Town of Weathersfield Vermont
Request for Bids (RFB)
Bridge Superstructure Replacement
Bridge #63 - Ascutney Basin Road
Perkinsville (Weathersfield), VT

1. GOAL

1.1 The goal of this project is to remove the existing concrete bridge superstructure and replace it with new. The existing concrete superstructure is deteriorated, has been damaged by flooding, and can no longer safely carry current traffic loads. The existing substructure (abutments and wingwalls) will be retained and reused. The project includes related site work, excavation and paving.

2. SCOPE OF WORK

2.1 Complete the work as shown on the project plans and as included in the project specifications, bid documents and contract documents.
2.2 Remove and dispose of the existing bridge superstructure.
2.3 Preserve and reuse the existing substructure (abutments and wingwalls).
2.4 Design, Fabricate, Construct and Install a replacement bridge superstructure.
2.5 Site work, excavation, guardrail, paving, grading, erosion prevention, sediment control and traffic control.
2.6 A temporary bridge was installed on the southern downstream side of the Ascutney Basin bridge. The temporary bridge is to be removed by the Contractor and delivered to its owner (Daniels Construction, 4409 US 5 S, Ascutney, VT,05030) after completion of the new bridge superstructure project. The site of the temporary bridge is to be restored to original grade, and the soil seeded and mulched. Install and maintain erosion prevention measures until permanent vegetation is established at this adjacent site.
2.7 Provide sufficient management and technical staff to manage the project, the construction, to provide and maintain the required Contract Documents (submittals, requests for information, request for change, etc.).

3. ATTACHMENTS

3.1 Attachment A – Bid Form
3.2 Attachment B - Construction Preliminary Plans (SO1, SO2, and SO3)
3.3 Attachment C - SD 367.01 & 367.02
3.4 Attachment D - Paving Scope of Work
3.5 Attachment E - Project Specifications
3.6 Attachment F - Temporary Bridge Design

4. GENERAL CONDITIONS

4.1 The contractor is to ask any questions that may be material to their bid during the question period.

4.2 The contractor will specify in their bid submittal any items which are identified in the RFB documents as part of the project that are not included with a narrative as to why they are not included.

4.3 The contractor will specify the range of dates on which they expect the work will commence and be completed.

5. OTHER CONSIDERATIONS

5.1 It is our intent to move forward with this project as soon as possible. Preference is for construction to be completed during the 2024 construction season.

6. INDEMNIFICATION AND INSURANCE

6.1 The chosen contractor shall comply with the following requirements

6.2 The contractor agrees to defend and save harmless the Town of Weathersfield, its officers, Engineer, agents and employees against all claims, demands, payments, suits, actions, recovery, and judgments of every kind and description arising out of the performance of the Agreement, including personal injury or property damage brought or recovered against it by reason of any negligent action or omission of the consultant, its agents, or employees and with respect to the degree to which the Town is free from negligence on the part of itself, its employees and agents.

6.3 The contractor shall carry Comprehensive Broad Form General Liability Insurance in the amount shown below including protection for bodily injury and property damage.

6.4 The contractor shall also maintain Automobile Liability Insurance providing limits prescribed by the Town and Umbrella or Excess Liability Insurance in the amount shown below. The Workers' Compensation Insurance shall provide coverage pursuant to V. S. A. Title 21, Section 600 et seq.

6.5 The Professional Engineer retained by the contractor to complete the work identified in the Bridge Superstructure Design Performance Specification, shall provide proof of Professional Liability Insurance for the project period at the amount listed below.

6.6 Before the work starts, Certificates of Insurance shall be supplied to the Town by the contractor detailing the required coverage. These Certificates shall be issued by a carrier authorized to do business within the State of Vermont. The State of Vermont and the Town of Weathersfield shall also be named as an additional insured.

6.7 The contractor shall have and require all sub-consultants to have and maintain insurance coverage and list the Town as an additional insured in accordance with

the minimum amounts listed below. Prior to the start of any work, the Town shall be furnished with an insurance certificate as proof that coverage is in place.

6.7.1 General Liability-$1,000,000 per occurrence
6.7.2 Product Liability-$1,000,000 per occurrence
6.7.3 Property Damage-$1,000,000 per occurrence
6.7.4 Personal Injury-$1,000,000 per occurrence
6.7.5 Automotive Liability-$500,000 per occurrence
6.7.6 Worker's Compensation-Statutory Requirement
6.7.7 Professional Engineering Liability Insurance – $500,000 per occurrence.

7. INSTRUCTIONS TO BIDDER

7.1 PRE-BID CONFERENCE

There will be a Pre-Bid Conference on March 11, 2024, at 10am prevailing time at the project site. The site is located at the intersection of VT Route 106 and Ascutney Basin Road in Perkinsville, (Weathersfield) VT. This conference is strongly recommended but not mandatory for contractors that are interested in bidding on this project. Questions asked during the Pre-Bid Conference will be answered at the Pre-Bid Conference. The Town may make an attempt to write up a summary of what it believes the substantive Questions asked that are Answered at the site but does not guarantee that all Questions and Answers from the Pre-Bid Conference will be provided to bidders that are absent from the Conference.

7.2 INTERESTED BIDDERS

To be added to the plan holders list (interested bidder list / interested contractor list) so that you receive the Answers provided to the Questions received, send an email to Brandon Gulnick at townmanager@weathersfield.org Specify that you would like to be updated on the Bridge Superstructure Replacement - Bridge #63 - Ascutney Basin Road project.

7.3 QUESTION PERIOD

The Question Period begins when the bid is advertised and ends on March 18, 2024, at 10 am. Any questions received past this date will not be answered. The purpose of the Question Period is to Answer all questions the bidders have which are material to their bids, the project documents, the bid documents, the project, the request for proposals (bids), insurance, project design, etc. The purpose of the question period deadline is to provide a reasonable period of time for questions to be asked, answered and distributed prior to the bid due date.

7.4 ANSWERS TO QUESTIONS, CHANGES, NOTES & ADDENDA

Answers to Questions received will be sent to all interested contractors that have requested to be added to the Interested Bidders listed as described in 6.2 above by March 28, 2024, at 5pm. If you have not requested to be added to this list, you will not receive these updates.

The Town may make an attempt to write up a summary of what it believes the substantive Questions asked that are Answered at the site during the Pre-Bid Conference but does not guarantee that all Questions and Answers from the Pre-Bid Conference will be provided to bidders that are absent from the Conference.

7.5 **BID SUBMISSION**

7.6 All Bids must be submitted on the provided bid form. The bid form must be filled out in its entirety and signed/dated. An incomplete bid form results in automatic disqualification.

7.7 If multiple bids are submitted by the same bidder, only the last one submitted prior to the bid due date and time shall be considered.

7.8 Bids must be sealed & submitted to the attention of the Town Manager, Brandon Gulnick. Bids may either be mailed to PO BOX 550, Ascutney, VT 05030 OR delivered in person to 5259 US Route 5, Ascutney, VT 05030. If bids are mailed, we recommend mailing them well in advance to ensure the bid is received prior to the public bid opening and bid award. Late bids will not be accepted, even in the case the envelope is postmarked prior to the due date.

7.9 Bids must be submitted no later than April 30, 2024, at 2 pm.

7.10 **PUBLIC BID OPENING/ BID AWARD**

7.10.1 A Public Bid Opening will take place in the Conference Room at Martin Memorial Hall on April 30, 2024, at 3:00 pm. Bids will be unsealed, read aloud, and logged into a bid opening form.

7.10.2 Bids will be analyzed, and a recommendation will be made by the Town Manager to the Selectboard on May 6, 2024. Contractors will be notified by May 8, 2024.

7.11 **SELECTION CRITERIA**

7.11.1 The project will be awarded to the most responsible contractor whose bid represents the best value for the Town of Weathersfield.

7.11.2 All bids will be received & reviewed based on the information provided on the bid form.

8. THE TOWN RESERVES THE RIGHT:

8.1 To accept or reject any or all bids and to accept proposals other than the lowest price, and to amend, modify, or withdraw this Request for Bids.

8.2 To require supplemental statements or information from proposers.

8.3 To extend the deadline for responses to this Request for Bids

8.4 To waive or correct any irregularities in bids received.

8.5 To negotiate separately with competing bidders.

8.6 To allow or disallow entry into the pre-bid conference for any potential bidder arriving after the start of the pre-bid conference.

9. CALENDAR

9.1 Request for Bids posted February 21,2024
9.2 Pre-Bid Conference on March 11, 2024, at 10am
9.3 Question Period ends on March 18, 2024, at 10am
9.4 Answers to questions, changes, notes & addenda emailed to plan holders no later than March 28, 2024, at 5pm.
9.5 Bids Due: April 30, 2024, at 11am
9.6 Public Bid Opening on April 30, 2024, at 1pm
9.7 Bid Review: May 6, 2024.
9.8 Contractor Notification: May 8, 2024

ATTACHMENT A
[BID FORM]

TOWN OF WEATHERSFIELD, VERMONT
BID FORM

Bridge Superstructure Replacement
Bridge #63 - Ascutney Basin Road
Perkinsville (Weathersfield), VT

Instructions: Please fill out this bid form in its entirety.

Bidders Name: _____

Address: _____

Email Address: _____

Phone Number: _____

Please list three similar projects your company has completed

1.

2.

3.

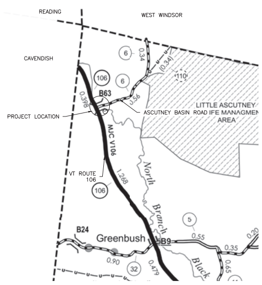
Lump Sum Project Bid	$ _____
Estimated date that all submittals can be completed and transmitted to Owner:	_____
Estimated Project Construction Start Date:	_____
Estimated Project Completion Date:	_____

In developing this Bid, I have followed all instructions set forth by the Town of Weathersfield and hereby certify that the work to be performed will fully conform to conditions stipulated as part of the Town's request for bids. I have read the bid documents, the Answers to questions, changes, notes & addenda emailed to plan holders and agree to adhere to all of the provisions. The bid price includes any and all administrative & fuel costs.

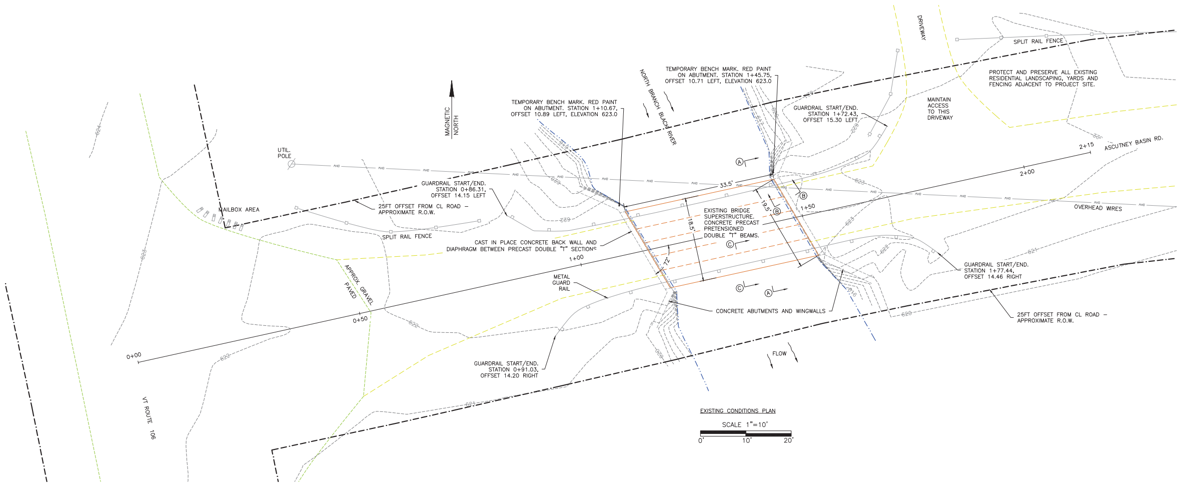
Furthermore, I certify that the price in this bid has been arrived at independently without collusion, consultation, communication, or agreement, for the purpose of restricting competition, as to any matter relating to such price with any other bidder or with any competitor.

Signature of bidder: _____ Date: _____

ATTACHMENT B
[CONSTRUCTION PRELIMINARY PLANS (SO1, SO2, AND SO3)]



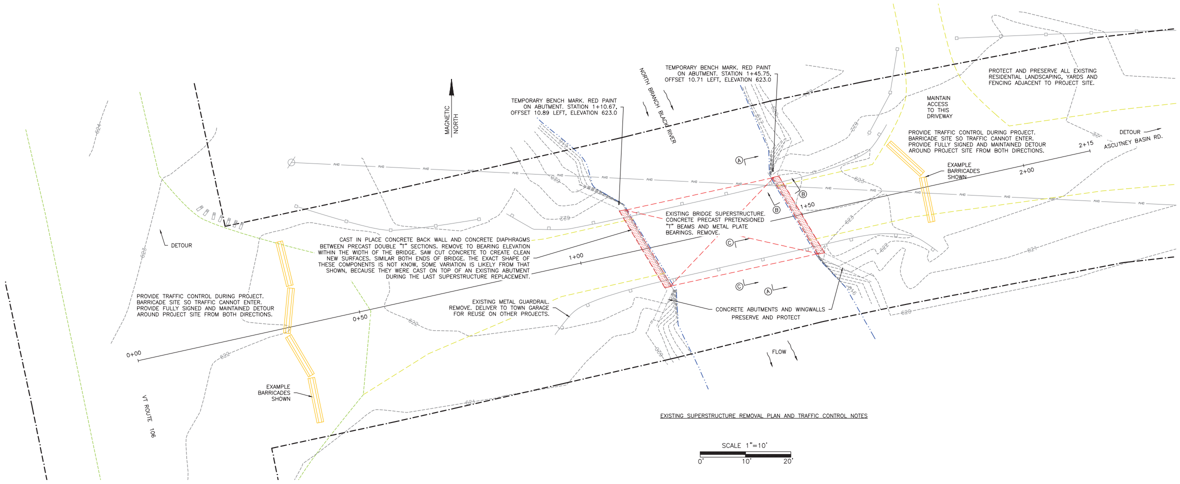
PROJECT LOCATION – NTS


MAGNETIC NORTH
NORTH BRANCH BLACK RIVER
TEMPORARY BENCH MARK, RED PAINT ON ABUTMENT, STATION 1+10.67, OFFSET 10.89 LEFT, ELEVATION 623.0
TEMPORARY BENCH MARK, RED PAINT ON ABUTMENT, STATION 1+45.75, OFFSET 10.71 LEFT, ELEVATION 623.0
GUARDRAIL START/END, STATION 1+72.43, OFFSET 15.30 LEFT
DRIVEWAY
SPLIT RAIL FENCE
PROTECT AND PRESERVE ALL EXISTING RESIDENTIAL LANDSCAPING, YARDS AND FENCING ADJACENT TO PROJECT SITE.
MAINTAIN ACCESS TO THIS DRIVEWAY
UTIL. POLE
GUARDRAIL START/END, STATION 0+86.31, OFFSET 14.15 LEFT
25FT OFFSET FROM CL ROAD – APPROXIMATE R.O.W.
MAILBOX AREA
SPLIT RAIL FENCE
EXISTING BRIDGE SUPERSTRUCTURE. CONCRETE PRECAST PRETENSIONED DOUBLE "T" BEAMS.
CAST IN PLACE CONCRETE BACK WALL AND DIAPHRAGM BETWEEN PRECAST DOUBLE "T" SECTIONS
ASCUTNEY BASIN RD.
OVERHEAD WIRES
GUARDRAIL START/END, STATION 1+77.44, OFFSET 14.46 RIGHT
25FT OFFSET FROM CL ROAD – APPROXIMATE R.O.W.
METAL GUARD RAIL
CONCRETE ABUTMENTS AND WINGWALLS
APPROX. GRAVEL PAVED
GUARDRAIL START/END, STATION 0+91.03, OFFSET 14.20 RIGHT
FLOW
VT ROUTE 106
0+00
0+50
1+00
1+50
2+00
2+15

EXISTING CONDITIONS PLAN

SCALE 1"=10'

0' 10' 20'


MAGNETIC NORTH
NORTH BRANCH BLACK RIVER
TEMPORARY BENCH MARK, RED PAINT ON ABUTMENT, STATION 1+10.67, OFFSET 10.89 LEFT, ELEVATION 623.0
TEMPORARY BENCH MARK, RED PAINT ON ABUTMENT, STATION 1+45.75, OFFSET 10.71 LEFT, ELEVATION 623.0
PROTECT AND PRESERVE ALL EXISTING RESIDENTIAL LANDSCAPING, YARDS AND FENCING ADJACENT TO PROJECT SITE.
MAINTAIN ACCESS TO THIS DRIVEWAY
PROVIDE TRAFFIC CONTROL DURING PROJECT. BARRICADE SITE SO TRAFFIC CANNOT ENTER. PROVIDE FULLY SIGNED AND MAINTAINED DETOUR AROUND PROJECT SITE FROM BOTH DIRECTIONS.
DETOUR
ASCUTNEY BASIN RD.
EXAMPLE BARRICADES SHOWN
EXISTING BRIDGE SUPERSTRUCTURE CONCRETE PRECAST PRETENSIONED "T" BEAMS AND METAL PLATE BEARINGS. REMOVE.
CAST IN PLACE CONCRETE BACK WALL AND CONCRETE DIAPHRAGMS BETWEEN PRECAST DOUBLE "T" SECTIONS. REMOVE TO BEARING ELEVATION WITHIN THE WIDTH OF THE BRIDGE. SAW CUT CONCRETE TO CREATE CLEAN NEW SURFACES. SIMILAR BOTH ENDS OF BRIDGE. THE EXACT SHAPE OF THESE COMPONENTS IS NOT KNOW, SOME VARIATION IS LIKELY FROM THAT SHOWN, BECAUSE THEY WERE CAST ON TOP OF AN EXISTING ABUTMENT DURING THE LAST SUPERSTRUCTURE REPLACEMENT.
DETOUR
PROVIDE TRAFFIC CONTROL DURING PROJECT. BARRICADE SITE SO TRAFFIC CANNOT ENTER. PROVIDE FULLY SIGNED AND MAINTAINED DETOUR AROUND PROJECT SITE FROM BOTH DIRECTIONS.
EXISTING METAL GUARDRAIL. REMOVE, DELIVER TO TOWN GARAGE FOR REUSE ON OTHER PROJECTS.
CONCRETE ABUTMENTS AND WINGWALLS PRESERVE AND PROTECT
FLOW
EXAMPLE BARRICADES SHOWN
VT ROUTE 106
0+00
0+50
1+00
1+50
2+00
2+15

