REPLACEMENT OF BRIDGE NO. 04575
MAIN STREET OVER
TANKERHOOSEN RIVER
VERNON, CONNECTICUT

STATE PROJECT NO. 146-199

PRELIMINARY ENGINEERING REPORT

DECEMBER 2016

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Preliminary Engineering Report

FOREWORD

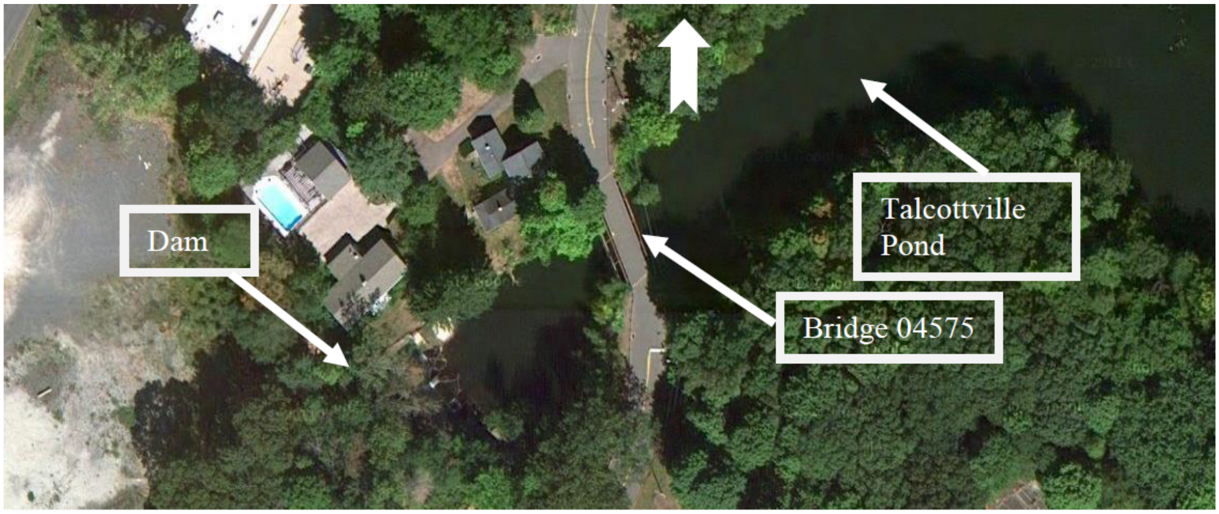
Various technical investigations were conducted during the preliminary engineering phase of this project for the replacement of the Main Street Bridge No. 04575 over the Tankerhoosen River:

- A Hydrology Report was submitted in June 2016 and approved by CTDOT on June 21, 2016.
- A Preliminary Hydraulic Findings and Qualitative Scour Assessment Memorandum being submitted in December 2016 summarizes the results of the Hydraulics Analysis and provides a qualitative scour assessment.
- A Preliminary Foundation Report Memorandum being submitted in December 2016 provides guidelines for new foundations for the bridge replacement alternatives.
- This subject report, Preliminary Engineering Report, primarily focuses on the various elements pertaining to the design and provides a brief summary of facts and findings contained in the aforementioned report.
- A separate Structure Type Selection Report was not submitted due to the nature of the alternatives being investigated. The use of multiple steel beams was stipulated in the scope of work for all alternatives and the bridge configurations are based upon geometric considerations and are discussed and evaluated in this Preliminary Engineering Report.

1. PROJECT DESCRIPTION

Bridge 04575 carries Main Street over the Tankerhoosen River in the town of Vernon (Town), Connecticut. Main Street is classified an “Urban Local Road” and the bridge is located approximately 2100 feet north of the intersection of Main Street and Route 83 (Hartford Turnpike).

The Main Street Bridge carries a single lane of vehicular traffic in the northbound and southbound directions over a 16-feet wide curb-to-curb roadway. The roadway approaches to the bridge are 25-feet +/- wide. The bridge provides the only means of ingress and egress to a community of approximately three (3) residents, access to the Hop River State Park Trail and the area is considered to be part of the Talcottville Historic District. The Average Daily Traffic (ADT) on the bridge is estimated to be approximately 20 vehicles per day. There is no sidewalk present on the bridge and the roadway is shared by both vehicular and pedestrian traffic. While the bridge itself is located on a tangent horizontal alignment, the roadway approaches to the bridge are on a reverse curve. Vertically, the bridge is at the summit of a crest vertical curve.



Aerial View of Main Street Bridge Site

East (Upstream) Elevation Bridge

The Main Street Bridge is a steel beam bridge with a span length of 68 feet. The superstructure of the bridge consists of a corrugated metal deck supported by six (6) steel beams. The superstructure supports a bituminous concrete roadway and a metal beam guiderail system with posts bolted to brackets that are welded to the fascia beam webs. The bridge rail system extends to the approaches and does not meet current safety standards. The aforementioned superstructure was built in 1995 over the original bridge superstructure comprising of a steel lenticular pony truss and floorbeam system. The original wrought iron thru-truss bridge was built in 1885 and as left in place during the 1995 reconstruction with the truss providing a façade. The original truss bridge is considered to be historic and is on the National Register of Historic Places. The lenticular truss was a patented design of the Berlin Iron and Bridge Company and there are only eleven known examples of this type of bridge remaining in the state of Connecticut. In its current configuration, the original trusses and floorbeams do not carry any loads other than its self-weight and a gas main.

Both the original and 1995 bridge superstructures are supported by dry laid stone masonry abutments with a concrete seat located behind the first course of stones. Dry laid stone masonry wingwalls channelize the river within the bridge footprint and contain the approach roadway fill.

The 2011 CTDOT Routine Inspection Report rates the bridge to be "functionally obsolete" based on the Deck Geometry rating (NBIS Item 68 rating "3") as the roadway width is less than 18 feet for two lanes of traffic. However, based on discussions between Close, Jensen and Miller P.C. (Consultant Liaison Engineer, i.e. CLE), Federal Highway Administration (FHWA) and CTDOT, it has been determined that a permanent one-lane configuration could be provided based on the low ADT on the bridge, without resulting in the bridge being classified as "functionally obsolete", as long as the roadway width is greater than 12 feet but less than 16 feet.

