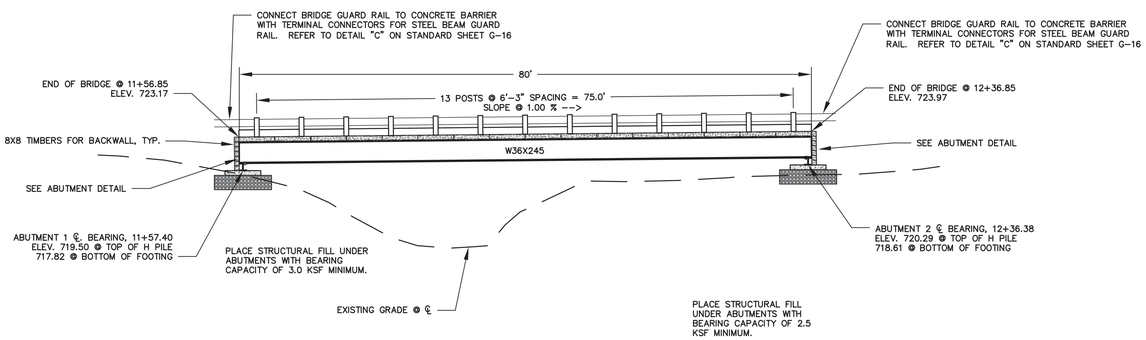
0 2' 4'

NOTES:

1. ALL BEAMS ARE TO BE IN GOOD CONDITION WITH A MINIMUM YIELD STRENGTH OF 36 KSI.
2. STEEL FOR BRACING SHALL BE NEW OR IN LIKE NEW CONDITION AND ASTM A36 OR STRONGER.
3. BOLTS AND NUTS FOR CONNECTIONS SHALL BE H.S. A-325 WITH ALL HOLES DRILLED. ALL BOLTED CONNECTIONS TO HAVE A FLAT WASHER ON EACH END.
4. CONCRETE FOR PRECAST PANELS SHALL BE CLASS A.
5. REINFORCING STEEL SHALL BE GRADE 60.
6. BRIDGE IS DESIGNED FOR TWO-WAY TRAFFIC, HS-25 LOADING. DESIGN BASED ON CONTRACT DOCUMENTS AND TEMPORARY STRUCTURE CONSIDERATIONS.
7. PRECAST DECK PANELS TO HAVE A 8" NOMINAL DEPTH. PREVIOUSLY DESIGNED BY A.L. ST. ONGE FOR HS-25 LOADING.
8. ALL WELDING TO BE PERFORMED BY QUALIFIED WELDERS USING E70XX OR STRONGER WELDING ELECTRODE.

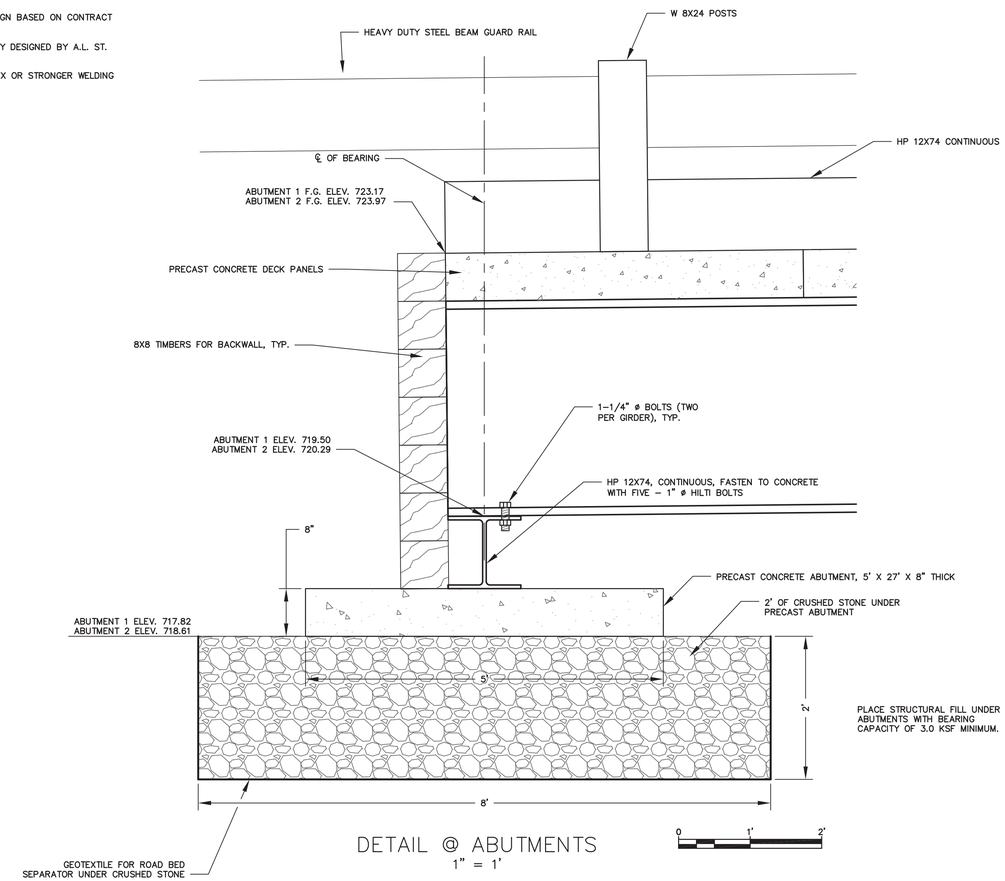


BRIDGE FRAMING PLAN
1" = 10'



BRIDGE ELEVATION
1" = 10'

0 10' 20'



DETAIL @ ABUTMENTS
1" = 1'

0 1' 2'

RUGGLES ENGINEERING SERVICES, INC.
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JOB No. 15030

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Address P.O. BOX 65 MONTGOMERY, VT 05470

TEMPORARY BRIDGE PLAN AND DETAILS
MIDDLESEX BRF 024-1(37)

REVISIONS		
No.	Description	Date

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Drawn: –
Checked: –
DATE: 07/13/15

BR 1

Sheet of

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Plans-BR-Temp-Bridge-2015-07-13