EXISTING SUPERSTRUCTURE REMOVAL PLAN AND TRAFFIC CONTROL NOTES

SCALE 1"=10'

0' 10' 20'

DRAWING KEY GENERAL

EXISTING

- PAVED ROAD
- GRAVEL ROAD
- BRIDGE SUPERSTRUCTURE
- STREAM/RIVER
- GROUND CONTOURS
- 25FT OFFSET FROM CL ROAD – APPROXIMATE R.O.W.
- METAL GUARDRAIL
- OVERHEAD POWER LINE

PROPOSED

- DEMO / ITEMS TO BE REMOVED OR MODIFIED
- BRIDGE SUPERSTRUCTURE
- LIMITS OF PAVING – NEW/ADDITIONAL
- METAL GUARDRAIL

Heritage Engineering, P.C.
P.O. Box 255
7290 VT Route 131, Suite 4A
Perkinsville, VT 05151
Ph/Fax (802) 263-5400
heritageengineering@tds.net
www.heritageengineeringvt.com

HERITAGE ENGINEERING
PROFESSIONAL ENGINEERING DESIGN · PERMITTING
CONSTRUCTION ENGINEERING · STORMWATER · SEPTIC DESIGN

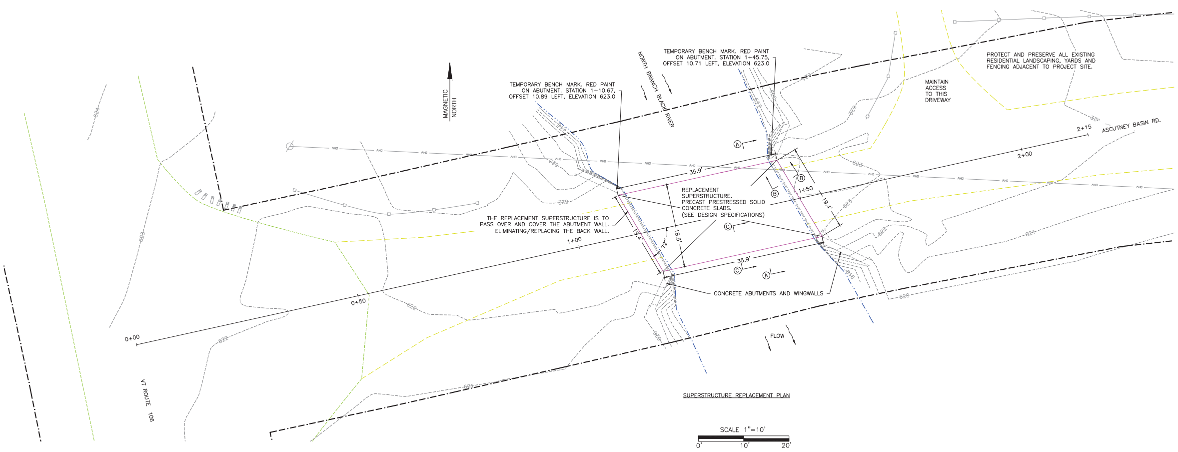
DRAFT

NO.	DATE	DESCRIPTION	BY

NOT FOR CONSTRUCTION – PRELIMINARY PLANS

BRIDGE SUPERSTRUCTURE REPLACEMENT
TOWN HIGHWAY #6 - ASCUTNEY BASIN ROAD
TOWN OF WEATHERSFIELD VT
BRIDGE #63

DRAWN BY: DTH	
DESIGNED BY: DTH	
PROJECT NUMBER 2021-25	
SCALE: AS SHOWN	DATE: 06-27-2023
DRAWING NO: **S01**	
SHEET: 1	OF: 3



TEMPORARY BENCH MARK. RED PAINT ON ABUTMENT. STATION 1+10.67, OFFSET 10.89 LEFT, ELEVATION 623.0
TEMPORARY BENCH MARK. RED PAINT ON ABUTMENT. STATION 1+45.75, OFFSET 10.71 LEFT, ELEVATION 623.0
NORTH BRANCH BLACK RIVER
MAGNETIC NORTH
PROTECT AND PRESERVE ALL EXISTING RESIDENTIAL LANDSCAPING, YARDS AND FENCING ADJACENT TO PROJECT SITE.
MAINTAIN ACCESS TO THIS DRIVEWAY
ASCUTNEY BASIN RD.
REPLACEMENT SUPERSTRUCTURE. PRECAST PRESTRESSED SOLID CONCRETE SLABS. (SEE DESIGN SPECIFICATIONS)
THE REPLACEMENT SUPERSTRUCTURE IS TO PASS OVER AND COVER THE ABUTMENT WALL. ELIMINATING/REPLACING THE BACK WALL.
CONCRETE ABUTMENTS AND WINGWALLS
FLOW
VT ROUTE 106
0+00
0+50
1+00
1+50
2+00
2+15
35.9'
18.5'

SUPERSTRUCTURE REPLACEMENT PLAN

SCALE 1"=10'

0' 10' 20'

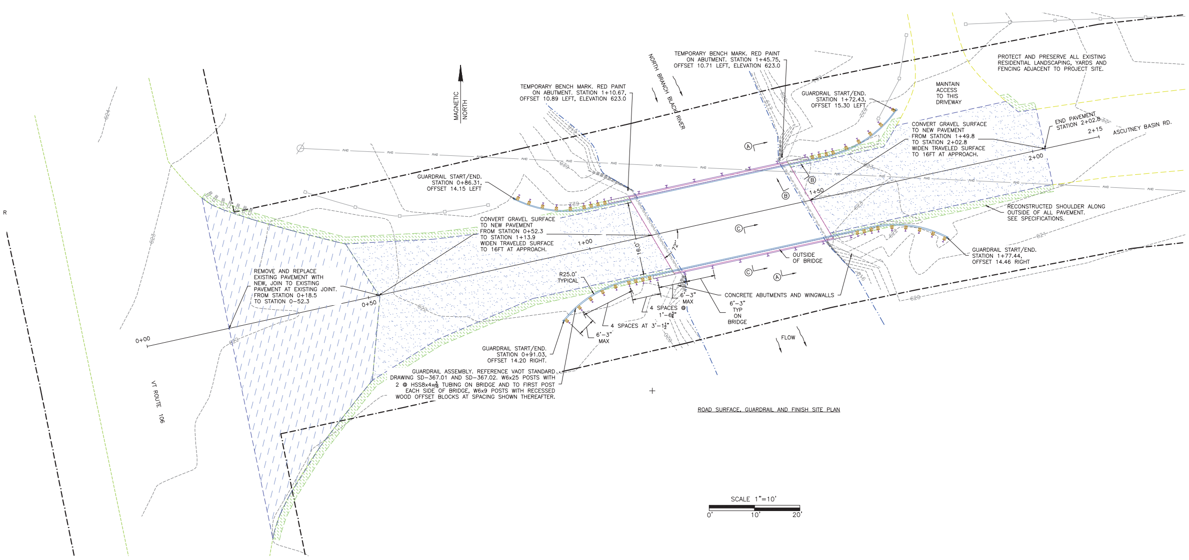
DRAWING KEY GENERAL

EXISTING

PAVED ROAD
GRAVEL ROAD
BRIDGE SUPERSTRUCTURE
STREAM/RIVER
GROUND CONTOURS
25FT OFFSET FROM CL ROAD – APPROXIMATE R
METAL GUARDRAIL
OVERHEAD POWER LINE

PROPOSED

DEMO / ITEMS TO BE REMOVED OR MODIFIED
BRIDGE SUPERSTRUCTURE
LIMITS OF PAVING – NEW/ADDITIONAL
METAL GUARDRAIL



TEMPORARY BENCH MARK. RED PAINT ON ABUTMENT. STATION 1+10.67, OFFSET 10.89 LEFT, ELEVATION 623.0
TEMPORARY BENCH MARK. RED PAINT ON ABUTMENT. STATION 1+45.75, OFFSET 10.71 LEFT, ELEVATION 623.0
NORTH BRANCH BLACK RIVER
MAGNETIC NORTH
PROTECT AND PRESERVE ALL EXISTING RESIDENTIAL LANDSCAPING, YARDS AND FENCING ADJACENT TO PROJECT SITE.
MAINTAIN ACCESS TO THIS DRIVEWAY
GUARDRAIL START/END. STATION 1+72.43, OFFSET 15.30 LEFT
END PAVEMENT STATION 2+02.8
CONVERT GRAVEL SURFACE TO NEW PAVEMENT FROM STATION 1+49.8 TO STATION 2+02.8 WIDEN TRAVELED SURFACE TO 16FT AT APPROACH.
ASCUTNEY BASIN RD.
GUARDRAIL START/END. STATION 0+86.31, OFFSET 14.15 LEFT
CONVERT GRAVEL SURFACE TO NEW PAVEMENT FROM STATION 0+52.3 TO STATION 1+13.9 WIDEN TRAVELED SURFACE TO 16FT AT APPROACH.
RECONSTRUCTED SHOULDER ALONG OUTSIDE OF ALL PAVEMENT. SEE SPECIFICATIONS.
REMOVE AND REPLACE EXISTING PAVEMENT WITH NEW. JOIN TO EXISTING PAVEMENT AT EXISTING JOINT. FROM STATION 0+18.5 TO STATION 0-52.3
R25.0' TYPICAL
OUTSIDE OF BRIDGE
GUARDRAIL START/END. STATION 1+77.44, OFFSET 14.46 RIGHT
6'-3" MAX
4 SPACES @ 1'-6½"
4'-5" TYP ON BRIDGE
CONCRETE ABUTMENTS AND WINGWALLS
4 SPACES AT 3'-1½"
6'-3" MAX
FLOW
GUARDRAIL START/END. STATION 0+91.03, OFFSET 14.20 RIGHT.
GUARDRAIL ASSEMBLY. REFERENCE VAOT STANDARD DRAWING SD-367.01 AND SD-367.02. W6x25 POSTS WITH 2 @ HSS8x4x¼ TUBING ON BRIDGE AND TO FIRST POST EACH SIDE OF BRIDGE. W6x9 POSTS WITH RECESSED WOOD OFFSET BLOCKS AT SPACING SHOWN THEREAFTER.
VT ROUTE 106
0+00
0+50
1+00
1+50
2+00
2+15

ROAD SURFACE, GUARDRAIL AND FINISH SITE PLAN

SCALE 1"=10'

0' 10' 20'

REFERENCE SCALE OF ORIGINAL PAPER

NOT FOR CONSTRUCTION – PRELIMINARY PLANS

Heritage Engineering, P.C.
P.O. Box 255
7290 VT Route 131, Suite 4A
Perkinsville, VT 05151
Ph/Fax (802) 263-5400
heritageengineering@tds.net
www.heritageengineeringvt.com

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PROFESSIONAL ENGINEERING DESIGN · PERMITTING
CONSTRUCTION ENGINEERING · STORMWATER · SEPTIC DESIGN

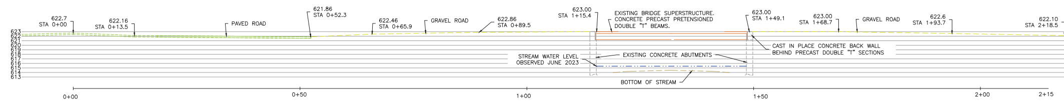
DRAFT

NO.	DATE	DESCRIPTION	BY

BRIDGE SUPERSTRUCTURE REPLACEMENT
TOWN HIGHWAY #6 - ASCUTNEY BASIN ROAD

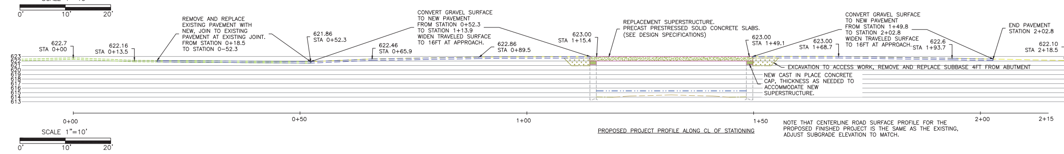
TOWN OF WEATHERSFIELD VT
BRIDGE #63

DRAWN BY: DTH	
DESIGNED BY: DTH	
PROJECT NUMBER: 2021-25	
SCALE: AS SHOWN	DATE: 06-27-2023
DRAWING NO: S02	
SHEET: 2	OF: 3



622.7
STA 0+00
622.16
STA 0+13.5
PAVED ROAD
621.86
STA 0+52.3
622.46
STA 0+65.9
GRAVEL ROAD
622.86
STA 0+89.5
623.00
STA 1+15.4
EXISTING BRIDGE SUPERSTRUCTURE. CONCRETE PRECAST PRETENSIONED DOUBLE "T" BEAMS.
623.00
STA 1+49.1
623.00
STA 1+68.7
GRAVEL ROAD
622.6
STA 1+93.7
622.10
STA 2+18.5
CAST IN PLACE CONCRETE BACK WALL BEHIND PRECAST DOUBLE "T" SECTIONS
STREAM WATER LEVEL OBSERVED JUNE 2023
EXISTING CONCRETE ABUTMENTS
BOTTOM OF STREAM
0+00
0+50
1+00
1+50
2+00
2+15
SCALE 1"=10'

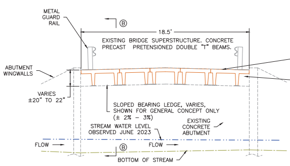
EXISTING PROJECT PROFILE ALONG CL OF STATIONING



REMOVE AND REPLACE EXISTING PAVEMENT WITH NEW, JOIN TO EXISTING PAVEMENT AT EXISTING JOINT. FROM STATION 0+18.5 TO STATION 0–52.3
CONVERT GRAVEL SURFACE TO NEW PAVEMENT FROM STATION 0+52.3 TO STATION 1+13.9 WIDEN TRAVELED SURFACE TO 16FT AT APPROACH.
REPLACEMENT SUPERSTRUCTURE. PRECAST PRESTRESSED SOLID CONCRETE SLABS. (SEE DESIGN SPECIFICATIONS)
CONVERT GRAVEL SURFACE TO NEW PAVEMENT FROM STATION 1+49.8 TO STATION 2+02.8 WIDEN TRAVELED SURFACE TO 16FT AT APPROACH.
END PAVEMENT STATION 2+02.8
622.7
STA 0+00
622.16
STA 0+13.5
621.86
STA 0+52.3
622.46
STA 0+65.9
622.86
STA 0+89.5
623.00
STA 1+15.4
623.00
STA 1+49.1
623.00
STA 1+68.7
622.6
STA 1+93.7
622.10
STA 2+18.5
EXCAVATION TO ACCESS WORK, REMOVE AND REPLACE SUBBASE 4FT FROM ABUTMENT
NEW CAST IN PLACE CONCRETE CAP, THICKNESS AS NEEDED TO ACCOMMODATE NEW SUPERSTRUCTURE.
0+00
0+50
1+00
1+50
2+00
2+15
SCALE 1"=10'

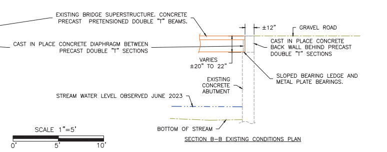
PROPOSED PROJECT PROFILE ALONG CL OF STATIONING

NOTE THAT CENTERLINE ROAD SURFACE PROFILE FOR THE PROPOSED FINISHED PROJECT IS THE SAME AS THE EXISTING, ADJUST SUBGRADE ELEVATION TO MATCH.