The 2011 CTDOT Inspection Report rates the Deck on the bridge to be in "Good" condition (NBIS Item 58 rating "7") as the corrugated metal deck does not exhibit any major deficiencies. The bituminous concrete pavement exhibits random cracks and the bridge rail system exhibits isolated collision damage and rust.

The steel beam superstructure is rated to be in "Fair" condition (NBIS Item 59 rating "5") due to presence of section loss and laminar rust in the webs and bottom flanges of the weathering steel beams. The 2011 report states that the interior girders ends are difficult to inspect due to low clearance. It appears that the original truss bridge is not being regularly inspected since it does not carry any live loads. According to the inspection report, the inventory load rating capacity of the steel beam bridge for an AASHTO HS20 vehicle is 40 Tons (36 Tons standard).

The dry laid stone masonry abutments supporting the superstructure and the wingwalls are rated to be in "Poor" condition (NBIS Item 60 rating "4") due to presence of large voids and cracks in stones. A 15-foot section of the Northwest Wingwall, located 50 feet downstream from the bridge, has failed due to a fallen tree.

According to the 2011 CTDOT Inspection Report, the condition of channel and channel protection is "Satisfactory" (NBIS Item 61 rating "6") due to minor erosion and embankment encroachment, both upstream and downstream of the bridge. A stone masonry pier, part of an old trolley line, extending 3.5 feet above the water is present upstream of the bridge. The channel is controlled by a dam present 130-feet downstream of the Main Street Bridge.

The 2011 CTDOT Inspection Report rates the NBIS Item 71 "Waterway Adequacy" as "8" indicating that the bridge deck is above the roadway approaches with slight chance of being overtopped. A review of the FEMA website indicates that Tankerhoosen River at Main Street has been studied and mapped and a review of the FIRM map shows that project site is located within the 100-year flood zone (i.e. Zone AE) and there is a regulated floodway. The bridge foundations have been determined to be stable for the calculated scour conditions according to the 2011 Inspection Report (NBIS Item 113 rating "5").

There are several overhead utilities present along the east fascia of the bridge including electric, telephone and cable. An 8 inch gas main supported by the floorbeams of the original truss structure is present on the west fascia of the bridge.

The overall condition of the bridge was rated to be "Poor" (NBIS Item 67 rating "4") by the 2011 CTDOT inspection and the bridge is classified to be "Structurally Deficient".

A Task 100 Environmental Screening Review performed by CTDOT has determined that no further investigations are warranted.

An internal "Environmental Review Form" completed by CTDOT Office of Environmental Planning has determined that there is no conflict with or impact to the CT DOT screened environmental resources except replacement of the bridge constitutes an adverse impact. A section 106 and 4f will likely be required to address this which will be prepared by the CLE.

Connecticut Commission on Culture and Tourism, Historic Preservation and Museum Division has concluded that the bridge replacement will constitute an adverse effect on the historic integrity of the bridge and requires that the feasible alternatives regarding retention, rehabilitation and re-use of the existing structure be considered.

2. GEOMETRIC DETAILS

As an "Urban Local Road" classification, Main Street has a posted speed and design speed of 25 mph and 30 mph, respectively. However, it is noted that the northern limits of Main Street within the project limits terminates as a cul-de-sac approximately 250' from the north abutment of the bridge. The corresponding design criteria from the 2003 CTDOT Highway Design Manual (HDM) is included in ***Appendix E***.

The geometric roadway alignment for this project is dependent on the selected Traffic Control that will be implemented during construction. If traffic is to be maintained on Main Street, the new bridge will need to be constructed off line and new realigned approaches will be required. If traffic is detoured via a temporary access driveway, the replacement bridge will be constructed in the same location as the existing, the geometrics will follow the existing centerline of the road. For each case the roadway profile will be raised by approximately 1 foot to provide for additional free board between the new bridges low chord and water surface.

3. TRAFFIC CONTROL

Located on the north side of the Main Street bridge there are 2 driveways that provide access to 3 residences along with the entrance to the Hop River State Park Trail. This section of Main Street does not have an outlet due the cul-de-sac end of the road, thereby, not allowing for a detour of traffic utilizing the existing roadway network during the construction of the replacement bridge. Given this constraint, we have evaluated the following scenarios that will allow for construction to be complete while still maintaining access to the 3 residences and trail. The options that were evaluated are as follows:

1. Maintain traffic on the existing bridge (requires new bridge to be constructed on a new alignment.

2. Install a temporary bridge off-line to maintain traffic (new bridge same location as existing).
3. Construct a temporary access through private property from Main Street to Route 83 to provide for a temporary detour route for the residents during construction (new bridge same location as existing).

Each of the above options are discussed summarizing the impacts/pros & cons of each to provide for the best means to maintain traffic during construction.

Option 1: Maintaining traffic on the existing bridge during construction requires that a new bridge on a new alignment be located to the east of the existing bridge as locating the new bridge to the west would have a significant impact to the property located on the northwest side of the bridge. Constructing a new bridge on a new alignment to the east requires the replacement bridge be 40'+/- longer than the existing bridge due to the widening of the Tankerhoosen River east of the bridge. Maintaining traffic on the existing bridge would keep MPT costs to a minimum, however construction costs for the new off-line longer bridge with associated new realigned roadway approaches and ROW will have a higher construction cost.

Option 2: Constructing a temporary bridge to maintain traffic while the new bridge is being constructed at the same location of the existing bridge has some of the same similarities to Option 1. The temporary bridge would have to be located east of the existing bridge. It would require temporary easement to construct, maintain and remove when traffic is shifted back to the existing road and new bridge once completed. There would also be an increased cost for this temporary bridge along with a longer construction duration as two bridges would need to be constructed and demolished.