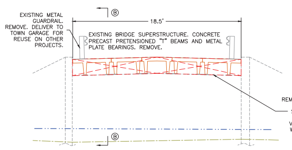
METAL GUARD RAIL
18.5'
EXISTING BRIDGE SUPERSTRUCTURE. CONCRETE PRECAST PRETENSIONED DOUBLE "T" BEAMS.
ABUTMENT WINGWALLS
VARIES ±20" TO 22"
SLOPED BEARING LEDGE, VARIES, SHOWN FOR GENERAL CONCEPT ONLY (± 2% – 3%)
STREAM WATER LEVEL OBSERVED JUNE 2023
EXISTING CONCRETE ABUTMENT
FLOW
FLOW
BOTTOM OF STREAM

SECTION A–A EXISTING CONDITIONS PLAN

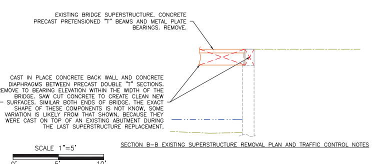


EXISTING BRIDGE SUPERSTRUCTURE. CONCRETE PRECAST PRETENSIONED DOUBLE "T" BEAMS.
CAST IN PLACE CONCRETE DIAPHRAGM BETWEEN PRECAST DOUBLE "T" SECTIONS
±12"
GRAVEL ROAD
CAST IN PLACE CONCRETE BACK WALL BEHIND PRECAST DOUBLE "T" SECTIONS
VARIES ±20" TO 22"
EXISTING CONCRETE ABUTMENT
SLOPED BEARING LEDGE AND METAL PLATE BEARINGS.
STREAM WATER LEVEL OBSERVED JUNE 2023
BOTTOM OF STREAM
SCALE 1"=5'

SECTION B–B EXISTING CONDITIONS PLAN

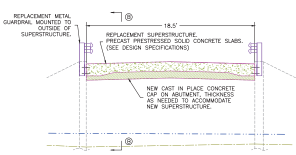


SECTION A–A EXISTING SUPERSTRUCTURE REMOVAL PLAN AND TRAFFIC CONTROL NOTES



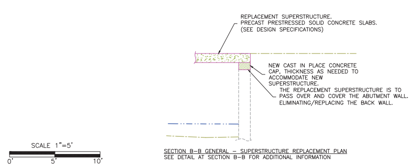
EXISTING BRIDGE SUPERSTRUCTURE. CONCRETE PRECAST PRETENSIONED "T" BEAMS AND METAL PLATE BEARINGS. REMOVE.
CAST IN PLACE CONCRETE BACK WALL AND CONCRETE DIAPHRAGMS BETWEEN PRECAST DOUBLE "T" SECTIONS. REMOVE TO BEARING ELEVATION WITHIN THE WIDTH OF THE BRIDGE. SAW CUT CONCRETE TO CREATE CLEAN NEW SURFACES. SIMILAR BOTH ENDS OF BRIDGE. THE EXACT SHAPE OF THESE COMPONENTS IS NOT KNOW, SOME VARIATION IS LIKELY FROM THAT SHOWN, BECAUSE THEY WERE CAST ON TOP OF AN EXISTING ABUTMENT DURING THE LAST SUPERSTRUCTURE REPLACEMENT.
SCALE 1"=5'

SECTION B–B EXISTING SUPERSTRUCTURE REMOVAL PLAN AND TRAFFIC CONTROL NOTES



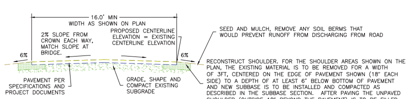
REPLACEMENT METAL GUARDRAIL MOUNTED TO OUTSIDE OF SUPERSTRUCTURE.
18.5'
REPLACEMENT SUPERSTRUCTURE. PRECAST PRESTRESSED SOLID CONCRETE SLABS. (SEE DESIGN SPECIFICATIONS)
NEW CAST IN PLACE CONCRETE CAP ON ABUTMENT, THICKNESS AS NEEDED TO ACCOMMODATE NEW SUPERSTRUCTURE.
SCALE 1"=5'

SECTION A–A SUPERSTRUCTURE REPLACEMENT PLAN



REPLACEMENT SUPERSTRUCTURE. PRECAST PRESTRESSED SOLID CONCRETE SLABS. (SEE DESIGN SPECIFICATIONS)
NEW CAST IN PLACE CONCRETE CAP, THICKNESS AS NEEDED TO ACCOMMODATE NEW SUPERSTRUCTURE.
THE REPLACEMENT SUPERSTRUCTURE IS TO PASS OVER AND COVER THE ABUTMENT WALL. ELIMINATING/REPLACING THE BACK WALL.

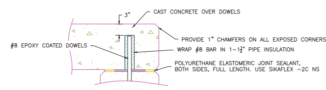
SECTION B–B GENERAL – SUPERSTRUCTURE REPLACEMENT PLAN
SEE DETAIL AT SECTION B–B FOR ADDITIONAL INFORMATION



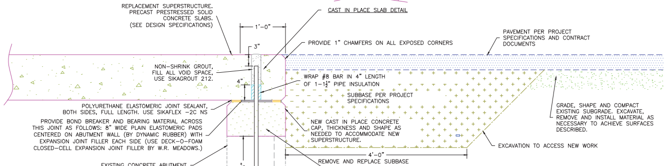
16.0' MIN
WIDTH AS SHOWN ON PLAN
2% SLOPE FROM CROWN EACH WAY, MATCH SLOPE AT BRIDGE.
PROPOSED CENTERLINE ELEVATION = EXISTING CENTERLINE ELEVATION
6%
6%
PAVEMENT PER SPECIFICATIONS AND PROJECT DOCUMENTS
GRADE, SHAPE AND COMPACT EXISTING SUBGRADE
SEED AND MULCH, REMOVE ANY SOIL BERMS THAT WOULD PREVENT RUNOFF FROM DISCHARGING FROM ROAD
RECONSTRUCT SHOULDER. FOR THE SHOULDER AREAS SHOWN ON THE PLAN, THE EXISTING MATERIAL IS TO BE REMOVED FOR A WIDTH OF 3FT, CENTERED ON THE EDGE OF PAVEMENT SHOWN (18" EACH SIDE) TO A DEPTH OF AT LEAST 6" BELOW BOTTOM OF PAVEMENT AND NEW SUBBASE IS TO BE INSTALLED AND COMPACTED AS DESCRIBED IN THE SUBBASE SECTION. AFTER PAVING THE UNPAVED SHOULDER (OUTSIDE 18" BEYOND THE PAVEMENT) IS TO BE FILLED WITH SUBBASE AND GRADED TO MATCH THE PAVEMENT EDGE.

TYPICAL PROPOSED ROAD CROSS SECTION

EXCAVATE, REMOVE AND INSTALL MATERIAL AS NECESSARY, GRADE AND COMPACT TO ACHIEVE SLOPED SURFACES SHOWN. WARP CROWN TO MATCH EXISTING PAVEMENT AND EXISTING ROAD SURFACES AT EACH END.

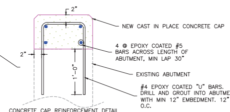


CAST IN PLACE SLAB DETAIL

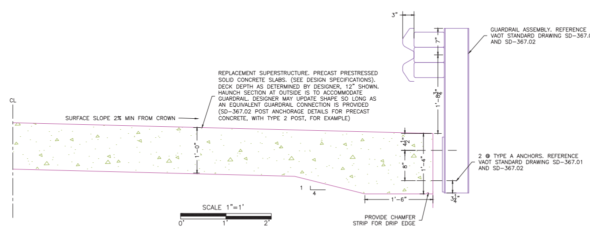


REPLACEMENT SUPERSTRUCTURE. PRECAST PRESTRESSED SOLID CONCRETE SLABS. (SEE DESIGN SPECIFICATIONS)
1'-0"
3"
PROVIDE 1" CHAMFERS ON ALL EXPOSED CORNERS
PAVEMENT PER PROJECT SPECIFICATIONS AND CONTRACT DOCUMENTS
NON–SHRINK GROUT, FILL ALL VOID SPACE, USE SIKAGROUT 212.
4"
WRAP #8 BAR IN 4" LENGTH OF 1–1½" PIPE INSULATION
SUBBASE PER PROJECT SPECIFICATIONS
POLYURETHANE ELASTOMERIC JOINT SEALANT, BOTH SIDES, FULL LENGTH. USE SIKAFLEX –2C NS
PROVIDE BOND BREAKER AND BEARING MATERIAL ACROSS THIS JOINT AS FOLLOWS: 8" WIDE PLAIN ELASTOMERIC PADS CENTERED ON ABUTMENT WALL (BY DYNAMIC RUBBER) WITH EXPANSION JOINT FILLER EACH SIDE (USE DECK–O–FOAM CLOSED–CELL EXPANSION JOINT FILLER BY W.R. MEADOWS.)
NEW CAST IN PLACE CONCRETE CAP, THICKNESS AND SHAPE AS NEEDED TO ACCOMMODATE NEW SUPERSTRUCTURE.
GRADE, SHAPE AND COMPACT EXISTING SUBGRADE. EXCAVATE, REMOVE AND INSTALL MATERIAL AS NECESSARY TO ACHIEVE SURFACES DESCRIBED.
EXCAVATION TO ACCESS NEW WORK
EXISTING CONCRETE ABUTMENT
4'-0"
REMOVE AND REPLACE SUBBASE
1'-6"
#8 EPOXY COATED DOWELS. DRILL AND GROUT INTO ABUTMENT WITH MIN 18" EMBEDMENT. 24" O.C. WRAP UPPER SECTION THAT IS WITHIN SLAB WITH PIPE INSULATION. USE 30" LONG DOWEL.
EXISTING CONCRETE ABUTMENT WALL, BACK OF WALL MAY VARY, ADJUST CAST IN PLACE CONCRETE CAP AS NEEDED TO MATCH.
SCALE 1"=1'

DETAIL AT SECTION B–B



CONCRETE CAP REINFORCEMENT DETAIL



3"
GUARDRAIL ASSEMBLY. REFERENCE VAOT STANDARD DRAWING SD–367.01 AND SD–367.02
REPLACEMENT SUPERSTRUCTURE. PRECAST PRESTRESSED SOLID CONCRETE SLABS. (SEE DESIGN SPECIFICATIONS). DECK DEPTH AS DETERMINED BY DESIGNER, 12" SHOWN. HAUNCH SECTION AT OUTSIDE IS TO ACCOMMODATE GUARDRAIL. DESIGNER MAY UPDATE SHAPE SO LONG AS AN EQUIVALENT GUARDRAIL CONNECTION IS PROVIDED (SD–367.02 POST ANCHORAGE DETAILS FOR PRECAST CONCRETE, WITH TYPE 2 POST, FOR EXAMPLE)
CL
SURFACE SLOPE 2% MIN FROM CROWN
1'-0"
7"
1'-8¾"
4½"
8"
1'-4"
2 @ TYPE A ANCHORS. REFERENCE VAOT STANDARD DRAWING SD–367.01 AND SD–367.02
1
4
1'-6"
3¼"
PROVIDE CHAMFER STRIP FOR DRIP EDGE
SCALE 1"=1'

SECTION C–C

NOT FOR CONSTRUCTION – PRELIMINARY PLANS

Heritage Engineering, P.C.
P.O. Box 255
7290 VT Route 131, Suite 4A
Perkinsville, VT 05151
Ph/Fax (802) 263-5400
heritageengineering@tds.net
www.heritageengineeringvt.com

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CONSTRUCTION ENGINEERING · STORMWATER · SEPTIC DESIGN

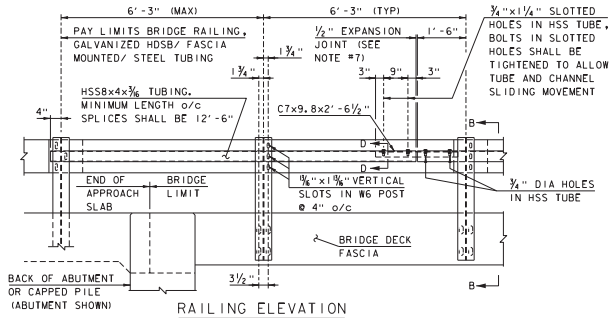
DRAFT

NO.	DATE	DESCRIPTION	BY

BRIDGE SUPERSTRUCTURE REPLACEMENT
TOWN HIGHWAY #6 - ASCUTNEY BASIN ROAD
TOWN OF WEATHERSFIELD VT
BRIDGE #63

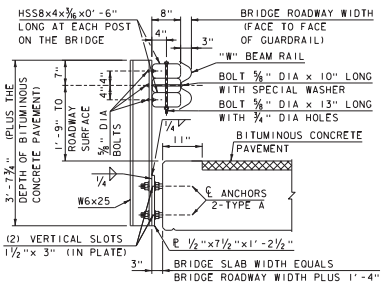
DRAWN BY: DTH	
DESIGNED BY: DTH	
PROJECT NUMBER: 2021-25	
SCALE: AS SHOWN	DATE: 06-27-2023
DRAWING NO: **S03**	
SHEET: 3	OF: 3

ATTACHMENT C
[SD 367.01 & 367.02]



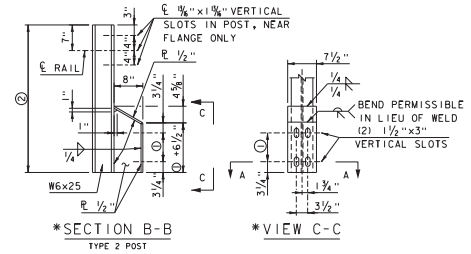
RAILING ELEVATION

(TYPE I POSTS SHOWN)



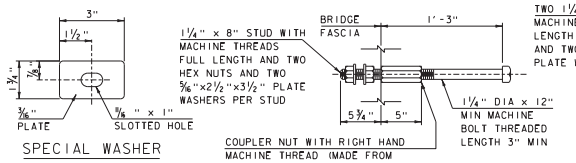
SECTION B-B

TYPE I POST



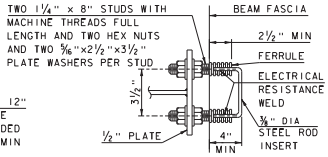
*FOR USE WITH PRESTRESSED CONCRETE BOX BEAMS:

DIMENSION ① IS 6" OR 8" DEPENDING ON BOX BEAM DEPTH. SEE PROJECT PLANS AND POST ANCHORAGE DETAILS. DIMENSION ② DETAILED BY FABRICATOR, SEE PROFILE AND CAMBER DETAILS. MINIMUM POST LENGTH IS 3'-6½" AND MAXIMUM POST LENGTH IS 4'-1¼".



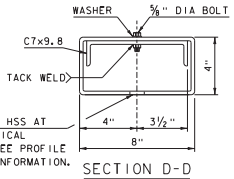
SPECIAL WASHER

PLACE WASHER BETWEEN BOLT HEAD AND FACE OF RAIL.



SECTION A-A

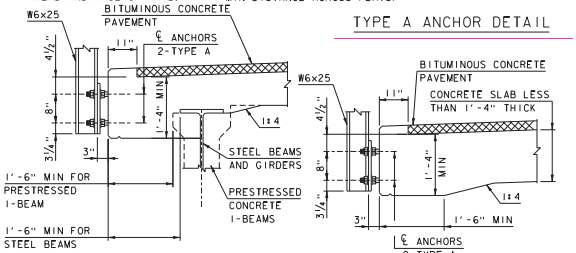
TYPE B ANCHOR DETAIL



1" DIA DRAIN HOLE (ONLY IN HSS AT LOWEST POINT WHEN SAG VERTICAL CURVES ARE ENCOUNTERED). SEE PROFILE SHEET FOR VERTICAL CURVE INFORMATION.

SECTION D-D

TYPE A ANCHOR DETAIL



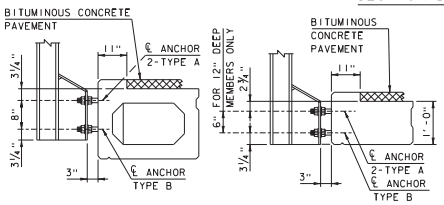
LONGITUDINAL BEAM BRIDGES

CONCRETE SLABS

(EDGE BEAM SHOWN)

POST ANCHORAGE DETAILS

(NOT FOR USE WITH PRESTRESSED BOX BEAMS)



POST ANCHORAGE DETAILS (PRECAST CONCRETE)

NOTES:

1. ALL WORK AND MATERIALS SHALL CONFORM TO SECTION 525.
2. PRIOR TO GALVANIZING THE ASSEMBLED POST, GRIND ALL EDGES TO A MINIMUM RADIUS OF 1/16".
3. ALL POSTS SHALL BE SET NORMAL TO GRADE.
4. SPLICES FOR THE STEEL BEAM GUARDRAIL SHALL LAP IN THE DIRECTION OF TRAFFIC.
5. A RAILING JOINT SPLICE SHALL BE PROVIDED IN ANY RAIL BAY SPANNING THE END OF AN INTEGRAL ABUTMENT BRIDGE AND AT ALL SUPERSTRUCTURE EXPANSION JOINTS.
6. SEE STANDARD DRAWING G-1FOR DETAILS OF DELINEATORS. A DELINEATOR SHALL BE INSTALLED AT 30 FOOT SPACING OR THE NEAREST POST. WHITE IS TO BE INSTALLED ON THE DRIVER'S RIGHT. FOR ONE WAY BRIDGES, YELLOW IS TO BE INSTALLED ON THE DRIVER'S LEFT
7. THE ½" EXPANSION JOINT SHOWN IN THE RAILING ELEVATION IS DESIGNED FOR BRIDGE LENGTHS UP TO 80 FEET. ANY LONGER SPANS WILL HAVE TO BE MODIFIED TO ACCOUNT FOR THEIR MOVEMENT.
8. FOR RADII LESS THAN 950 FEET, HSS8×4 TUBES SHALL BE SHOP BENT TO FIT THE APPLICABLE CURVE.
9. THE MINIMUM DISTANCE FROM THE LAST POST TO THE END OF SLAB IS 1'-6".
10. FERRULES SHALL BE 12L14 COLD DRAWN CARBON STEEL.
11. HOLES IN RAIL FOR RAIL TUBE ATTACHMENT MAY BE FIELD DRILLED. HOLES SHALL BE COATED WITH AN APPROVED ZINC-RICH PAINT PRIOR TO INSTALLATION.
12. THIS RAILING HAS NOT BEEN DESIGNED TO CURRENT LOADING REQUIREMENTS OR ANALYZED TO CURRENT CRASH TEST STANDARDS.
13. THIS RAILING MAY ONLY BE USED ON BRIDGES MEETING THE FOLLOWING REQUIREMENTS;
    - i. THE STRUCTURE IS NOT ON THE NATIONAL HIGHWAY SYSTEM OR THE VERMONT STATE HIGHWAY SYSTEM.
    - ii. THE STRUCTURE REQUIRES A TL-2 SERVICE LEVEL, OR LESS, PER THE VTRANS STRUCTURES DESIGN MANUAL.
    - iii. THE ROADWAY HAS A DESIGN SPEED OF 30 MPH OR LESS
    - iv. THE ROADWAY HAS AN ADT OF 600 VEHICLES OR LESS.

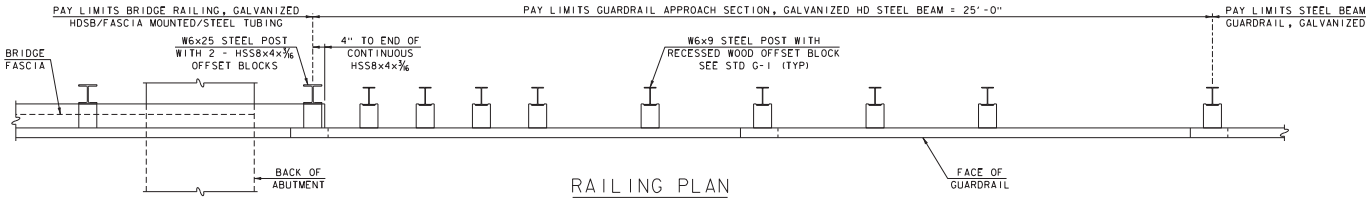
REVISIONS	
MARCH 23, 2023	ORIGINAL APPROVAL
OTHER STANDARDS REQUIRED: G-1	

BRIDGE RAILING, GALVANIZED HDSB/ FASCIA MOUNTED/ STEEL TUBING

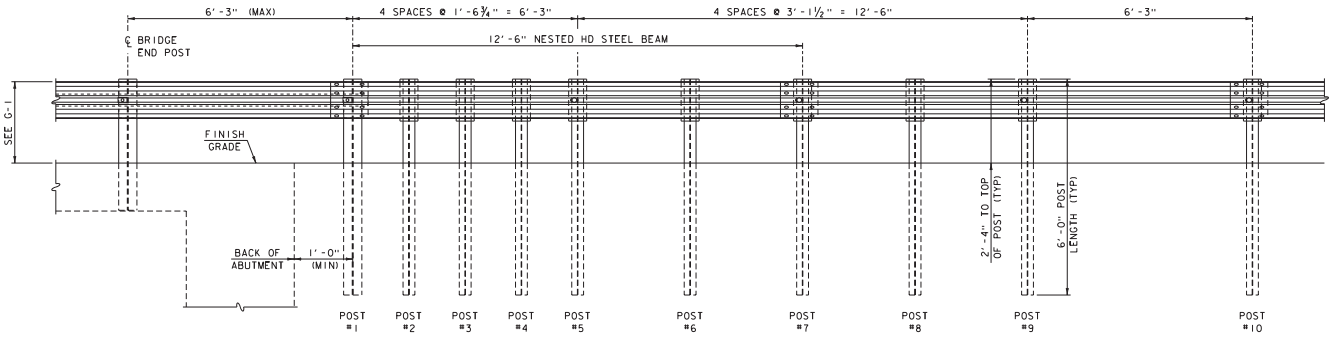
VERMONT AGENCY OF TRANSPORTATION — STRUCTURES SECTION

STRUCTURES DETAIL

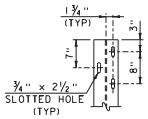
SD-367.01



RAILING PLAN



RAILING ELEVATION



POST #1 HOLE DETAIL

NOTES:

1. PAYMENT FOR POST #1, HSS8x4x3/16 OFFSET BLOCKS AND TUBULAR BACKUP RAIL EXTENDING TO POST #1 OFF THE BRIDGE SHALL BE MADE UNDER BRIDGE RAILING, GALVANIZED HDSB/FASCIA MOUNTED/STEEL TUBING.
2. BLOCKOUTS SHALL BE RECESSED WOOD ONLY. STEEL OR PLASTIC BLOCKOUTS ARE NOT PERMITTED.
3. GUARDRAIL IS NOT ATTACHED TO POST NUMBERS 2-4, 6 AND 8. THERE SHALL BE NO GAP BETWEEN THE POSTS THAT ARE NOT ATTACHED AND THE RAIL OFFSET BLOCKS SHALL BE ATTACHED TO POST WITH STANDARD POST BOLT.
4. POSTS MAY BE SET IN DRILLED HOLES OR DRIVEN TO GRADE.
5. THIS RAILING HAS NOT BEEN DESIGNED TO CURRENT LOADING REQUIREMENTS OR ANALYZED TO CURRENT CRASH TEST STANDARDS.
6. THIS RAILING MAY ONLY BE USED ON BRIDGES MEETING THE FOLLOWING REQUIREMENTS:
   i. THE STRUCTURE IS NOT ON THE NATIONAL HIGHWAY SYSTEM OR THE VERMONT STATE HIGHWAY SYSTEM.
   ii. THE STRUCTURE REQUIRES A TL-2 SERVICE LEVEL, OR LESS, PER THE VTRANS STRUCTURES DESIGN MANUAL.
   iii. THE ROADWAY HAS A DESIGN SPEED OF 30 MPH OR LESS
   iv. THE ROADWAY HAS AN ADT OF 600 VEHICLES OR LESS.

REVISIONS	
MARCH 23, 2023	ORIGINAL APPROVAL

OTHER DETAILS OR STANDARDS REQUIRED: SD-367.01 AND G-1

GUARDRAIL APPROACH SECTION, GALVANIZED HDSB/ FASCIA MOUNTED/ STEEL TUBING

VERMONT AGENCY OF TRANSPORTATION — STRUCTURES SECTION

STRUCTURES DETAIL

SD-367.02

ATTACHMENT D
[PAVING SCOPE OF WORK]

TOWN OF WEATHERSFIELD
Paving for Ascutney Basin Bridge Project

Project Description: See attached documents for dimensions.

Route	Begin MM	End MM	Total Miles	Road Width paved (ft.)	Estimated Ton
Ascutney Basin Bridge Aprons	0			0	
This project is to regrade and pave all marked areas on drawing #S02 with a base of ½" inch mix, 2.0"-inches in depth and to topcoat with ½" inch mix, 1.5" inches depth of Type III 75 Blow Marshall Bituminous Concrete Pavement or equivalent. Cut apron along route 106 and provide a lap joint. Pave driveway apron to 3' minimum length, backup entire roadside along newly paved area, driveway, and mailbox pullouts with shoulder gravel.					

Project Construction Specifications:

The provisions of the most recent version of the State of Vermont STANDARD SPECIFICATIONS FOR CONSTRUCTION to include all supplemental provisions and attachments, all contract documents specified, the most current version of MUTCD, and any other Federal, State, or Municipal applicable standards, policies and procedures shall apply to this contract.

Material items that may be included are:

1. Type III - 75 Blow Marshall bituminous concrete pavement (or equivalent) from a 2024 approved mix design and produced from a 2024 approved plant. Or equivalent
2. RS-1or RS-1H Emulsion containing current Type A and Type D certifications.
3. Shoulder/ driveway gravel

ATTACHMENT E
[PROJECT SPECIFICATIONS]

PROJECT SPECIFICATIONS
BRIDGE SUPERSTRUCTURE REPLACEMENT - BRIDGE #63 - ASCUTNEY BASIN ROAD

General Plan and Project Notes

- Design Drawings, Information Shown on the Plan and Project Information: The attached design drawings and project documents are intended to express the design intent of the project and to outline the general geometry of the structure and proposed work.
- All work shown on this plan is to be pursued in accordance with federal, state and local codes and laws.
- The contractors and individuals who work on this project shall be solely responsible for assuring that their work is in conformance with the plan, the specifications and applicable codes and regulations.
- The contractor should use the plans to accomplish the design intent and be prepared to make minor revisions to incorporate variations in the structures which will be encountered at the site. The dimensions of the existing structure are approximate. Contractor is to field measure and confirm geometry prior to the fabrication of items that will be delivered to the site. The exact shape of the cast in place concrete back walls and the concrete diaphragms between the precast double "T" sections are not known. Some variation is likely from that shown, as they were cast on top of an existing abutment during last superstructure replacement.
- If the contractor encounters existing conditions different than that shown, notify the Engineer to revise the plan and to provide approval for any proposed changes.
- In the event of a conflict or question the Engineer shall be contacted in writing immediately to resolve the issue. The owner and/or contractor shall not proceed with changes or substitutions unless approved by the Engineer in writing.
- All items to be installed in accordance with manufacturer's installation instructions, the project documents and the referenced codes and specifications. Substitutions of equivalent or better materials may be made with the Engineer's written approval. Plan drawings govern material selection. Where coating systems are applied (Primer and paint systems for example) the surface is to be prepared and the coating system applied as required by the manufacturer in their technical documents. Apply coating after fabrication is completed.
- Permits obtained for the project as of the date of construction are incorporated as a matter of record.
- The following specification is incorporated to these specifications when clarification or guidance is necessary for the project.:
    - Vermont Agency of Transportation - Vermont 2018 Standard Specifications for Construction.

Earthwork:

- The Contractor is to contact dig-safe prior to any excavation at the project site to check for and accommodate any subsurface utilities.
- For the small excavations that are to be completed at each approach area to the abutments and for the new swale, the contractor is to install and maintain erosion control measures so that no sediment laden stormwater leaves the site. Compostable filter socks are to be included within the new swale, of sufficient quantify and spacing, so that no sediment laden stormwater leaves the site. The erosion control measures are to be maintained by the Contractor until permanent vegetation is established.
- Reconstruct shoulder. For the shoulder areas shown on the plan, the existing material is to be removed for a width of 3ft, centered on the edge of pavement shown (18" each side) to a depth of at least 6" below bottom of pavement and new subbase is to be installed and compacted as described in the subbase section. After paving of the road the gravel shoulder (18" beyond the pavement) is to be filled with subbase and graded to match the pavement.

- Existing material at the bottom of any graded or excavated area (subgrade) which is below the improved work (below roads, shoulders, structures) is to be prepared by compactive effort to create an even and firm prepared surface suitable for placement of subbase. Any existing subbase material which does not appear to be at or near its maximum density shall be further compacted until it is.
- Subbase - Complete in accordance with Vtrans Standard Specifications Section 301 with materials per Section 704. This work shall consist of furnishing, placing, compacting and testing subbase on a prepared surface and for preparation of the surface below the subbase to receive this material. The material may be either subbase of gravel or subbase of crushed gravel. The subbase placement within the approach area of each abutment is critical to the long term performance of the pavement. The Contractor shall as part of this scope retain an independent testing company to complete the material testing, determine the maximum dry density of the subbase material with laboratory testing, complete the field density testing with nuclear density testing equipment during placement and to provide reports of this information to the Engineer and Owner. Compaction testing results must demonstrate that 95% of the maximum dry density has been achieved for the material placed. A record of both the materials used and the compaction testing completed shall be provided to the Engineer and Owner prior to placement of pavement on this project. Conduct and provide test results for at least 2 successful nuclear density tests for each lift of the subbase at each abutment. Conduct and provide test results for at least 4 successful nuclear density tests in the reconstructed shoulder areas beneath where the pavement will be placed. No payment will be made for subbase work and for pavement work installed over subbase that has not been tested and successfully passed those tests.
- Subbase alternate. The Contractor may use Controlled Density (Flowable) Fill for subbase.
- Payment for the required testing and reports is incidental to the earthwork and no additional payment will be made for the testing item.
- Seed and mulch all roadside disturbed areas adjacent to roadway. Any soil berm along the roadway shoulder that prevents the sheeting of water off the road must be removed.

<u>Structural Steel, Guardrail, Guardrail Assemblies, Bolts, Anchor Bolts, Anchor Rods:</u>

- Corrosion protection of the structural steel on this project is required. This steel is located outside in a severe exposure condition subject to regular wetting, freeze and thaw cycles and road salt application and other conditions unfavorable to steel.
  - The structural steel, guardrails, guardrail posts, guardrail assemblies, anchor bolts, bolts and all related hardware is to be hot-dip galvanized in accordance with the requirements of Vtrans sections 525, 714 and bridge railing drawings SD-367.01 and SD-367.02.
- Steel Materials:
  - The guardrails, guardrail posts, anchor bolts, bolts and all related hardware are to be provided and installed in accordance with the requirements of Vtrans sections 525, 714 and bridge railing drawings SD-367.01 and SD-367.02.

<u>Concrete:</u>

- Concrete is to be designed for durability as well as strength. The concrete is located outside in a severe exposure condition subject to regular wetting, freeze and thaw cycles, road salt application and other conditions unfavorable to concrete. Concrete is to be designed by the ready-mix supplier or the precast plant for these severe exposure conditions.
- Concrete that is not Prestressed Concrete is to conform to Section 501 – Performance Based Structural Concrete. Deck and Superstructure HPC Class PCD, min 28-day compressive strength 4,000psi. Substructure HPC Class PCS, min 28-day compressive strength 3,500psi.
  - The Contractor is to complete the work in conformance with all provisions of Section 501 except as modified herein.
  - The Contractor shall submit for review and approval:

        - The mix designs for the proposed concrete mixes per 501.03(a) and (b). The proposed mixes are to have already been approved for a Vtrans project within the last 24 months.
        - The information required within the attached BRIDGE SUPERSTRUCTURE DESIGN PERFORMANCE SPECIFICATION.
    - No concrete shall be placed until the mix design is approved by the Engineer.
    - The Contractor shall as part of this scope retain an independent testing company to complete the material testing for the concrete. A record of both the materials used and the testing completed shall be provided to the Engineer and Owner. The Contractor shall pay for testing, arrange for testing, schedule personnel, provide assistance, equipment, materials, and curing for field sampling and testing. Conduct and provide tests results per section 501.06 parts (b), (c), (f), (g), (h) for each concrete pour. No Trial Pour per part (a) of this section is required. This testing is required for all field placed concrete. No payment will be made for concrete work installed that has not been tested and successfully passed those tests. Payment for this work is incidental to the concrete work.
- Prestressed Concrete is to conform to Section 510 – Prestressed Concrete. The Contractor is to complete the work in conformance with all provisions of Section 510 except as modified herein.
    - The Contractor shall submit for review and approval:
        - Fabrication Drawings per section 510.04.
        - The mix designs for the proposed concrete mix per 510.04(a). The proposed mix is to have already been approved for a Vtrans project within the last 24 months.
        - The items listed in 510.04 (b)-(m) when not shown on the Fabrication Drawings.
        - The information required within the attached BRIDGE SUPERSTRUCTURE DESIGN PERFORMANCE SPECIFICATION.
    - No concrete shall be placed until the listed submittals have been approved.
    - The Contractor shall as part of this scope retain an independent testing company to complete the material testing for the concrete. A record of both the materials used and the testing completed shall be provided to the Engineer and Owner. The Contractor, in coordination with the Precast Plant shall pay for testing, arrange for testing, schedule personnel, provide assistance, equipment, materials, and curing for plant sampling and testing. Conduct and provide concrete tests results per section 510.05 (b) for each concrete pour at the plant. No payment will be made for concrete work installed that has not been tested and successfully passed those tests. Payment for this work is incidental to the concrete work.
- The Superstructure top surface includes as integral the Bridge Deck. Contractor is to comply with Bridge Deck requirements. Finish and texture top surface to meet the requirements of Bridge Decks with No Asphalt Wearing Surface 501.16(a)(2).
- Precast Concrete to conform to Section 540.
- Cast in place concrete and Controlled Density (Flowable) Fill to conform to Section 541.
- Elastomeric Bearing Pads are to conform to Section 531.
- Reinforcing steel: Yield strength 60,000psi. Epoxy coated reinforcement is required.
- Drill and bond dowels, drill and grout dowels, anchor bolts, threaded rod and rebar shall be anchored into existing concrete with either:
    - Simpson Strong-Tie Set-XP anchoring adhesive when the temperature is above 55 degrees for the entire epoxy curing period and AT-XP if the temperature is below 55 degrees.
    - SikaGrout 212.
- Provide 1.5” min concrete cover over reinforcement at interior exposed sections of concrete. Provide 2” min concrete cover over reinforcement at exterior exposed sections of concrete. Provide 3” concrete cover below reinforcing steel poured against the earth.
- Concrete curing for the deck surface shall continue for at least the first 14 days after the concrete is poured. Concrete curing for other concrete surfaces shall continue for at least the first 7 days after the concrete is poured. A longer duration is suggested if possible. Curing may be completed by maintaining a

wet concrete surface with burlap and sprinklers or with the use of a spray on curing compound. Spray on curing compound is suggested as the preferred method. Any curing compound residue shall be removed before application of grout, caulking, epoxy or other coating.

- Loading of the concrete shall not occur until it has reached its specified 28 day compressive strength.
- Where new concrete joins existing concrete or bedrock the existing surfaces shall be cleaned and free of laitance, coatings, dirt and other unsound material.
- Measurement and Payment for High Performance Concrete is a lump sum for the entire superstructure complete and accepted in place. Payment will be full compensation for all work such as grouting, plans, designs, labor, tools, equipment and incidentals necessary to complete the work. Payment for concrete testing is incidental to the concrete work and no additional payment will be made for the testing item.
- Measurement and Payment for Prestressed Concrete is a lump sum for the entire superstructure complete and accepted in place. Payment will be full compensation for all work such as grouting, plans, designs, labor, tools, equipment and incidentals necessary to complete the work. Payment for concrete testing is incidental to the concrete work and no additional payment will be made for the testing item.

<u>Work Scopes, in addition to or clarify what is shown on the plan:</u>

- Provide and install material (nuts, bolts, connectors, nails, brackets, trim, shims, blocking, etc.) as necessary to accomplish project.
- Work items not specifically listed as Pay Items in the bid documents are to be included by the Contractor in the lump sum price for the overall project. All work necessary to complete the project is to be included in the lump sum for the project. No additional payments will be made beyond this amount.
- The existing subsurface utilities within the project site (underground utilities, phone, power, water, sewer, etc.) are not shown and have not been identified. These utilities are to be located by the contractor and protected. The contractor is to contact Dig-Safe prior to any excavation.
- Contractor is to field measure and confirm geometry prior to the fabrication of items that will be delivered to the site. The exact shape of the cast in place concrete back walls and the concrete diaphragms between the precast double "T" sections are not known. Some variation is likely from that shown, because these assemblies were cast on top of an existing abutment and shaped to fit the existing construction during last superstructure replacement.
- Compliance with any permits obtained by the Town for the project are included in the Contractor's scope.
- The replacement of the concrete superstructure requires that the existing superstructure be removed and that some of the existing substructure be removed and modified. The existing substructure (back wall, cast in place concrete diaphragm and bearings require modification to accommodate the replacement superstructure. Remove existing conflicting section of the substructure by sawcutting only. No hammering of existing substructure is permitted, as it will be reused. Disposal of the existing superstructure, related back wall concrete, pavement and surplus excavated material is to be completed by the Contractor.
- Provide temporary shoring as necessary to complete the project.
- Traffic control is required. Contractor to provide traffic control operations and management during the project period. Closure of road is required during a large portion of this project. Install and maintain a complete detour route in both directions, including signs and barricades during the entire project period. Coordinate and permit detour route with the Towns of Weathersfield, Reading, Cavendish and West Windsor and with the State of VT.
    - As of the preparation of these bid documents, the Town is contemplating the installation of a temporary bridge adjacent to this bridge under a separate contract. This bridge may be in place or it may not. The traffic control operations and maintenance during the project period is to be modified as necessary to accommodate the project with or without this temporary bridge.