Option 3: Creating a detour route via construction of a temporary driveway access from Route 83 through one of the existing properties to the Main Street cul-de-sac will provide access to the 3 residences and the trail. This temporary access drive option was previously used successfully for the replacement of the truss bridge deck back in the 1990's (See ***Appendix G*** for previous contract plan depicting the temporary driveway). In reviewing the previous plans for the temporary driveway, we propose to follow the same route and driveway dimensions. This option will require temporary easements to allow for the construction of this temporary driveway and restoration when removed. The increased cost for this temporary driveway will be far less costly as compared to building a new bridge that is 40' longer than the existing or a second temporary bridge need to maintain traffic as described in Options 1 and 2 above.

4. SUBSTRUCTURE AND SUPERSTRUCTURE EVALUATION

Evaluated Alternatives

The primary goal of the project is to design a replacement so that the bridge has adequate load carrying capacity to meet current design standards and the condition of the bridge is rated to be in "Good" or better condition. Since the overall condition of the existing bridge is "Poor" and the structure is considered to be "functionally obsolete" with a

Sufficiency Rating of 48.2, only complete bridge replacement alternatives were studied.

During the development of project's scope of work it was agreed that a superstructure consisting of multiple steel beams with a reinforced concrete deck was the only structure type to be studied since it is the most viable structure type to accommodate the utilities under the bridge deck, to attach the existing historic trusses as fascia elements and to satisfy low chord hydraulic concerns. No other superstructure types were evaluated in this study. The selected bridge alternative will be certified that the bridge is capable of withstanding pressures, velocities, impact and uplift forces from a 100-year flood.

The following replacement alternatives were investigated:

1. Replacement Alternative 1: One-Lane Steel Multi-Beam Bridge with vehicle and pedestrian access on the existing alignment.

2. Replacement Alternative 2: Two-Lane Steel Multi-Beam Bridge with vehicle and pedestrian access on the existing alignment.

3. Replacement Alternative 3: Two-Lane Steel Multi-Beam Bridge with vehicle only access on a new alignment and a pedestrian bridge on the existing alignment.

Bridge Evaluation Methodology

The ability of a bridge to carry legal loads is determined from the minimum load rating capacity of its member components. The legal load for new bridge construction is an HL-93 design vehicle (see Figure 1) according to the AASHTO LRFD Design Specifications. The HL-93 loading comprises of:

a) Design Truck or Design Tandem whichever produces maximum forces; combined with
b) Design Lane Load

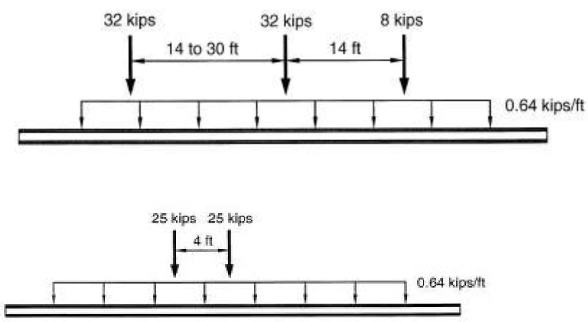
The Design Truck is a 3-axle 28 to 44 foot long vehicle weighing 36 tons while the Design Tandem is a 2-axle 4 foot long vehicle weighing 25 Tons. The Design Lane load is a uniform load of 640 pounds/feet applied in combination with the aforementioned loads.

The governing load ratings are calculated at two levels, Inventory and Operating. The **Inventory Rating** represents an allowable live load that can safely use the bridge for an "indefinite" period of time. The **Operating Rating** describes the "maximum" permissible live load to which the bridge may be subjected. Unlimited usage of the bridge by vehicles at the Operating level will shorten the useful life of the structure. The **Inventory Rating** Factor for a member is obtained by subtracting the dead load effects on the member from the member capacity and dividing the results by the effects of the HL-93 live loads. The calculated dead loads are increased by 25% (components and attachments to the bridge) to 50% (wearing surface on the bridge) while the live loads are increased by 75% to account for uncertainties.

In summary,

$$\textit{Inventory Rating Factor} = \frac{\textit{Member Capacity} - 1.25 \text{ to } 1.50 * (\textit{Dead Loads})}{1.75 * (\textit{Live Loads})}$$

An ***Inventory Rating Factor*** greater than or equal to 1.0 indicates ability of the member to safely carry the HL-93 legal load. Therefore all load carrying components of the bridge including the main beams are designed with an ***Inventory Rating Factor*** greater than or equal to 1.0.



Design Truck + Lane Load

Design Tandem + Lane Load

Figure 1 – AASHTO HL-93 Vehicle

Proposed Bridge Replacement

Replacement Alternative 1: One Lane Bridge (On Line)

This alternative proposes the replacement of the existing bridge with a steel multi-beam bridge with an alternating one-way travel lane on the existing alignment to carry vehicular and pedestrian traffic.

A 55.5 ft. wide clear channel opening, matching the existing opening, would require a 62'-6" span bridge. The proposed bridge width will carry one (1) 12'-0" wide travel lane and a 5'-6" wide sidewalk along the east side. The proposed 12'-0" wide roadway would follow the proposed approach width. New cast-in-place concrete abutments would be constructed subsequent to the removal of existing bridge with the proposed foundations designed for maximum scoured conditions. To match the appearance of the existing channel walls, the new abutments will be faced with the existing stones saw cut to a 4" thick veneer of faced with a matching stone veneer. The existing stone walls adjacent to the proposed abutment would be removed in the construction area utilizing a system of cofferdams. The portion of the existing stone wall removed during construction of the abutments will be rebuilt prior to removal of the cofferdam.

The existing historic truss would be utilized in this alternative in an aesthetic capacity only as a façade on the proposed superstructure. The truss would not support any traffic or structural load from the superstructure other than its own self-weight. The trusses would be connected to the exterior girders and face of the deck superstructure to provide lateral stability for the trusses. The proposed abutments would extend a distance of 3'-0" beyond the edge of the superstructure on both sides and a pedestal placed at each end of the cap to support the historic truss.

A total of four (4) W30x132 rolled beams would support the reinforced concrete deck. The steel beams were designed utilizing Bentley Leap Bridge Steel structural analysis program for the dead loads due to its self-weight and weight of the proposed concrete deck, sidewalk, railing and wearing surface and live loads due to an AASHTO HL-93 design vehicle. A yield stress of 50 ksi was assumed in the analysis based on AASHTO M270 Grade 50 steel typically specified for structural steel. In order to avoid future maintenance associated with painted steel, galvanized steel would be utilized with an option to paint the fascia beams.