- As of the preparation of these bid documents, the Town is contemplating the installation of a temporary bridge adjacent to this bridge under a separate contract. This bridge may be in place or it may not. If the bridge is in place the Contractor is to adjust their plan as needed to accommodate the temporary bridge. The temporary bridge is to be removed by the Contractor and delivered to its owner after completion of the new bridge superstructure project. The site of the temporary bridge is to be restored to original grade, and the soil seeded and mulched. Install and maintain erosion prevention measures until permanent vegetation is established at this adjacent site.
- The contractor may propose replacing more material than that shown on the plans, with equal or better new material. The plans are intended to show the minimum extent of repairs. If for example there would be an economic benefit to the owner to replace an existing assembly with new, i.e. more efficient and thus representing some cost savings, it may be proposed to do so.
- The existing guardrail that is removed is to be delivered to the Town of Weathersfield Highway Department garage for reuse on other project.
- There is no specific Contractor storage yard or staging area dedicated for this project. Unless otherwise approved in writing by the Town or by nearby property owner, all construction activities are to be contained within the approximate right-of-way shown on the plans. Where the new swale grading extends slightly outside the right-of-way, work is to be completed from the right-of-way side to minimize disturbance of the abutting property.
- Seed and mulch all disturbed grass and vegetated surfaces during and after construction.
- Install erosion control measures between disturbed areas and the river. No sediment laden stormwater may run from the construction area into the river. Compostable filter socks are to be included within the new swale, of sufficient quantify and spacing, so that no sediment laden stormwater leaves the site. The erosion control measures are to be maintained by the Contractor until permanent vegetation is established.
- The work includes designing the structure in accordance with the BRIDGE SUPERSTRUCTURE DESIGN PERFORMANCE SPECIFICATION, submittals for this design, furnishing and installing the bridge superstructure and all work shown on the plans, incorporated in these specifications and included in the project documents.

BRIDGE SUPERSTRUCTURE DESIGN PERFORMANCE SPECIFICATION:

- The design and details of the bridge superstructure are to be completed by a Professional Engineer licensed in VT, referred to hereafter as the Bridge Superstructure Designer, or Designer, who is to be experienced and competent in this type of design work. The replacement superstructure is identified on the plans as a precast pretensioned concrete slab system. It is presumed that it will be designed, delivered and installed in several sections. The design is to include the means of fastening the sections together so that they perform as a single deck unit, are water-tight at any joints between the units, are rigidly fixed together so that they cannot move separately and so there are no void spaces between the units.
- As an alternative to a pretensioned concrete system, the Designer/Contractor may propose a conventionally reinforced slab system (cast-in-place or precast). The superstructure may be delivered and installed in sections or cast-in-place using traditional formwork. Epoxy coated reinforcement is required. If installed in separate sections the alternative design is to include the means of fastening the sections together so that they perform as a single deck unit, are water-tight at any joints between the units, are rigidly fixed together so that they cannot move separately and so there are no void spaces between the units. A VT Stream Alteration Permit will be necessary for work in and around the stream if a cast-in-place approach is planned. The Contractor will be responsible for preparing documents and making application and following the requirements of this permit if it is needed.
- The superstructure is to be composed of solid rectangular concrete section(s). Voided slabs, slabs with hollow areas, or thin web sections such as those present on typical precast sections (such as the existing

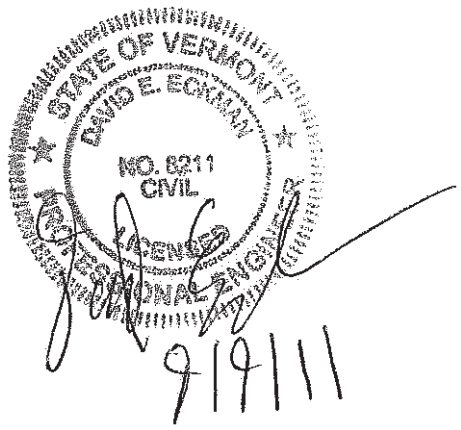
double “T”) will not be accepted for this project.

- The layout of the bridge superstructure shown on the plans is intended to demonstrate the intent of the project. The Designer and Contractor are to coordinate their work and measure and as-built the dimensions of the existing structure and adjust the final structure design and construction to match.
- This project is located in an exterior environment subject to a VT climate and exposed to heavy roadside salting and freezing temperatures. Provide a system that is consistent with the site’s environmental constraints and that will provide a strength and corrosion service life of 50 years. For design purposes the top surface of the concrete will be the exposed surface during service. No waterproof membrane or topping is proposed at this time.
- The Bridge Superstructure Designer is to use their expertise to specify the layout for construction and to provide design details needed to adequately support and anchor the superstructure. The bearing area details shown on the plans are intended to provide a minimum system design for bid and construction. The Designer shall provide supplemental or different bearing area details as necessary to support and connect the superstructure to the abutments as they deem it necessary.
- The design loads for the superstructure are to be factored and combined as specified in AASHTO LRFD Bridge Design Specifications, and include at a minimum the following unfactored loads:
    - Superstructure concrete sections self-weight = as determined by design, but not less than 150 psf.
    - Deck topping, permanent dead load = 60 psf.
    - Guardrail loads as determined necessary by the Designer.
    - Vehicle Live Load – As applied in AASHTO LRFD Bridge Design Specifications:
        - Design truck = 8 KIP front axle, two rear axles 32 KIP (14ft to 30ft apart varied for max effect) with impact load allowance IM = 33% or,
        - Design tandem = Pair of 25 KIP axles spaced 4ft apart with impact load allowance IM = 33%.
    - Snow or Ice = 50 psf.
    - Floating debris impact - The superstructure is located within a floodway. Previous flooding events have demonstrated that substantial impact loads resulting from floating debris occur. While no specific load requirements are presented or required, the Designer is notified that these loads exist so that the designer does not include details which would make it vulnerable to impact and submergence, such as voided slabs and thin web sections (precast double “T” for example).
    - Earthquake EQ, as determined necessary by designer.
    - Surcharge from vehicles on the buried face of the end of the slab and soil pressure from the retained earth behind the buried face of the end of the slab as determined necessary by designer.
    - Any other loads the Designer determines necessary based on their experience and expertise.
- The Designer is to notify the Owner and the Engineer if there are any contract documents or project details which, in their professional judgement, must be changed to accommodate the successful completion of the project.
- The Designer is to be retained by the Contractor and available as needed during the project process to:
    - Review and answer requests for information from the Contractor, Engineer, and Town.
    - Design changes to the bridge superstructure made necessary due to changes during the project.
    - Review bridge superstructure specific submittals from the Contractor specific to the Designer’s scope (proposed concrete and steel materials for example) and to answer bridge superstructure specific questions from the Fabricator, Contractor, Engineer or Town.
- The following information shall be submitted for review and approval by the Owner and Engineer. Each document provided is to be reviewed and stamped by a Professional Engineer licensed in VT.
    - Design/Shop drawings for the proposed superstructure, including sufficient details for the manufacture and installation of the superstructure. Include final design loads and material specifications.
    - Specific identification of anything that differs from the plans, specifications and project documents.

ATTACHMENT F
[TEMPORARY BRIDGE DESIGN]

TEMPORARY BRIDGE DESIGN

SEPTEMBER 9, 2011



PREPARED BY:

ECKMAN Engineering, LLC

1950 Lafayette Road, PO Box 3035
Portsmouth, New Hampshire 03802

PREPARED FOR:

Daniels Construction
4409 Route 5
Ascutney, Vermont 05030

ECKMAN Engineering, LLC

September 9, 2011

Mr. Matt Belden
Daniels Construction
4409 Route 5
Ascutney, Vermont 05030

Re: Proposed One-Lane Temporary Bridge

Dear Matt:

Attached please find the Temporary Bridge Design package as requested.

In the event that bedrock or other unanticipated subsurface conditions or other deviations from the design are required it is requested that Daniels Construction contact Eckman Engineering such that modifications can be prepared.

We trust the attached information sufficiently details the Temporary Detour Bridge proposed and if you have any questions or require additional information please feel free to phone or email david@eckmanengineering.com.

Yours truly,

David Eckman

David E. Eckman, P.E.
Principal Engineer

TEMPORARY BRIDGE

SUBMITTED FOR DOCUMENTATION

By: Daniels Construction

Address: 4409 Route 5

Ascutney, Vermont 05030

I hereby certify that I have carefully examined the attached submittal and have determined and verified all field conditions, construction criteria, materials, catalog numbers and similar data, coordinated the material contractors, and to the best of my knowledge and belief, the attached submittal is in full compliance with the contract requirements and specifications.

SIGNATURE: Matt Belden

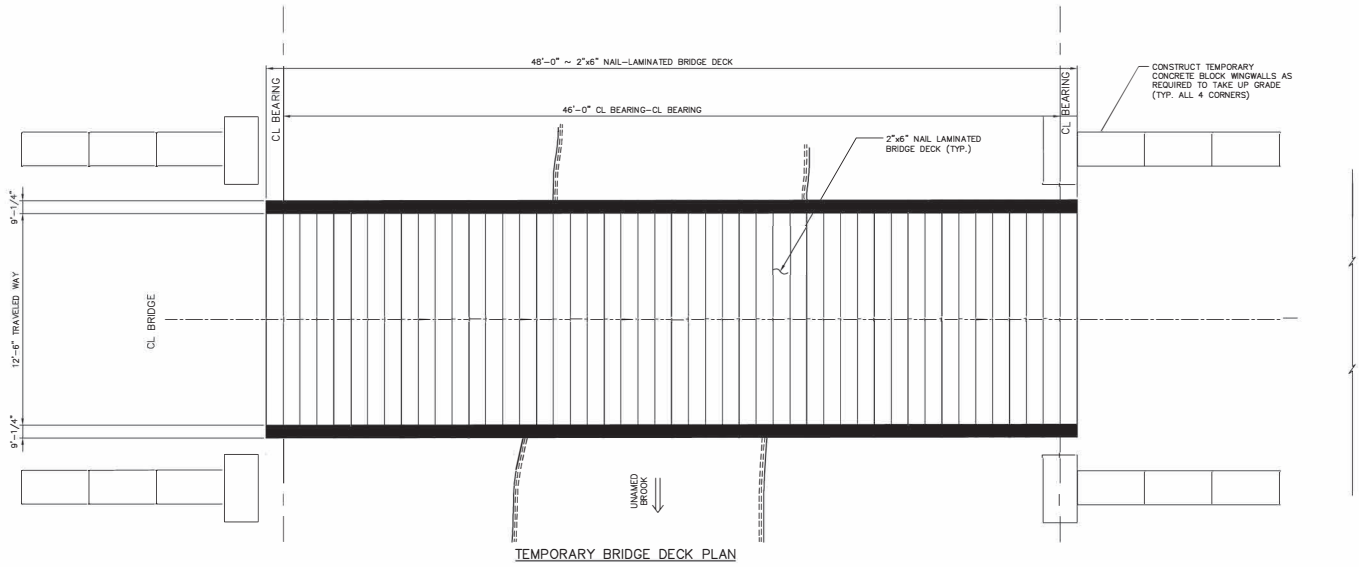
Authorized Person/Daniels Construction, Date

TABLE OF CONTENTS

LIST OF FIGURES AND TABLES

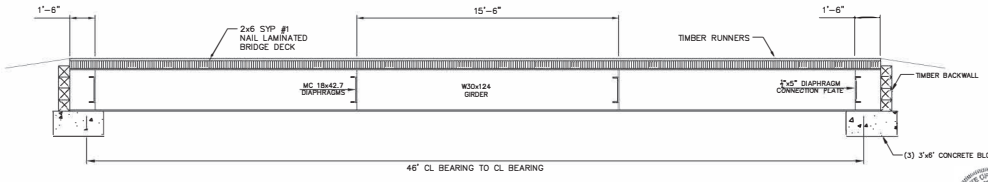
1.0 – TEMPORARY BRIDGE - PROJECT DESCRIPTION

This package contains construction plans, details and supporting design calculations for a one-lane temporary bridge. The temporary bridge as designed adequately provides HS20-44 load capacity.



TEMPORARY BRIDGE DECK PLAN

SCALE: 3/8"= 1'-0"



TEMPORARY BRIDGE ELEVATION

SCALE: 3/8"= 1'-0"

PLAN SIZE:
FULL SIZE PLANS ARE 22x36
11x17 ARE APPROXIMATE HALF SCALES

NO.	DESCRIPTION	APPD	DATE

REVISIONS

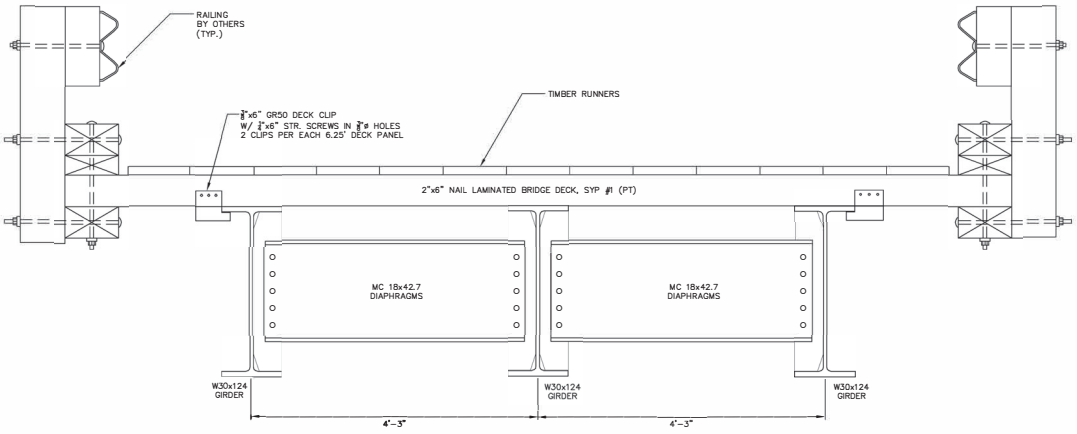
PREPARED FOR:	PREPARED BY:
DANIELS CONSTRUCTION	ECKMAN Engineering, LLC
4409 Route 5 PO Box 246 Ascutney, Vermont 05030 Phone: (802) 674-6323 Fax: (802) 674-5346	1950 Layfayette Road PO Box 3035 Portsmouth, NH 03802 Phone: (603) 433-1354 Fax: (603) 433-2367

PROJECT: 48' ONE LANE TEMPORARY BRIDGE

PROJECT NO.: N/A

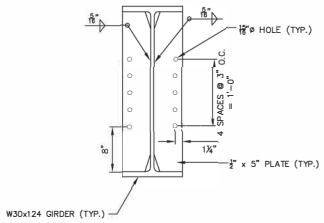
FILE NAME: 11-185_ENG_TEMP
DRAWN BY: PAD
DESIGNED BY: GDG
BRIDGE PLAN & ELEVATION

PLOT DATE: 09/09/11
CHECKED BY: DEE
SHEET: 1 OF 4



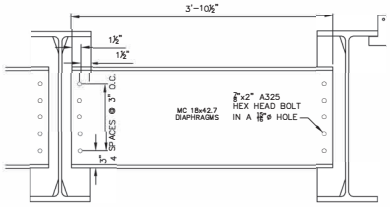
TRANSVERSE SECTION

SCALE: 1 1/2" = 1'-0"



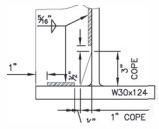
BEARING STIFFENER AND
BOLTED CONNETION DETAIL

SCALE: 1 1/2" = 1'-0"



BOLTED CONNECTION
DIAPHRAGM

SCALE: 1 1/2" = 1'-0"



DIAPHRAGM CONNECTION PLATE
WELD TERMINATION & COPING DETAILS

SCALE: 3" = 1'-0"

PLAN SIZE:
FULL SIZE PLANS ARE 22x36
11x17 ARE APPROXIMATE HALF SCALES

NO.	DESCRIPTION	APPD	DATE
	REVISIONS		

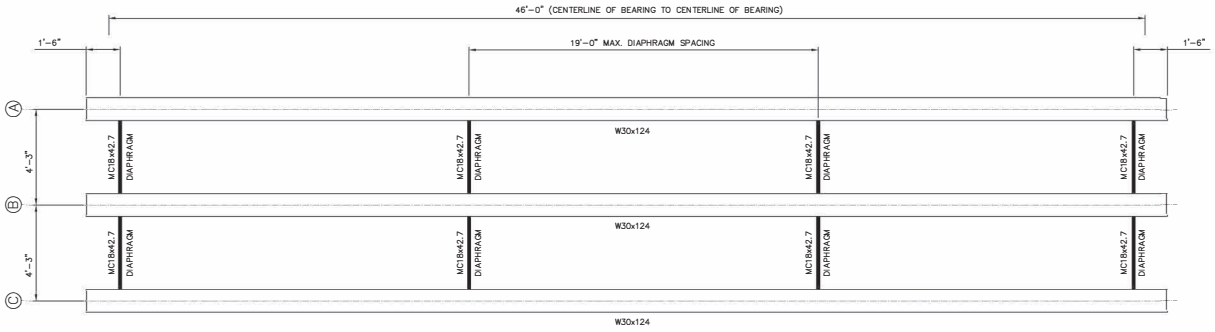
PREPARED FOR:	PREPARED BY:
DANIELS CONSTRUCTION	ECKMAN Engineering, LLC
4409 Route 5 PO Box 246 Ascutney, Vermont 05030 Phone: (802) 674-6323 Fax: (802) 674-5346	1950 Layfayette Road PO Box 3035 Portsmouth, NH 03802 Phone: (603) 433-1354 Fax: (603) 433-2367

PROJECT: 48' ONE-LANE TEMPORARY BRIDGE

PROJECT NO.: N/A

FILE NAME: 11-185_ENG_TEMP
DRAWN BY: PAD
DESIGNED BY: GDG
TRANSVERSE SECTION & DETAILS

PLOT DATE: 09/09/11
CHECKED BY: DEE
SHEET: 2 OF 4



SUPERSTRUCTURE FRAMING PLAN

SCALE: 1/2" = 1'-0"

PLAN SIZE:
FULL SIZE PLANS ARE 22x36
11x17 ARE APPROXIMATE HALF SCALES

NO.	DESCRIPTION	APP'D	DATE

REVISIONS

9/9/11

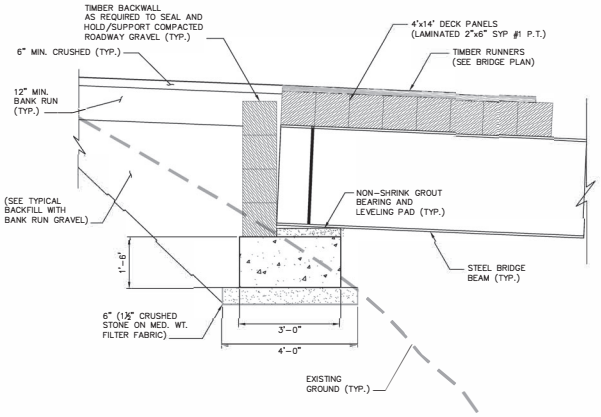
PREPARED FOR:	PREPARED BY:
DANIELS CONSTRUCTION	ECKMAN Engineering, LLC
4409 Route 5 PO Box 246 Ascutney, Vermont 05030 Phone: (802) 674-6323 Fax: (802) 674-5346	1950 Layfayette Road PO Box 3035 Portsmouth, NH 03802 Phone: (603) 433-1354 Fax: (603) 433-2367

PROJECT: 48' ONE-LANE TEMPORARY BRIDGE

PROJECT NO.: N/A

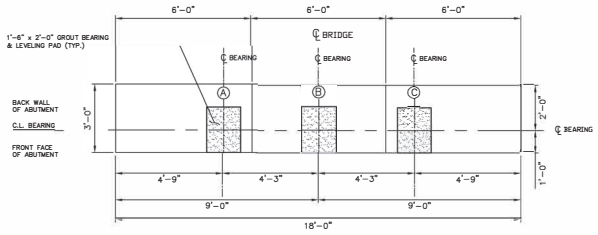
FILE NAME: 11-185_ENG_TEMP
DRAWN BY: PAD
DESIGNED BY: GDG
FRAMING PLAN & DETAILS

PLOT DATE: 09/09/11
CHECKED BY: DEE
SHEET: 3 OF 4



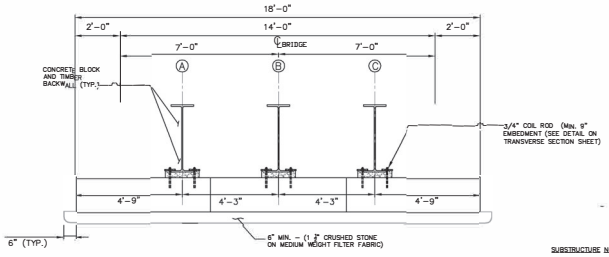
ABUTMENT SECTION (TYP.)

SCALE: 3/4" = 1'-0"



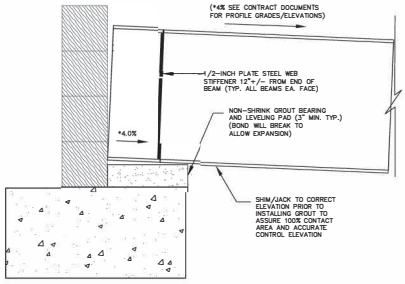
ABUTMENT PLAN (NORTH SHOWN, SOUTH SIMILAR BUT OPPOSITE)

SCALE: 1/2" = 1'-0"



ABUTMENT ELEVATION (TYP.)

SCALE: 1/2" = 1'-0"



BRIDGE SEAT DETAIL

SCALE: 1" = 1'-0"

SUBSTRUCTURE NOTES:

1) BRIDGE ABUTMENTS TO BE CONSTRUCTED OF CONCRETE BLOCKS PLACED ON A LEVEL 6" CRUSHED STONE BASE FOUNDED ON A LAYER OF MED. WEIGHT FILTER FABRIC LAID ON EXCAVATED AND COMPACTED SUBGRADE.

2) CONCRETE BLOCKS SHALL COVER A MINIMUM GROUND AREA OF 3'x16' USING BLOCKS POSITIONED AS DETAILED TO TRANSFER BRIDGE LOADS TO DESIGN FOOTPRINT AREA. OTHER CONFIGURATIONS WITH THE SAME OR DIFFERENT SIZE BLOCKS ARE ALLOWED TO BE USED BY THE CONTRACTOR AS LONG AS LOAD IS TRANSFERED TO A SIMILAR FOOTING AREA.

PLAN SIZE:
FULL SIZE PLANS ARE 22x36
11x17 ARE APPROXIMATE HALF SCALES

NO.	DESCRIPTION	APPD	DATE
REVISIONS			

PREPARED FOR:	PREPARED BY:
DANIELS CONSTRUCTION	ECKMAN Engineering, LLC
4409 Route 5 PO Box 246 Ascutney, Vermont 05030 Phone: (802) 674-6323 Fax: (802) 674-5346	1950 Layfayette Road PO Box 3035 Portsmouth, NH 03802 Phone: (603) 433-1354 Fax: (603) 433-2367

PROJECT: 48' ONE-LANE TEMPORARY BRIDGE

PROJECT NO.: N/A

FILE NAME: 11-185_ENG_TEMP

DRAWN BY: GDG

DESIGNED BY: GDG

FRAMING PLAN & DETAILS

PLOT DATE: 09/09/11

CHECKED BY: DEE

SHEET: 4 OF 4

APPENDICES

APPENDIX "A"

SUPERSTRUCTURE ANALYSIS & DESIGN CALCULATIONS

Eckman Engineering, LLC
1950 Lafayette Road Suite 301 , PO Box 3035
Portsmouth, NH 03801
(603) 433-1354 FAX (603) 433-2367

Client: Daniels Construction

PROJECT: 48' ONE-LANE TEMPORARY BRIDGE
PROJECT NUMBER: 11-185
CALCULATED BY: GDG DATE: 09/08/11
REVISED BY: DATE:
CHECKED BY: DEE DATE: 09/09/11

SUBJECT: Temporary Bridge Superstructure Design

Units

$$pcf := \frac{lbf}{ft^3} \qquad psf := \frac{lbf}{ft^2}$$

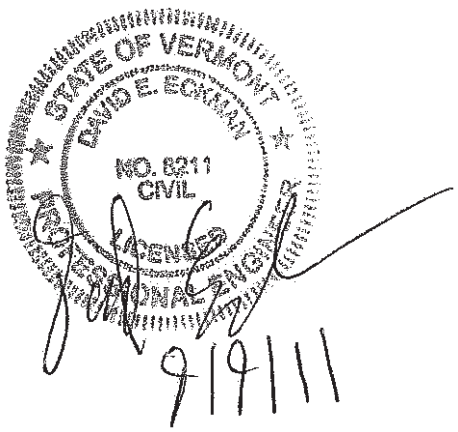
References

"AASHTO LRFD Bridge Design Specifications", 4th Ed., 2007
"AISC Manual of Steel Construction", 3rd Ed.
"NDS Design Values for Wood Construction Supplement", 2001 Edition

AASHTO Load Factors

Load factors from AASHTO Table 3.4.1-1 & 2.

$\gamma_{DL} := 1.25$ $\gamma_{LL} := 1.75$



Bridge Properties

$L_{beam} := 48ft + 0in$ $W_{bridge} := 14ft + 0in$ $N_b := 3$

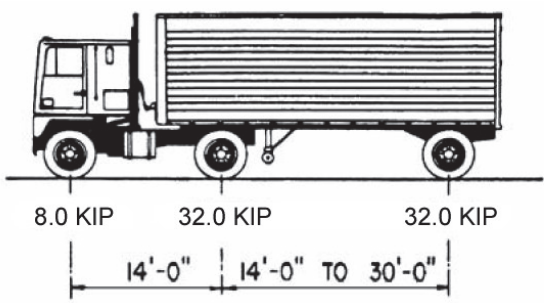
$N_L := 1.0$ (AASHTO 3.6.1.1.1)

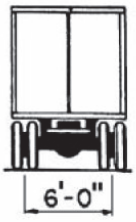
$f_y := 36ksi$ $E_s := 29000ksi$

Live Loads

HS20 loading consists of an HS20-44 design truck.

Design Truck - HS20-44 (AASHTO 3.6.1.2.2)





$P_{front} := 8.0kip$ $P_{rear} := 32.0kip$

$IM := 0.33$ $m_f := 1.20$ (AASHTO Table 3.6.1.1.2-1)

$P_{u\_front} := (1 + 0.33) \cdot m_f \cdot P_{front}$ $P_{u\_front} = 12.8\,kip$

$P_{u\_rear} := (1 + 0.33) \cdot m_f \cdot P_{rear}$ $P_{u\_rear} = 51.1\,kip$

Bridge Deck Design: (2x6 SYP #1 Deck)

Properties

$L_{deck} := 14ft$ $L_{design} := 1ft$ $s_{beam} := 4ft + 3in$ $s_{over} := 2ft + 9in$

$\rho_{hardwood} := 55pcf$ $t_{deck} := 5.50in$ $t_{runner} := 1.50in$

Dead Load Maximum Shear, Moment, and Reactions

Timber Deck

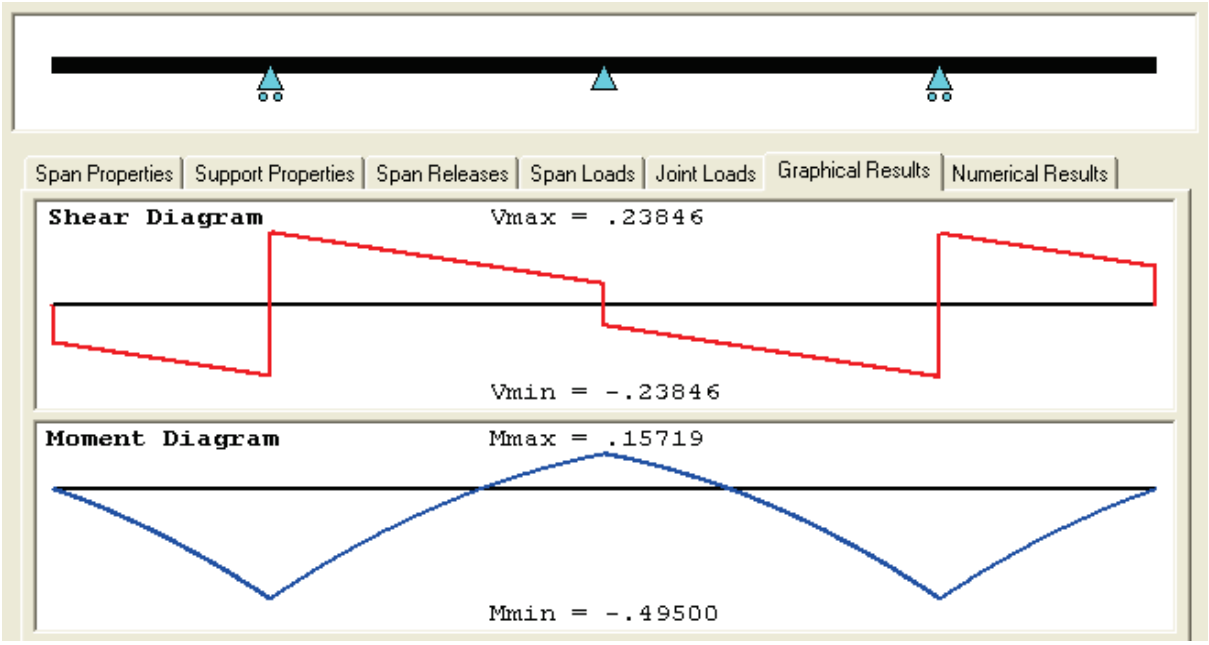
$w_{deck} := \gamma_{DL} \cdot \left[\rho_{hardwood} \cdot \left[\left(t_{deck} + t_{runner}\right) \cdot L_{design}\right]\right]$ $w_{deck} = 0.040\,klf$

Apply load over entire width of bridge

Guardrail

$Wt_{rail} := 100plf$

$P_{rail} := \gamma_{DL} \cdot \left(Wt_{rail} \cdot L_{design}\right)$ $P_{rail} = 0.125\,kip$



SUPPORT JOINT REACTIONS (in direction of rotated joint axes)

JOINT	X-REACTION	Y-REACTION	Z-MOMENT
1	0.00000	0.00000	0.00000
2	0.00000	0.47346	0.00000
3	0.00000	-0.13691	0.00000
4	0.00000	0.47346	0.00000
5	0.00000	0.00000	0.00000

$R_{uDL1} := 0.474kip$ $R_{uDL2} := -0.137kip$ $R_{uDL3} := 0.474kip$

$V_{uDLpos} := 0.239kip$ $V_{uDLneg} := 0.239kip$

$V_{uDL} := \max(V_{uDLpos}, V_{uDLneg})$ $V_{uDL} = 0.239\,kip$

$M_{uDLpos} := 0.157kip \cdot ft$ $M_{uDLneg} := 0.495kip \cdot ft$

Live Load Maximum Shear, Moment, and Reactions

Use DT Beam 1.0 to Determine LL Moments

Per AASHTO 3.6.1.2.5 Tire Contact Area, the width shall be taken as 20.0 in. and length 10.0 in.

$W_{tire} := 20in$ $L_{tire} := 10in$

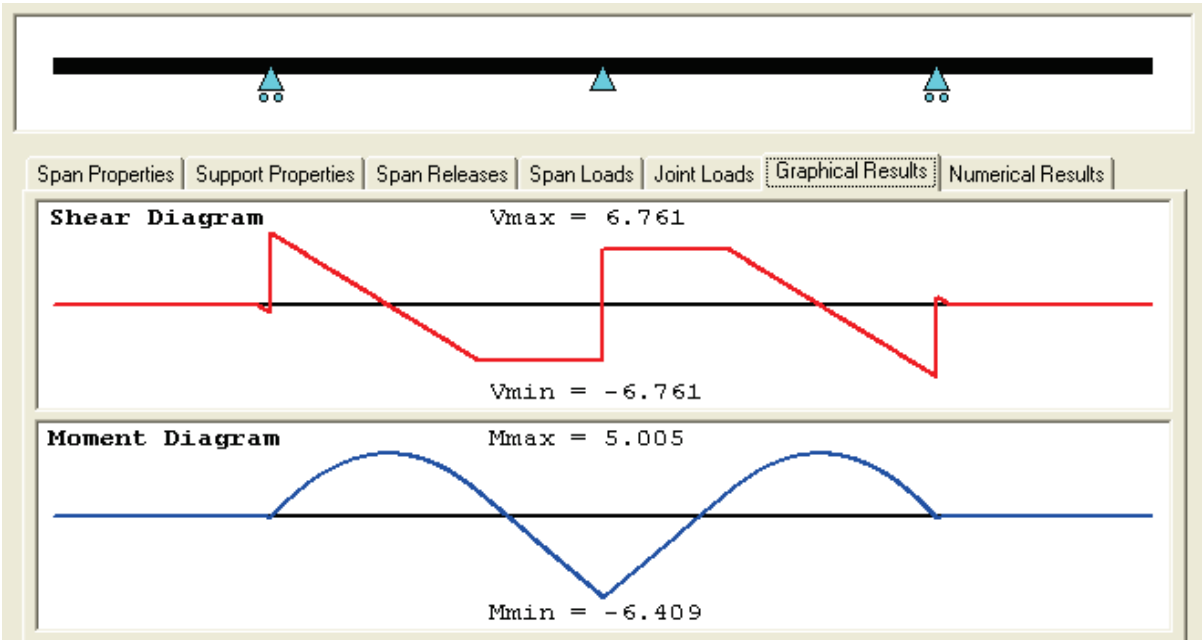
$P_{u\_tire} := \frac{P_{u\_rear}}{2}$ $P_{u\_tire} = 25536\,lbf$

$W_\sigma := W_{tire} + 2 \cdot (t_{deck} + t_{runner})$ $W_\sigma = 34\,in$

$L_\sigma := L_{tire} + 2 \cdot (t_{deck} + t_{runner})$ $L_\sigma = 24\,in$

$\sigma_{u\_tire} := \frac{P_{u\_tire}}{W_\sigma \cdot L_\sigma}$ $\sigma_{u\_tire} = 31.3\,psi$

$w_{truck} := \sigma_{u\_tire} \cdot L_{design}$ $w_{truck} = 4.51\,klf$



SUPPORT JOINT REACTIONS (in direction of rotated joint axes)

JOINT	X-REACTION	Y-REACTION	Z-MOMENT
1	0.00000	0.00000	0.00000
2	0.00000	7.51406	0.00000
3	0.00000	10.53456	0.00000
4	0.00000	7.51406	0.00000
5	0.00000	0.00000	0.00000