While a standard 8½" thick reinforced concrete deck made composite with the steel beams would be utilized to support the roadway, the sidewalk would be detailed with a 6" standard curb reveal to match the proposed approach. In order to maintain the existing overtopping conditions, an open rail would be used. A 9" high 1'-10" wide concrete base would support the rail. The low cord elevation varies with each alternate and is located at the east side of the south abutment. Wingwalls would be required to contain the embankments utilizing the existing low rubble stone retaining walls that would be preserved or reconstructed.

A reinforced cast-in-place concrete abutment stem and backwall would replace the substructure at each abutment location. A reinforced concrete spread footing on rock would support the abutments.

A General-Plan, Elevation and Cross-Section of the proposed bridge configuration is depicted in sketch SK-1 (***Appendix F***).

The following describes the proposed sequence to accomplish the construction:

- Temporarily shield/relocate aerial utilities and protect/support utilities attached to or near existing structure
- Detour traffic and close the bridge to vehicular and pedestrian traffic
- Install debris shield under the bridge and remove existing bridge superstructure
- Install cofferdam around existing abutments and:
    - Divert water to the existing center channel and remove existing abutments and a portion of the existing stone retaining wall, complete excavation work and construct new abutments & rebuild existing stone retaining wall in the dry
- Remove installed cofferdams
- Erect steel beams on new abutments
- Construct concrete bridge deck, approach slabs and sidewalk
- Place waterproofing membrane and bituminous concrete wearing surface on bridge deck and approach slabs
- Construct sidewalk, rail base, and open rail system
- Attach historic truss to superstructure
- Complete approach roadway work
- Remove all barriers and open bridge to vehicular and pedestrian traffic

It is anticipated that the proposed construction can be accomplished in one construction season (9 months). The proposed replacement (Year 2017 pricing) is estimated at $2,440,000 in the construction cost estimate (see ***Appendix D***).

Replacement Alternative 2: Two Lane Bridge (On Line)

This alternative proposes the replacement of the existing bridge with a two-lane steel multi-beam bridge on the existing alignment to carry vehicular and pedestrian traffic.

A 58.4 ft. wide clear channel opening, exceeding the existing opening, would require a 65'-6" span bridge. The proposed bridge width will carry two (2) 12'-0" wide travel lanes and a 5'-6" wide sidewalk along the east side. The proposed 24'-0" wide roadway would follow the proposed approach width. New cast-in-place concrete abutments with matching stone veneer would be constructed subsequent to the removal of existing bridge with the proposed foundations designed for maximum scoured conditions. The existing stone walls adjacent to the proposed abutment would be removed in the construction area utilizing a system of cofferdams. The portion of the existing stone wall removed during construction of the abutments will be rebuilt prior to removal of the cofferdam.

The existing historic truss would be utilized in this alternative in an aesthetic capacity only as a façade on the proposed superstructure. The truss would not support any traffic or structural load from the superstructure other than its own self-weight. The span length of the proposed bridge is greater than the existing truss length, therefore, the truss cannot be supported on the abutment. The truss would be centered within the span and would be connected to the exterior girders and face of the deck superstructure to provide lateral stability for the trusses.

A total of six (6) W30x148 rolled beams would support the reinforced concrete deck. The steel beams were designed utilizing Bentley Leap Bridge Steel structural analysis program for the dead loads due to its self-weight and weight of the proposed concrete deck, sidewalk, railing and wearing surface and live loads due to an AASHTO HL-93 design vehicle. A yield stress of 50ksi was assumed in the analysis based on AASHTO M270 Grade 50 steel typically specified for structural steel. In order to avoid future maintenance associated with painted steel, galvanized steel would be utilized.

While a standard 8½" thick reinforced concrete deck made composite with the steel beams would be utilized to support the roadway, the sidewalk would be detailed with a 6" standard curb reveal to match the proposed approach. In order to maintain the existing overtopping conditions, an open rail would be used. A 9" high 1'-10" wide concrete base would support the rail. The low cord elevation varies with each alternate and is located at the east side of the south abutment. Wing walls would be required to contain the embankments utilizing the existing low rubble stone retaining walls that would be preserved or reconstructed.

A reinforced cast-in-place concrete abutment stem and backwall would replace the substructure at each abutment location. A reinforced concrete spread footing on rock would support the abutments.

A General-Plan, Elevation and Cross-Section of the proposed bridge configuration is depicted in sketch SK-2 (***Appendix F***).

The following describes the proposed sequence to accomplish the construction:

- Temporarily shield/relocate aerial utilities and protect/support utilities attached to or near existing structure
- Detour traffic and close the bridge to vehicular and pedestrian traffic
- Install debris shield under the bridge and remove existing bridge superstructure
- Install cofferdam around existing abutments and:
  - Divert water to the existing center channel and remove existing abutments and a portion of the existing stone retaining wall, complete excavation work and construct new abutments & rebuild existing stone retaining wall in the dry
- Remove installed cofferdams
- Erect steel beams on new abutments
- Construct concrete bridge deck, approach slabs and sidewalk
- Place waterproofing membrane and bituminous concrete wearing surface on bridge deck and approach slabs
- Construct sidewalk, rail base, and open rail system
- Attach historic truss to superstructure
- Complete approach roadway work
- Remove all barriers and open bridge to vehicular and pedestrian traffic

It is anticipated that the proposed construction can be accomplished in one construction season (9 months). The proposed replacement (Year 2017 pricing) is estimated at $3,050,000 in the construction cost estimate (see ***Appendix D***).

Replacement Alternative 3: Two Lane Bridge (Off Line), w/ Separate Pedestrian Bridge

This alternative proposes the replacement of the existing bridge with a pedestrian bridge on the existing alignment and a two-lane steel multi-beam bridge on a new alignment to carry vehicular traffic only.

Pedestrian Bridge

The existing 61'-0" span historic pony trusses will be rehabilitated for use as a pedestrian bridge while maintaining the existing 55.5 ft. wide clear channel opening. The proposed pedestrian bridge width will carry one (1) 8'-0" wide timber deck sidewalk. A 9" wide timber curb would support a pedestrian rail on each side of the sidewalk. New cast-in-place concrete abutments with matching stone veneer would be constructed subsequent to the removal of existing bridge with the proposed foundations designed for maximum scoured conditions. The existing stone walls adjacent to the proposed abutment would be removed in the construction area utilizing a system of cofferdams. The portion of the existing stone wall removed during construction of the abutments will be rebuilt prior to removal of the cofferdam.

The pedestrian bridge would utilize the historic lenticular pony trusses as primary load carrying members. The lenticular truss would be analyzed, repaired, cleaned and painted prior to the attachment of new floorbeams, creating the truss system. The trusses would support pedestrian live load only in addition to its own self-weight. No vehicle access is assumed on the pedestrian bridge. The proposed deck system would consist of four (4) new W12x35 rolled beams as stringers and timber decking. The proposed abutments would support the historic trusses.

A reinforced cast-in-place concrete abutment stem and backwall would replace the substructure at each abutment location. A reinforced concrete spread footing on rock would support the abutments.

Vehicular Bridge

A 101'-6" span vehicle-only bridge would be constructed on a new alignment adjacent and east of the reconstructed pedestrian bridge. The proposed bridge width will carry two (2) 12'-0" wide travel lanes with the proposed 24'-0" wide roadway following the proposed new roadway approach width. New cast-in-place concrete abutments with matching stone veneer would be constructed with the proposed foundations designed for maximum scoured conditions. The existing stone walls adjacent to the proposed abutment would be removed in the construction area utilizing a system of cofferdams. The portion of the existing stone wall removed during construction of the abutments will be rebuilt prior to removal of the cofferdam.

A total of five (5) steel plate girders with 48" web depth would support the reinforced concrete deck. The steel beams were designed utilizing Bentley Leap Bridge Steel structural analysis program for the dead loads due to its self-weight and weight of the proposed concrete deck, railing and wearing surface and live loads due to an AASHTO HL-93 design vehicle. A yield stress of 50 ksi was assumed in the analysis based on AASHTO M270 Grade 50 steel typically specified for structural steel. In order to avoid future maintenance associated with painted steel, galvanized steel would be utilized.

A standard 8½" thick reinforced concrete deck made composite with the steel beams would be utilized to support the roadway and the wearing surface and rails. In order to maintain the existing overtopping conditions, an open rail would be used. A 9" high 1'-10" wide concrete base would support the rail. The low cord elevation varies with each alternate and is located at the east side of the south abutment. Wing walls would be required to contain the embankments utilizing the existing low rubble stone retaining walls that would be preserved or reconstructed.

A reinforced cast-in-place concrete abutment stem and backwall would replace the substructure at each abutment location. A reinforced concrete spread footing on rock would support the abutments.

A General-Plan, Elevation and Cross-Section of the proposed bridge configuration is depicted in sketches SK-3 & SK-4 (***Appendix F***).

The following describes the proposed sequence to accomplish the construction:

- Maintain traffic on the existing bridge while constructing the new vehicular bridge on a parallel alignment.

- Temporarily shield/relocate aerial utilities and protect/support utilities in the proposed structure construction limits.
- Install cofferdam around proposed abutment locations.
  - Divert water to the existing channel and remove a portion of the existing stone retaining walls, complete excavation work, construct new abutments and rebuild existing stone retaining wall in the dry.
- Remove installed cofferdams
- Erect steel plate girder superstructure on new abutments.
- Construct concrete bridge deck, and approach slabs.
- Place waterproofing membrane and bituminous concrete wearing surface on bridge deck and approach slabs.
- Construct open metal bridge rail system.
- Complete approach roadway work.
- Remove all barriers and open bridge to vehicular traffic.
- Close and barricade the existing bridge to all traffic.
- Temporarily shield/relocate aerial utilities and protect/support utilities attached to or near existing structure.
- Install debris shield under the bridge and remove existing bridge superstructure, carefully removing, cleaning, repairing, coating and storing the existing historic trusses for re-use in the new pedestrian bridge.
- Install cofferdam around existing abutments and:
  - Divert water to the existing center channel and remove existing abutments and a portion of the existing stone retaining wall, complete excavation work and construct new abutments & rebuild existing stone retaining wall in the dry.
- Remove installed cofferdams.
- Erect the refurbished historic trusses on new abutments with temporary supports as necessary.
- Erect the new floor beams and stringers on the historic trusses.
- Construct concrete approach slabs.
- Construct timber bridge deck and curbs.
- Construct pedestrian metal handrail system.
- Remove all barriers and open bridge to pedestrian traffic.

It is anticipated that the proposed construction can be accomplished in two construction seasons (18 months). The proposed replacement (Year 2017 pricing) is estimated at $4,220,000 in the construction cost estimate (see ***Appendix D***).

5. HYDROLOGY, HYDRAULIC AND SCOUR EVALUATIONS

A Hydrologic Report was submitted in June 2016 under separate cover and approved by CTDOT on June 21, 2016. A Summary Memorandum of Preliminary Hydraulic Findings and Qualitative Scour Assessment is being submitted concurrently with this report.

Water surface profiles for the subject reach of the Tankerhoosen River were revised by the Federal Emergency Management Agency on August 9, 1999, for the Town of Vernon, Tolland County Flood Insurance Study (FIS). In order to evaluate the impacts the proposed work will have on the water surface elevations in the vicinity of Main Street, a hydraulic model of the river was developed by Dewberry.

The HEC-RAS 4.1.0 computer program was used to develop the hydraulic model. In accordance with the scope of work, the 2, 10, 25, 50, 100, and 500 year storms were modeled using the peak flows listed in the approved Hydrologic Report. The following table summarizes the recommended design flows, which were used in the Existing Condition Model (ECM) and Proposed Condition Model (PCM) models, as well as the Flood Insurance Study (FIS) flows, which are used in the regulatory floodway analysis.