$V_{LLpos} := 6.761kip$ $V_{LLneg} := 6.761kip$

$M_{LLpos} := 5.005kip \cdot ft$ $M_{LLneg} := 6.409kip \cdot ft$

$R_{LL1} := 7.52kip$ $R_{LL2} := 10.53kip$ $R_{LL3} := 7.52kip$

Maximum moments are larger than in AASHTO Table A4-1, use AASHTO Moments:

$V_{LL} := \max(V_{LLpos}, V_{LLneg})$ $V_{LL} = 6.76\,kip$

$M_{LLpos} := 4.66kip \cdot ft$ $M_{LLneg} := 2.73kip \cdot ft$

Maximum Factored Shear, Moment, and Reaction

$R_{u1} := R_{uDL1} + \gamma_{LL} \cdot (R_{LL1})$ $R_{u1} = 13.63\,kip$

$R_{u2} := R_{uDL2} + \gamma_{LL} \cdot (R_{LL2})$ $R_{u2} = 18.3\,kip$

$R_{u3} := R_{uDL3} + \gamma_{LL} \cdot (R_{LL3})$ $R_{u3} = 13.6\,kip$

$R_u := \max(R_{u1}, R_{u2}, R_{u3})$ $R_u = 18.3\,kip$

$V_u := V_{uDL} + \gamma_{LL} \cdot (V_{LL})$ $V_u = 12.1\,kip$

$M_{uPos} := M_{uDLpos} + \gamma_{LL} \cdot (M_{LLpos})$ $M_{uPos} = 8.31\ ft\,kip$

$M_{uNeg} := M_{uDLneg} + \gamma_{LL} \cdot (M_{LLneg})$ $M_{uNeg} = 5.27\ ft\,kip$

$M_u := \max(M_{uPos}, M_{uNeg})$ $M_u = 8.31\ ft\,kip$

Maximum Allowable Moment Calculation

$F_b := 1650psi$ (Table 4B of NDS Design Values for Wood Construction)

Removing Adjustment Factors, the Allowable Design Flexural Stress can be increased by 2.10 (See ASTM D 5456 - 99a, Table 1)

$f_b := F_b \cdot 2.10$ $f_b = 3465\,psi$

$c_{deck} := \frac{t_{deck}}{2}$ $c_{deck} = 2.75\,in$

$I_{deck} := \frac{1}{12} \cdot L_{design} \cdot t_{deck}^{3}$ $I_{deck} = 166\,in^4$

$M_{ult} := \frac{f_b \cdot I_{deck}}{c_{deck}}$ $M_{ult} = 17.5\ ft\,kip$ $M_u = 8.31\ ft\,kip$

$Check := \begin{cases} \text{"Timber Deck Bending Moment OK"} & \text{if } M_{ult} > M_u \\ \text{"Timber Deck Bending Moment Not OK"} & \text{otherwise} \end{cases}$

Check = "Timber Deck Bending Moment OK"

Maximum Allowable Shear Calculation

$F_v := 175psi$ (Table 4B of NDS Design Values for Wood Construction)

Removing Adjustment Factors, the allowable Shear Stress can be increased by an applied adjustment factor of 3.15. (See ASTM D 5456 - 99a, Table 1)

$f_v := F_v \cdot 3.15$ $f_v = 551\ psi$

$y_{bar} := \frac{t_{deck}}{4}$ $y_{bar} = 1.38\ in$

$A_{deck} := L_{design} \cdot t_{deck}$ $A_{deck} = 66.0\ in^2$ (See Figure 6.12b ~ reference "Design of Wood Structures - ASD, 4th Edition, McGraw Hill)

$Q := A_{deck} \cdot y_{bar}$ $Q = 91\ in^3$

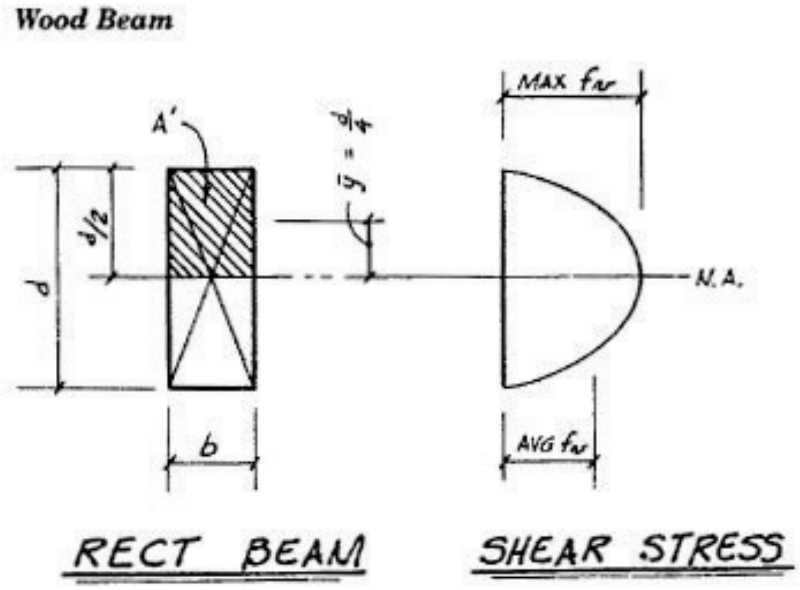


Figure 6.12b Shear stress distribution in a typical wood beam (rectangular section).

$V_{ult} := \frac{f_v \cdot I_{deck} \cdot L_{design}}{Q}$ $V_{ult} = 12.1\ kip$ $V_u = 12.1\ kip$

$Check := \begin{cases} \text{"Timber Deck Shear OK"} & \text{if } V_{ult} > V_u \\ \text{"Timber Deck Shear Not OK"} & \text{otherwise} \end{cases}$

Check = "Timber Deck Shear OK"

Check Bearing (Compression)

Maximum Ultimate Bearing Stress (Compression) F_c:

$F_c := 480psi$ (Compression perpendicular to grain)

Removing Adjustment Factors, the Allowable Bearing Stress can be increased by an applied adjustment factor of 1.67. (See ASTM D 5456 - 99a, Table 1)

$f_{c\_allow} := F_c \cdot 1.67$ $f_{c\_allow} = 802\ psi$

Bearing Case) The deck is supported by one of the 2 inner beams.

$R_u = 18.3\ kip$

The bearing area will be the (design length) x (W30x124 flange width)

$b_f := 10.5in$

$A_b := L_{design} \cdot b_f$ $\quad A_b = 126\,in^2$

$f_c := \frac{R_u}{A_b}$ $\quad f_c = 145\,psi$

Check := "Timber Deck Bearing OK" if $f_c < f_{c\_allow}$
"Timber Deck Bearing Not OK" otherwise

Check = "Timber Deck Bearing OK"

Steel Bridge Beam Design: (W30x124 A36 Steel)

Properties $\phi_b := 0.90$ $f_y = 36\,ksi$ $f_u := 58ksi$ $f_r := 10ksi$ $E_s = 29000\,ksi$

$L_{beam} = 48.0\ ft$ $L_{bearing} := 12in$ $L_{clear} := L_{beam} - 2L_{bearing}$ $L_{clear} = 46\ ft$

$w_{beam} := 124plf$ $d_{beam} := 30.2in$ $t_w := 0.585in$ $b_{2t} := 5.65$ $t_f := 0.930in$

$A_b := 36.5in^2$ $S_x := 355in^3$ $I_x := 5360in^4$ $Z_x := 408in^3$ $h_{tw} := 46.2$

$r_y := 2.23in$ $r_{ts} := 2.73in$ $h_o := 29.2in$ $J := 7.99in^4$ $c := 1.0$

Exterior Beam Dead Load

Beam $w_{beam} = 124\,plf$

Deck $w_{deck} := \rho_{hardwood} \cdot (t_{deck} + t_{runner}) \cdot \left(s_{over} + \frac{s_{beam}}{2}\right)$ $\quad w_{deck} = 156\,plf$

Concrete Barrier $w_{rail} := Wt_{rail}$ $\quad w_{rail} = 100\,plf$

Total $w_{uDLext} := \gamma_{DL} \cdot (w_{beam} + w_{deck} + w_{rail})$ $\quad w_{uDLext} = 476\,plf$

Interior Beam Dead Load

Beam $w_{beam} = 124\,plf$

Deck $w_{deck} := \rho_{hardwood} \cdot (t_{deck} + t_{runner}) \cdot \left(\frac{s_{beam}}{2} + \frac{s_{beam}}{2}\right)$ $\quad w_{deck} = 136\,plf$

Total $w_{uDLint} := \gamma_{DL} \cdot (w_{beam} + w_{deck})$ $\quad w_{uDLint} = 325\,plf$

Live Load Distribution Factors

Moment in Interior Beams

Use AASHTO Table 4.6.2.2.2b-1 and Table 4.6.2.2.2a-1

One Design Land Loaded, Wood Deck on Steel Beams, See Table 4.6.2.2.2a-1

One Design Lane Loaded, Spike Laminated Deck

$g_{int\_moment} := \max\left[\left(\frac{m_f \cdot N_L}{N_b}\right), \frac{s_{beam}}{8.30ft}\right]$ $\quad g_{int\_moment} = 0.512$

Moment in Exterior Beams

Use AASHTO Table 4.6.2.2.2d-1

One Design Lane Loaded, Wood Deck on Steel Beams

Use the Lever Rule, Sum Moments about the Interior Girder

$d_{wheel} := 4ft + 3in$

$g_{ext\_moment} := \max\left[\left(\frac{m_f \cdot N_L}{N_b}\right), \left(0.5 \cdot \frac{d_{wheel}}{s_{beam}}\right)\right]$ $g_{ext\_moment} = 0.500$

Shear in Interior Beams

Use AASHTO Table 4.6.2.2.3a-1

One Design Lane Loaded, Wood Deck on Steel Beams

Use Table 4.6.2.2.2a-1

$g_{int\_shear} := g_{int\_moment}$ $g_{int\_shear} = 0.512$

Shear in Exterior Beams

Use AASHTO Table 4.6.2.2.3b-1

One Design Lane Loaded, Wood Deck on Steel Beams

Use Lever Rule, Same as Moment in Exterior Beams

$g_{ext\_shear} := g_{ext\_moment}$ $g_{ext\_shear} = 0.500$

<u>Maximum Factored Dead Load Shear, Moment, and Reaction</u>

Exterior Beam

$w_{uDLext} = 476\,plf$

$R_{uDLext} := \frac{w_{uDLext} \cdot L_{clear}}{2}$ $R_{uDLext} = 10.9\,kip$

$V_{uDLext} := R_{uDLext}$ $V_{uDLext} = 10.9\,kip$

$M_{uDLext} := \frac{w_{uDLext} \cdot L_{clear}^2}{8}$ $M_{uDLext} = 126\ ft\,kip$

Interior Beam

$w_{uDLint} = 325\,plf$

$R_{uDLint} := \frac{w_{uDLint} \cdot L_{clear}}{2}$ $R_{uDLint} = 7.5\,kip$

$V_{uDLint} := R_{uDLint}$ $V_{uDLint} = 7.5\,kip$

$M_{uDLint} := \frac{w_{uDLint} \cdot L_{clear}^2}{8}$ $M_{uDLint} = 86\ ft\,kip$

Maximum Unfactored Live Load Shear, Moment, and Reaction

Truck Load

$P_{u\_front} = 12.8\,kip$ $P_{u\_rear} = 51.1\,kip$

Use QuickBridge to Determine the Maximum Shear, Moment, and Reaction

$R_{truck} := 90.7kip$ $V_{truck} := 90.7kip$ $M_{truck} := 940.9kip \cdot ft$

Maximum Factored Live Load Shear, Moment, and Reaction

Exterior Beam

$R_{uLLext} := \gamma_{LL} \cdot g_{ext\_shear} \cdot (R_{truck})$ $R_{uLLext} = 79.4\,kip$

$V_{uLLext} := \gamma_{LL} \cdot g_{ext\_shear} \cdot (V_{truck})$ $V_{uLLext} = 79.4\,kip$

$M_{uLLext} := \gamma_{LL} \cdot g_{ext\_moment} \cdot (M_{truck})$ $M_{uLLext} = 823\ ft\,kip$

Interior Beam

$R_{uLLint} := \gamma_{LL} \cdot g_{int\_shear} \cdot (R_{truck})$ $R_{uLLint} = 81.3\,kip$

$V_{uLLint} := \gamma_{LL} \cdot g_{int\_shear} \cdot (V_{truck})$ $V_{uLLint} = 81.3\,kip$

$M_{uLLint} := \gamma_{LL} \cdot g_{int\_moment} \cdot (M_{truck})$ $M_{uLLint} = 843\ ft\,kip$

Maximum Factored Total Load Shear, Moment, and Reaction

Exterior Beam

$R_{uExt} := R_{uDLext} + R_{uLLext}$ $R_{uExt} = 90.3\,kip$

$V_{uExt} := V_{uDLext} + V_{uLLext}$ $V_{uExt} = 90.3\,kip$

$M_{uExt} := M_{uDLext} + M_{uLLext}$ $M_{uExt} = 949\ ft\,kip$

Interior Beam

$R_{uInt} := R_{uDLint} + R_{uLLint}$ $R_{uInt} = 88.8\,kip$

$V_{uInt} := V_{uDLint} + V_{uLLint}$ $V_{uInt} = 88.8\,kip$

$M_{uInt} := M_{uDLint} + M_{uLLint}$ $M_{uInt} = 929\ ft\,kip$

Maximums

$R_u := \max(R_{uExt}, R_{uInt})$ $R_u = 90.3\,kip$

$V_u := \max(V_{uExt}, V_{uInt})$ $V_u = 90.3\,kip$

$M_u := \max(M_{uExt}, M_{uInt})$ $M_u = 949\ ft\,kip$

Lateral-Torsional Buckling

$L_b := 19ft + 6in$

$L_p := 1.76 \cdot r_y \cdot \sqrt{\frac{E_s}{f_y}}$ $L_p = 9.28\ ft$

$M_p := f_y \cdot Z_x$ $M_p = 1224\,kip \cdot ft$

$F_L := f_y - f_r$ $F_L = 26\,ksi$

$M_r := F_L \cdot S_x$ $M_r = 769\,kip \cdot ft$

$L_r := 1.95 \cdot r_{ts} \cdot \frac{E_s}{0.7 \cdot f_y} \cdot \sqrt{\frac{J \cdot c}{S_x \cdot h_o}} \cdot \sqrt{1 + \sqrt{1 + 6.76 \cdot \left(\frac{0.7 \cdot f_y}{E_s}\right) \cdot \left(\frac{S_x \cdot h_o}{J \cdot c}\right)}}$ $L_r = 28.1\ ft$

Since $L_p > L_b > L_r$, the allowable moment equation is:

$$M_n = C_b \cdot \left[M_p - \left(M_p - 0.7 \cdot f_y \cdot S_x\right) \cdot \left(\frac{L_b - L_p}{L_r - L_p}\right) \right] \le M_p$$

Check Bending Moment

$\phi_b := 0.90$ $M_u = 949\,kip \cdot ft$

$M_a := 774 kip \cdot ft$ (Moment at 1/4 point of unbraced length)

$M_b := 949 kip \cdot ft$ (Moment at 1/2 point of unbraced length)

$M_c := 759 kip \cdot ft$ (Moment at 3/4 point of unbraced length)

$C_b := \frac{12.5 \cdot M_u}{2.5M_u + 3M_a + 4M_b + 3M_c}$ $C_b = 1.10$

$M_n := \min\left[C_b \cdot \left[M_p - \left(M_p - 0.7 \cdot f_y \cdot S_x\right) \cdot \left(\frac{L_b - L_p}{L_r - L_p}\right) \right], M_p \right]$ $M_n = 1063\,kip \cdot ft$

$\phi M_n := \phi_b \cdot M_n$ $\phi M_n = 956\,kip \cdot ft$

$Check := \begin{cases} \text{"W33x118 Beam Bending Moment OK"} & \text{if } \phi M_n > M_u \\ \text{"W33x118 Beam Bending Moment Not OK"} & \text{otherwise} \end{cases}$

Check = "W33x118 Beam Bending Moment OK"

Check Deflection

Determine the Service Live Loads

$P_{u\_front} := P_{front}$ $P_{u\_front} = 8.0\,kip$

$P_{u\_rear} := P_{rear}$ $P_{u\_rear} = 32.0\,kip$

The maximum shear and moment occurs when the centerline of the span is equidistant from the center of gravity of the truck and the middle axle.

$d_f := 0ft$ $d_m := 14ft$ $d_b := 28ft$

$$d_{cg} := \frac{\left(P_{u\_front} \cdot d_f\right) + \left(P_{u\_rear} \cdot d_m\right) + \left(P_{u\_rear} \cdot d_b\right)}{P_{u\_front} + 2P_{u\_rear}} \qquad d_{cg} = 18.667\ ft$$

$$offset_{cg} := \frac{d_{cg} - d_m}{2} \qquad offset_{cg} = 2.333\ ft$$

The maximum shear and moment will occur when the middle axle of the truck is 2.333ft from the centerline of the span.

$$L_m := \frac{L_{clear}}{2} - offset_{cg} \qquad L_m = 20.667\ ft$$

$L_f := L_m - d_m$ $L_f = 6.667\ ft$ $L_b := L_m + \left(d_b - d_m\right)$ $L_b = 34.667\ ft$

Use superposition to calculate the deflection due to each axle point load.

$P_1 := P_{u\_front} \cdot \left(\max\left(g_{ext\_moment}, g_{int\_moment}\right)\right)$ $P_1 = 4.10\,kip$ $b_{P1} := L_f$ $b_{P1} = 6.667\ ft$

$a_{P1} := L_{clear} - b_{P1}$ $a_{P1} = 39.333\ ft$

$$\Delta_{P1} := \frac{P_1 \cdot a_{P1} \cdot b_{P1} \cdot \left(a_{P1} + 2 \cdot b_{P1}\right) \cdot \sqrt{3 \cdot a_{P1} \cdot \left(a_{P1} + 2 \cdot b_{P1}\right)}}{27 E_s \cdot I_x \cdot L_{clear}} \qquad \Delta_{P1} = 0.040\,in$$

$P_2 := P_{u\_rear} \cdot \left(\max\left(g_{ext\_moment}, g_{int\_moment}\right)\right)$ $P_2 = 16.4\,kip$ $b_{P2} := L_m$ $b_{P2} = 20.667\ ft$

$a_{P2} := L_{clear} - b_{P2}$ $a_{P2} = 25.333\ ft$

$$\Delta_{P2} := \frac{P_2 \cdot a_{P2} \cdot b_{P2} \cdot \left(a_{P2} + 2 \cdot b_{P2}\right) \cdot \sqrt{3 \cdot a_{P2} \cdot \left(a_{P2} + 2 \cdot b_{P2}\right)}}{27 E_s \cdot I_x \cdot L_{clear}} \qquad \Delta_{P2} = 0.364\,in$$

$P_3 := P_{u\_rear} \cdot \left(\max\left(g_{ext\_moment}, g_{int\_moment}\right)\right)$ $P_3 = 16.4\,kip$ $a_{P3} := L_b$ $a_{P3} = 34.667\ ft$

$b_{P3} := L_{clear} - a_{P3}$ $b_{P3} = 11.333\ ft$

$$\Delta_{P3} := \frac{P_3 \cdot a_{P3} \cdot b_{P3} \cdot \left(a_{P3} + 2 \cdot b_{P3}\right) \cdot \sqrt{3 \cdot a_{P3} \cdot \left(a_{P3} + 2 \cdot b_{P3}\right)}}{27 E_s \cdot I_x \cdot L_{clear}} \qquad \Delta_{P3} = 0.255\,in$$

$\Delta_{truck} := \Delta_{P1} + \Delta_{P2} + \Delta_{P3}$ $\Delta_{truck} = 0.659\,in$

$$Limit := \frac{L_{clear}}{\Delta_{truck}} \qquad Limit = 837$$

$$Check := \begin{cases} \text{"Girder Deflection OK"} & \text{if } Limit \geq 800 \\ \text{"Girder Deflection Not OK"} & \text{otherwise} \end{cases}$$

Check = "Girder Deflection OK"

Use superposition to calculate the deflection due to lane load and 25% of the truck.

$P_1 := 0.25P_{u\_front} \cdot \left(\max\left(g_{ext\_moment}, g_{int\_moment}\right)\right)$ $P_1 = 1.02\,kip$ $b_{P1} := L_f$ $b_{P1} = 6.667\ ft$

$a_{P1} := L_{clear} - b_{P1}$ $a_{P1} = 39.333\ ft$

$$\Delta_{P1} := \frac{P_1 \cdot a_{P1} \cdot b_{P1} \cdot \left(a_{P1} + 2 \cdot b_{P1}\right) \cdot \sqrt{3 \cdot a_{P1} \cdot \left(a_{P1} + 2 \cdot b_{P1}\right)}}{27 E_s \cdot I_x \cdot L_{clear}} \qquad \Delta_{P1} = 0.010\,in$$

$P_2 := 0.25 P_{u\_rear} \cdot \left(\max\left(g_{ext\_moment}, g_{int\_moment}\right)\right)$ $P_2 = 4.1\,kip$ $b_{P2} := L_m$ $b_{P2} = 20.667\ ft$

$a_{P2} := L_{clear} - b_{P2}$ $a_{P2} = 25.333\ ft$

$$\Delta_{P2} := \frac{P_2 \cdot a_{P2} \cdot b_{P2} \cdot \left(a_{P2} + 2 \cdot b_{P2}\right) \cdot \sqrt{3 \cdot a_{P2} \cdot \left(a_{P2} + 2 \cdot b_{P2}\right)}}{27 E_s \cdot I_x \cdot L_{clear}} \qquad \Delta_{P2} = 0.091\,in$$

$P_3 := 0.25 P_{u\_rear} \cdot \left(\max\left(g_{ext\_moment}, g_{int\_moment}\right)\right)$ $P_3 = 4.1\,kip$ $a_{P3} := L_b$ $a_{P3} = 34.667\ ft$

$b_{P3} := L_{clear} - a_{P3}$ $b_{P3} = 11.333\ ft$

$$\Delta_{P3} := \frac{P_3 \cdot a_{P3} \cdot b_{P3} \cdot \left(a_{P3} + 2 \cdot b_{P3}\right) \cdot \sqrt{3 \cdot a_{P3} \cdot \left(a_{P3} + 2 \cdot b_{P3}\right)}}{27 E_s \cdot I_x \cdot L_{clear}} \qquad \Delta_{P3} = 0.064\,in$$

$\Delta_{truck} := \Delta_{P1} + \Delta_{P2} + \Delta_{P3}$ $\Delta_{truck} = 0.165\,in$

$$Limit := \frac{L_{clear}}{\Delta_{truck}} \qquad Limit = 3348$$

$$Check := \begin{cases} \text{"Girder Deflection OK"} & \text{if } Limit \geq 800 \\ \text{"Girder Deflection Not OK"} & \text{otherwise} \end{cases}$$

Check = "Girder Deflection OK"

Check Shear

$\phi_v := 0.90$ $V_u = 90\,kip$

$A_w := d_{beam} \cdot t_w$ $A_w = 17.7\,in^2$

$$C_v := \begin{cases} 1.0 & \text{if } h_{tw} \leq 2.24 \cdot \sqrt{\frac{E_s}{f_y}} \\ \text{"Calculate"} & \text{otherwise} \end{cases} \qquad C_v = 1.0$$

$V_n := 0.60 \cdot f_y \cdot A_w \cdot C_v$ $V_n = 382\,kip$

$\phi V_n := \phi_v \cdot V_n$ $\phi V_n = 343\,kip$

$$Check := \begin{cases} \text{"W30x124 Beam Shear OK"} & \text{if } \phi V_n > V_u \\ \text{"W30x124 Beam Shear Not OK"} & \text{otherwise} \end{cases}$$

Check = "W30x124 Beam Shear OK"

Check the Web Local Yielding of At Reaction (AASHTO D6.5.2)

$R_u = 90.3\,kip$ $d_{beam} = 30.2\,in$ $L_{bearing} := 12in$

$L_{bearing} < d_{beam}$ Therefore, $R_n = (2.5 \cdot k + N) \cdot f_y \cdot t_w$

$\phi := 1.00$ $f_y = 36\,ksi$ $E_s = 29000\,ksi$

$t_w = 0.585\,in$ $k := 1.58in$ $N := 8in$

$R_n := (2.5 \cdot k + N) \cdot f_y \cdot t_w$ $R_n = 252\,kip$

$\phi R_n := \phi \cdot R_n$ $\phi R_n = 252\,kip$

$$Check := \begin{cases} \text{"Local Web Yielding OK"} & \text{if } \phi R_n \geq R_u \\ \text{"Web Stiffeners Required"} & \text{otherwise} \end{cases}$$

Check = "Local Web Yielding OK"

Check Web Crippling at Reaction (AASHTO D6.5.3)

$\phi := 0.75$ $\frac{d_{beam}}{2in} = 15.1$ $L_{bearing} = 12\,in$

$L_{bearing} < \frac{d_{beam}}{2}$ Therefore

$$R_n := \begin{cases} 0.40 \cdot t_w^2 \cdot \left[1 + 3 \cdot \left(\frac{N}{d_{beam}}\right)\left(\frac{t_w}{t_f}\right)^{1.5}\right] \cdot \sqrt{\frac{E_s \cdot f_y \cdot t_f}{t_w}} & \text{if } \frac{N}{d_{beam}} \leq 0.20 \\ 0.40 \cdot t_w^2 \cdot \left[1 + \left(\frac{4 \cdot N}{d_{beam}} - 0.2\right) \cdot \left(\frac{t_w}{t_f}\right)^{1.5}\right] \cdot \sqrt{\frac{E_s \cdot f_y \cdot t_f}{t_w}} & \text{if } \frac{N}{d_{beam}} > 0.20 \end{cases}$$

$R_n = 252\,kip$

$\phi R_n := \phi \cdot R_n$ $\phi R_n = 189\,kip$

$$Check := \begin{cases} \text{"Web Crippling OK"} & \text{if } \phi R_n \geq R_u \\ \text{"Web Stiffeners Required"} & \text{otherwise} \end{cases}$$

Check = "Web Crippling OK"

Deck Analysis for Railing Impact:

Railing Load

Use AASHTO TL-2 Loading

$P_{LLrail} := 27.0kip$ $H_e := 20.0in$

$M_{LLrail} := P_{LLrail} \cdot H_e$ $M_{LLrail} = 45.0\,ft\,kip$

$M_{DLrail} := \gamma_{DL} \cdot (P_{rail} \cdot s_{over})$ $M_{DLrail} = 0.43\,ft\,kip$

$M_u := M_{LLrail} + M_{DLrail}$ $M_u = 45.4\,ft\,kip$

Deck Maximum Allowable Moment Calculation

$F_b := 1650psi$ (Table 4B of NDS Design Values for Wood Construction)

Removing Adjustment Factors, the Allowable Design Flexural Stress can be increased by 2.10 (See ASTM D 5456 - 99a, Table 1)

$f_b := F_b \cdot 2.10$ $f_b = 3465\,psi$

$c_{deck} := \frac{t_{deck}}{2}$ $c_{deck} = 2.75\,in$ $L_{deck} := 36in$ (Assume post load gets distributed to atleast 36 of deck)

$I_{deck} := \frac{1}{12} \cdot L_{deck} \cdot t_{deck}^3$ $I_{deck} = 499\,in^4$

$M_{ult} := \frac{f_b \cdot I_{deck}}{c_{deck}}$ $M_{ult} = 52.4\ ft\,kip$ $M_u = 45.4\ ft\,kip$

$Check := \begin{cases} \text{"Deck Bending Moment Due to Rail Impact OK"} & \text{if } M_{ult} > M_u \\ \text{"Deck Bending Moment Due to Rail Impact Not OK"} & \text{otherwise} \end{cases}$

Check = "Deck Bending Moment Due to Rail Impact OK"

Truck definition

Number of axles: 3

Axle No	X	W
1	0.0	12.8
2	14.0	51.1
3	28.0	51.1

X is the coordinate and
W the weight of the axle
Coordinate of axle 1 is 0

Bridge geometry

Number of span

1

Span No	L	q	div
1	48	0	20

L is the length,
q uniform load and
div number of divisions
on a particular span
L and div must be > 0

Results

X	Vmax	Mmin	Mmax
0.00	90.7	0.0	0.0
2.40	85.0	0.0	203.9
4.80	79.2	0.0	380.2
7.20	73.5	0.0	528.9
9.60	67.7	0.0	650.0
12.00	62.0	0.0	743.6
14.40	56.2	0.0	810.5
16.80	50.5	0.0	862.6
19.20	44.7	0.0	887.1
21.60	39.6	0.0	891.8
24.00	34.5	0.0	930.1
26.40	34.5	0.0	940.9
28.80	40.2	0.0	924.0
31.20	46.0	0.0	879.5
33.60	51.7	0.0	807.4
36.00	57.5	0.0	730.7
38.40	62.6	0.0	629.6
40.80	67.7	0.0	503.8
43.20	72.8	0.0	353.6
45.60	77.9	0.0	187.0
48.00	83.0	0.0	0.0

No	Rmin	Rmax
1	0.0	90.7
2	0.0	83.0

APPENDIX "B"

SUBSTRUCTURE ANALYSIS & DESIGN CALCULATIONS

Eckman Engineering, LLC
1950 Lafayette Road Suite 301 , PO Box 3035
Portsmouth, NH 03801
(603) 433-1354 FAX (603) 433-2367

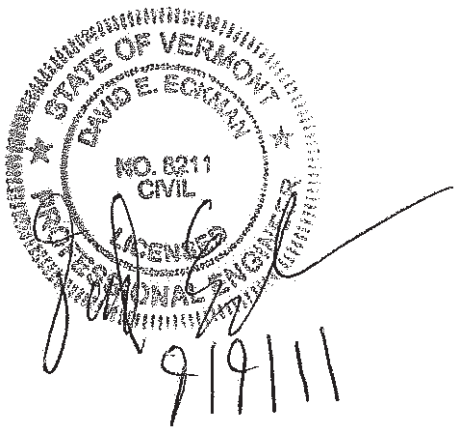
Client: Daniels Construction

PROJECT: 48' ONE-LANE TEMPORARY BRIDGE
PROJECT NUMBER: 10-134
CALCULATED BY: GDG DATE: 09/09/11
REVISED BY: DATE:
CHECKED BY: DEE DATE: 09/09/11

SUBJECT: Temporary Bridge Substructure Design

Units

$psf := \frac{lbf}{ft^2}$ $ksf := \frac{kip}{ft^2}$



References

"Principles of Foundation Engineering", 5th Ed., Braja M. Das.
"AASHTO LRFD Bridge Design Specifications", 4th Ed., 2007

AASHTO Load Factors

$\gamma_{DL} := 1.25$ $\gamma_{LL} := 1.75$ $\gamma_{WS} := 1.40$

$\gamma_{BR} := 1.75$ $\gamma_{TU} := 0.50$ $IM := 0.33$

One Design Lane $Nu_{lanes} := 1.0$ $m_f := 1.20$

Abutment Design

Given Information

$\gamma_{soil} := 125pcf$ $\gamma_{sat} := 131pcf$ $\phi := 25deg$ $c := 0psf$

$\gamma_{conc} := 150pcf$ $\gamma_{steel} := 490pcf$

Assumed sand or gravel soil conditions, conservatively assume ϕ = 25 deg. If clay-like conditions exist contact Eckman Engineering to reevaluate bearing capacity.

Terzaghi's Bearing Capacity

$B_{base} := 3ft$ (footing width) $D_f := 4ft$ (depth to bottom of footing)

Get Bearing Capacity Factors from Table 3.1 in Das.

$N_c := 25.13$ $N_q := 12.72$ $N_\gamma := 8.34$

$q := D_f \gamma_{sat}$ $q = 524\,psf$

$q_{u\_bearing} := (c \cdot N_c) + (q \cdot N_q) + \left(\frac{1}{2} \cdot \gamma_{soil} \cdot B_{base} \cdot N_\gamma\right)$ $q_{u\_bearing} = 8229\,psf$

Maximum Soil Capacity

$SF_{soil} := 1.5$ $q_u := q_{u\_bearing}$ $q_u = 8229\,psf$

$q_{safe} := \frac{q_u}{SF_{soil}}$ $q_{safe} = 5486\,psf$

Dead Loads

Steel Beams

Going to use W30x124 A36 Gr. 36 Steel Beams.

$N_{beam} := 3$ $L_{beam} := 48ft + 0in$ $w_{beam} := 124plf$ $s_{beam} := 4ft + 3in$

$Load_{beam} := N_{beam} \cdot (L_{beam} \cdot w_{beam})$ $Load_{beam} = 17.9\,kip$

Timber Deck (Nail Laminated Deck and Runners)

$t_{deck} := 7.00in$ $\gamma_{wood} := 55pcf$ $W_{deck} := 14ft$

$Load_{deck} := \gamma_{wood} \cdot (t_{deck} \cdot L_{beam} \cdot W_{deck})$ $Load_{deck} = 21.6\,kip$

Diaphragms

Using MC18x42.7 $w_{ch} := 42.7plf$ $L_{diaph} := 4ft + 0in$

$N_{diaph} := 5$ $Load_{diaph} := N_{diaph} \cdot L_{diaph} \cdot w_{ch}$ $Load_{diaph} = 0.85\,kip$

Railing System

$Wt_{rail} := 80plf$ (from superstructure calculations)

$Load_{railing} := L_{beam} \cdot Wt_{rail}$ $Load_{railing} = 3.84\,kip$

Total Dead Load

$DL := Load_{beam} + Load_{deck} + Load_{diaph} + Load_{railing}$ $DL = 44.1\,kip$

$DL_u := \gamma_{DL} \cdot DL$ $DL_u = 55.1\,kip$

Live Loads

Per AASHTO 3.6.1.2.2, the design truck is an HS20-44.

$P_{front} := 8000lbf$ $P_{rear} := 32000lbf$

$LL_{truck} := P_{front} + 2 \cdot P_{rear}$ $LL_{truck} = 72.0\,kip$

Total Live Load

$LL := LL_{truck}$ $LL = 72.0\,kip$

$LL_u := \gamma_{LL} \cdot m_f \cdot (1 + IM) \cdot LL$ $LL_u = 201\,kip$

Maximum Bearing Pressure Applied

$P_u := DL_u + LL_u$ $P_u = 256\,kip$ $N_{abut} := 2$

$P_{u\_abut} := \frac{P_u}{N_{abut}}$ $P_{u\_abut} = 128\,kip$

Abutments will be 1 level of concrete waste blocks. Blocks are 3'x6' x 18".
Layer 1 will be 3'x18'

$d_{block} := 1.5ft$ $B_1 := 3ft$ $W_1 := 18ft$

$V_1 := d_{block} \cdot B_1 \cdot W_1$ $V_1 = 81\ ft^3$

$V_{abut} := V_1$ $V_{abut} = 81\ ft^3$

$Load_{abut} := \gamma_{conc} \cdot V_{abut}$ $Load_{abut} = 12.2\,kip$

Total Applied Load to the Ground $P_{max} := P_{u\_abut} + \left(\gamma_{DL} \cdot Load_{abut}\right)$ $P_{max} = 143\,kip$

$q_{max} := \dfrac{P_{max}}{B_1 \cdot W_1}$ $q_{max} = 2654\,psf$ $q_{safe} = 5486\,psf$

$Check := \begin{cases} \text{"Bearing Pressure OK"} & \text{if } q_{max} < q_{safe} \\ \text{"Bearing Pressure Not OK"} & \text{otherwise} \end{cases}$ $Check = \text{"Bearing Pressure OK"}$