Table 1: Approved Design Flows at the Main Street Bridge

Storm (year)	Design Flow (cfs)
2	741
10	1,394
25	1,771
50	2,122
100	2,505
500	4,025

Table 2: FEMA FIS Flows

Storm (year)	Flow (cfs)
10	1,394
100	2,505

For all proposed conditions, an open steel rail system similar to the one that exists today is included in the design. This rail is not modeled as an obstruction. Additionally, Alternatives 1 & 2 involve the reuse of the existing historic lenticular truss as an aesthetic treatment only, and Alternative 3 utilizes the trusses as a pedestrian bridge. Like the existing condition, the truss floor beams from these alternatives are not included. All other geometric features, flows and boundary conditions from the ECM are the same for the PCM.

The following alternatives are investigated:

1. Alternative 1: Steel Multi-Beam Bridge – One 12’ lane and 5’-6” sidewalk.
2. Alternative 2: Steel Multi-Beam Bridge –Two 12’ lanes and 5’-6” sidewalk.
3. Alternative 3: Steel Multi-Beam Bridge – Two 12’ lanes and 8’-0” pedestrian bridge.

A field visit was conducted to assess the condition of the Tankerhoosen River and to evaluate the potential for scour at the bridge. No scour was evident along the abutments. The Bridge Inspection Report (by Infrastructure Engineers, 11/20/2015) noted areas of degradation and aggradation of up to 1.5’, however the variation is not having an effect on the substructure. The soil borings taken at the bridge indicate bedrock at or above the bottom of the channel and below the anticipated footing elevations. Depending on the proposed foundation design, scour may be a factor in determining the depth of the bridge foundation. A quantitative scour analysis will be performed during the final design phase of the project.

6. PRELIMINARY FOUNDATION REPORT

A Preliminary Foundation Report Memorandum is being submitted concurrently with this report. The following narrative is a summary of aforementioned report. Please refer to the Preliminary Foundation Report Memorandum for further information.

A subsurface investigation program consisting of two (2) borings were drilled by New England Boring Contractors, Inc. of Glastonbury, Connecticut at the subject bridge on November 30, 2016. One boring was drilled on the north and south side of the bridge respectively.

The borings typically encountered 2 inches of asphalt, which was underlain by red-brown, loose to very dense coarse to fine sand with varying amounts of medium to fine gravel and silt. This layer was encountered to depths varying between 15 ft. and 25 ft. (El. 195 to El.185.5) below roadway grade. Very dense gravel was encountered below the sand layer and extended to depths varying between 18 ft. and 30 ft. (El. 192 to El. 180.5). The gravel layer was then underlain by highly weathered, closely jointed conglomerate bedrock that extended to the bottom of borings.

Groundwater was observed at a depth ranging from 9.5 to 10 feet (El. 200.5) in both borings.

Based on the results of the subsurface investigation and the estimated depth of scour, it is anticipated that conventional spread footings may be suitable for the support of the proposed abutment and wingwall foundations. Spread footings for the south abutment must be constructed at or below El. 185.5 in the very dense gravel stratum. It is recommended that spread footings for the north abutment be founded on rock at or below El. 192.

Provided footings are constructed at these elevations, a factored bearing resistance of 6 ksf (3 tsf) is preliminarily recommended for the design of the proposed foundations. Settlement of spread footings on rock will be less than ¼ in. and will be complete at the end of construction. Settlement of spread footings on very dense gravel will be less than ½ in. and will be complete at the end of construction.

7. ALTERNATE TRANSPORTATION MODES

There are no existing pedestrian or bicycle accommodations on the bridge or Main Street from the project limits to the Elm Hill Road intersection. Although Main Street is classified as an "Urban Local Road" with an ADT of approximately 20 vehicles per day, this section of Main Street ends in a cul-de-sac and provides access to three (3) residents and to the Hop River State Park Trail. For this reason, this project does not plan to propose pedestrian facilities.

8. RIGHTS OF WAY

The existing Main Street ROW varies in width from approximately 30 feet to 75 feet within the projects limits. Land on the west side of Main Street is bound by 3 private properties and the I-84 ROW. On the east side, the ROW is bound by one private property and the land owned by the State of Connecticut within the limits of the project.

Replacing the existing vehicular bridge in its existing location (Alternates 1 & 2) will not require any ROW acquisition. However, temporary easements will be required for either maintaining traffic via a temporary bridge or temporary access driveway through a private property (see Option 2 & 3 under Traffic Control section above).

The temporary easements required for construction of the temporary bridge option will require approximately 0.16Ac of temporary easements from the State of Connecticut. The temporary driveway from Main Street to Route 83 will require approximately 0.094Ac of temporary easements from one private property and 0.08AC of temporary easements from the adjacent I-84 ROW.

Realigning Main Street and constructing a new replacement vehicular bridge to the east (Alternate 3) will require permanent ROW acquisition, not only for the new bridge but also for the realigned roadway approaches. This off-line replacement bridge will require approximately 0.16 AC of ROW acquisition from the State of Connecticut.

The schedule of property owners and title roll plan can be found in ***Appendix H***.

9. NOISE/AIR IMPACTS AND DESIGN FEATURES

No significant change in the vehicular traffic is anticipated after completion of this project. There will be a temporary increase in the noise levels during construction.

10. DRAINAGE AND PERMITTING

There is no history of flooding at the project site. The profile of the proposed road will be raised to provide additional free board between the new bridges low chord and water surface elevation.

Main Street currently maintains a bituminous lip curb with drainage inlets within the project limits. The existing bridge does not maintain a curb and stormwater from the bridge currently runs off into the river. For the new roadway approaches bituminous lip curb will be maintained and replaced as required and the new structure will have a brush curb which will convey the water to the roadway gutter system and eventually to an inlet and closed pipe. The proposed road will maintain its existing normal crown, thereby maintaining the general drainage pattern. The road profile will be adjusted to account for the deeper structure depth and hydraulic requirements. No new inlets or outfalls will be required. Given that the drainage patterns will remain the same, a drainage analysis will not be performed.

a. Preliminary Drainage Issues – No issues are anticipated.

b. Water resource impacts – No impacts are anticipated.

c. Sedimentation and Erosion Control Measures – A silt fence will be provided along the toe of slopes during construction. Turbidity barrier will be used in the river to prevent sedimentation.

d. Permit Involvement – Not Applicable.

11. UTILITIES

There are several overhead utilities present along the east fascia of the existing bridge. These utilities include electric, telephone and cable. In addition, a gas main is supported on the existing bridge's west side fascia. The existing gas main will be relocated during construction under the deck of the new bridge. Due to the close proximity to the existing structure the aerial utilities will need to be temporarily/permanently relocated to allow for crane and equipment access to construct the new bridge. It is anticipated that the aerial line between the two (2) utility poles on each side of the river will be impacted with the proposed construction activities. These poles are identified for each alternative in drawings HWY-02, HHWY-04 and HWY-06 in ***Appendix C***.

12. LANDSCAPING

Invasive vegetation, if present, within project limits will be removed. Construction of the new bridge may require the removal of several trees to facilitate construction; however, construction impacts will be limited to the extent possible to minimize impacts.

13. SUMMARY OF FINDINGS

As discussed previously, the various options of Traffic Control have a direct impact on the geometric roadway alignment, right of way acquisition, construction cost and hydraulics. Based on keeping the construction duration and construction costs to a minimum we recommend that

Option 3 for maintaining traffic during construction utilizing a temporary driveway access from Route 83 through one of the existing properties to the Main Street cul-de-sac be progressed to final design. Temporary easements for the temporary driveway will be required from one property owner and the State of Connecticut for encroachment into the I-84 existing ROW. Therefore the replacement vehicular bridge for Alternatives 1 & 2 can be constructed in the same location as the existing resulting in no permanent ROW acquisition. Alternative 3 will require permanent ROW acquisition due to constructing a new replacement vehicular bridge to the east of existing.

Steel Multi-Beam Bridge construction cost estimates have been prepared only utilizing Traffic Control Option 3 with a temporary driveway and are summarized below and attached in ***Appendix D.***

Alternative 1: One 12’ lane and 5’-6” sidewalk
Construction Cost: $2,440,000
Construction Duration: 9 months

Alternative 2: Two 12’ lanes and 5’-6” sidewalk
Construction Cost: $3,050,000
Construction Duration: 9 months

Alternative 3: Two 12’ lanes and separate 8’-0” pedestrian bridge
Construction Cost: $4,220,000
Construction Duration: 18 months

Hydraulic performance for Alternatives 1, 2 and 3 for the 2, 10, 25, 50, 100 and 500 year water surface profiles has no increases to the existing water surface elevations.

The drawings HWY-02, HWY-04 and HWY-06 (***Appendix C***) depict the roadway plans for each alternative. The typical section proposed for each alternative is depicted on drawing HWY-01 in ***Appendix C***. The profile for the proposed alignment for each alternative can be found on drawings HWY-03, HWY-05 and HWY-07 in ***Appendix C***.

There is no existing sidewalk located along the bridge or roadway on Main Street, and no sidewalk will be proposed at this time on the roadway, however a sidewalk will be provided across the waterway.

A comparison of existing and proposed roadway design elements with the current Design Standards specified in the CTDOT HDM is tabulated for each alternative in the Design Elements Table in ***Appendix B.***

Since all three alternative configurations utilizing MPT Option 3 are viable alternatives that will service the residents and Hop River State Park Trail, a decision by the Town and stakeholders must strike a balance between overall construction costs, construction duration, roadway width and the impacts to historic resources when selecting the preferred alternative to advance in Final Design and ultimately Construction.

Appendix A

Photos

Photo 1: Approach of bridge looking south.

Photo 2: Approach of bridge looking north.

Photo 3: Existing bridge looking east.

Photo 4: Existing bridge looking west.


Photo 5: Underside of superstructure looking south.


Photo 6: Elevation of south abutment.


Photo 7: Elevation of north abutment.


Photo 8: Elevation of southwest wingwall.

Photo 9: East elevation of lenticular pony truss.

Photo 10: Gas main supported on truss sidewalk floorbeams.

Photo 11: Typical truss bottom chord with eyebars.

Photo 12: Typical truss end post at abutment.

Appendix B

Design Elements Table

Appendix B: Design Elements Table

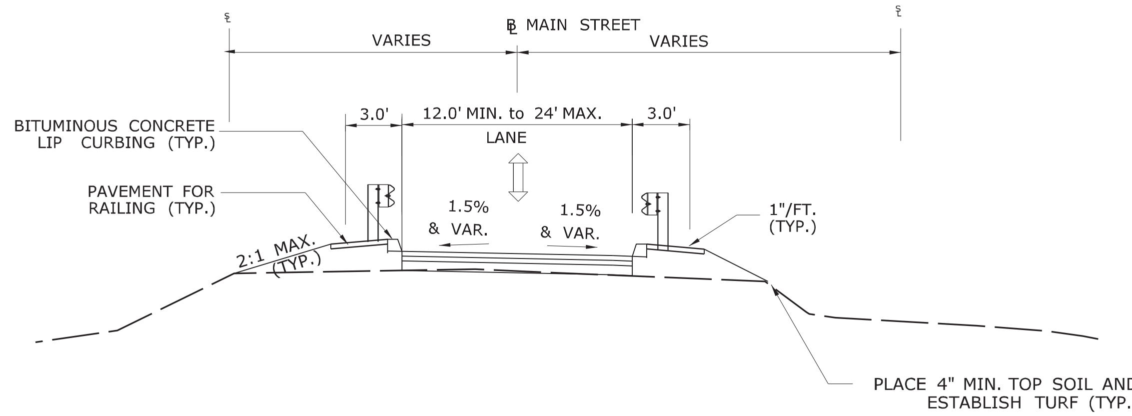
Design Element:	Design Standards	Existing	Proposed Alternative 1 Design	Proposed Alternative 2 Design	Proposed Alternative 3 Design
Design Speed	30 mph	30 mph	30 mph	30 mph	30 mph
Travel Lane Width	12 ft.				
Approach Road		10.0 -12.0 ft.	12 ft.	12 ft.	12 ft.
Bridge		15.0 ft.	12 ft. (1 Lane Bridge)	12 ft. (2 Lane Bridge)	12 ft. (2 lane Bridge)
Shoulder Width	2-4 ft.	0 ft.	0 ft.	0 ft.	0 ft.
Cross Slope					
Travel Lane	1.5-2.0%	Varies	1.5%	1.5%	1.5%
Shoulder	1.5-2.0%	N/A	N/A	N/A	N/A
Roadside Clear Zone	14 ft.	14 ft.	14 ft.	14 ft.	14 ft.
Minimum Radius of curvature	230 ft.	100 ft.	100 ft.*	100 ft.*	100 ft.*
Maximum Grade	10%	2.1%	2.1%	2.1%	1.6%
Minimum Grade	0.5%	0.2%	0.5%	0.5%	0.5%
Vertical Curvature (K value)					
Crest (min.)	19	15	N/A	N/A	29
Sag (min.)	37	26	17**	17**	26*
Stopping Sight Distance (Vertical)	200 ft.	<155ft	<155ft.	<155ft	<155ft.
Stopping Sight Distance (Horizontal)	200 ft.	100 ft.	100 ft.*	100 ft.*	100 ft.*

* Design exception will be sought for this criteria on the basis that this is a bridge replacement project and major roadway work is not feasible.

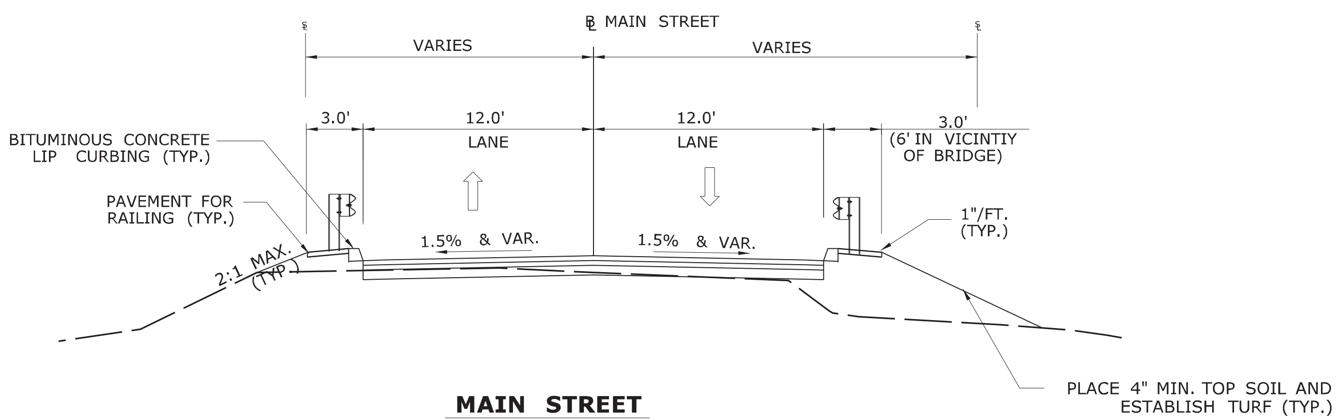
** Design exception will not be sought for this criteria as is occurs at the end of the Cul-de-sac where proposed profile is meeting existing ground and speed of vehicle will be extremely slow.

Appendix C

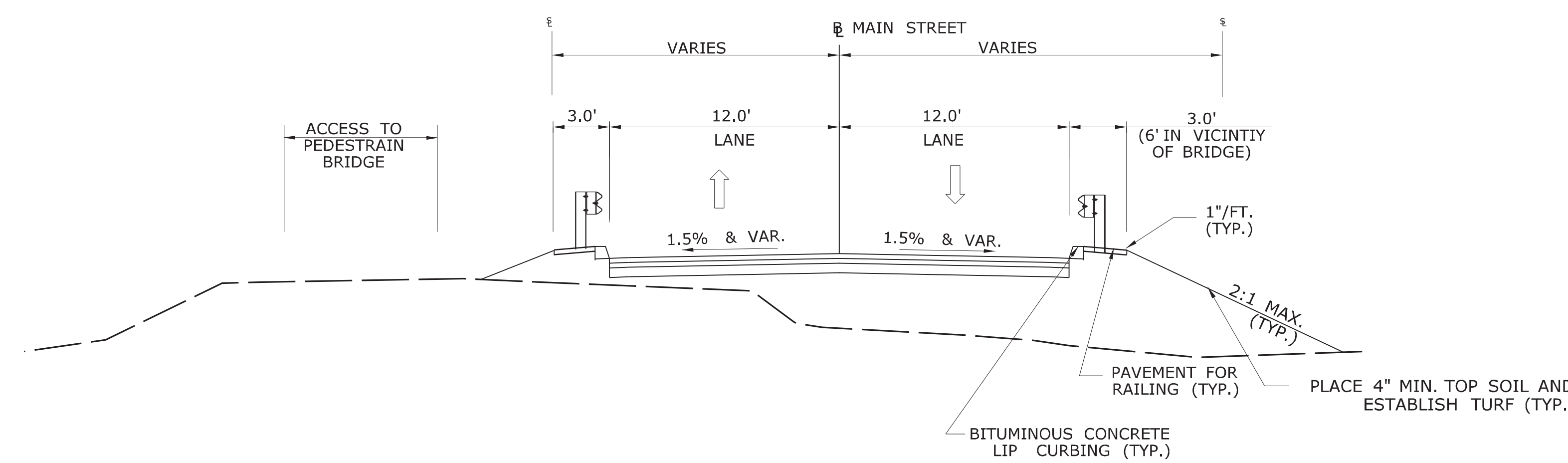
Roadway Typical Section, Plan and Profile



MAIN STREET
ALTERNATIVE 1
N.T.S.



MAIN STREET
ALTERNATIVE 2
N.T.S.



MAIN STREET
ALTERNATIVE 3
N.T.S.

PRELIMINARY DESIGN REVIEW

REV.	DATE	REVISION DESCRIPTION	SHEET NO.
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-	-	-	-

Plotted Date: 12/13/2016

DESIGNER/DRAFTER: **RBB/LAS**
CHECKED BY: **A.FULCO**
SCALE AS NOTED

TOWN OF VERNON
ENGINEERING DEPARTMENT

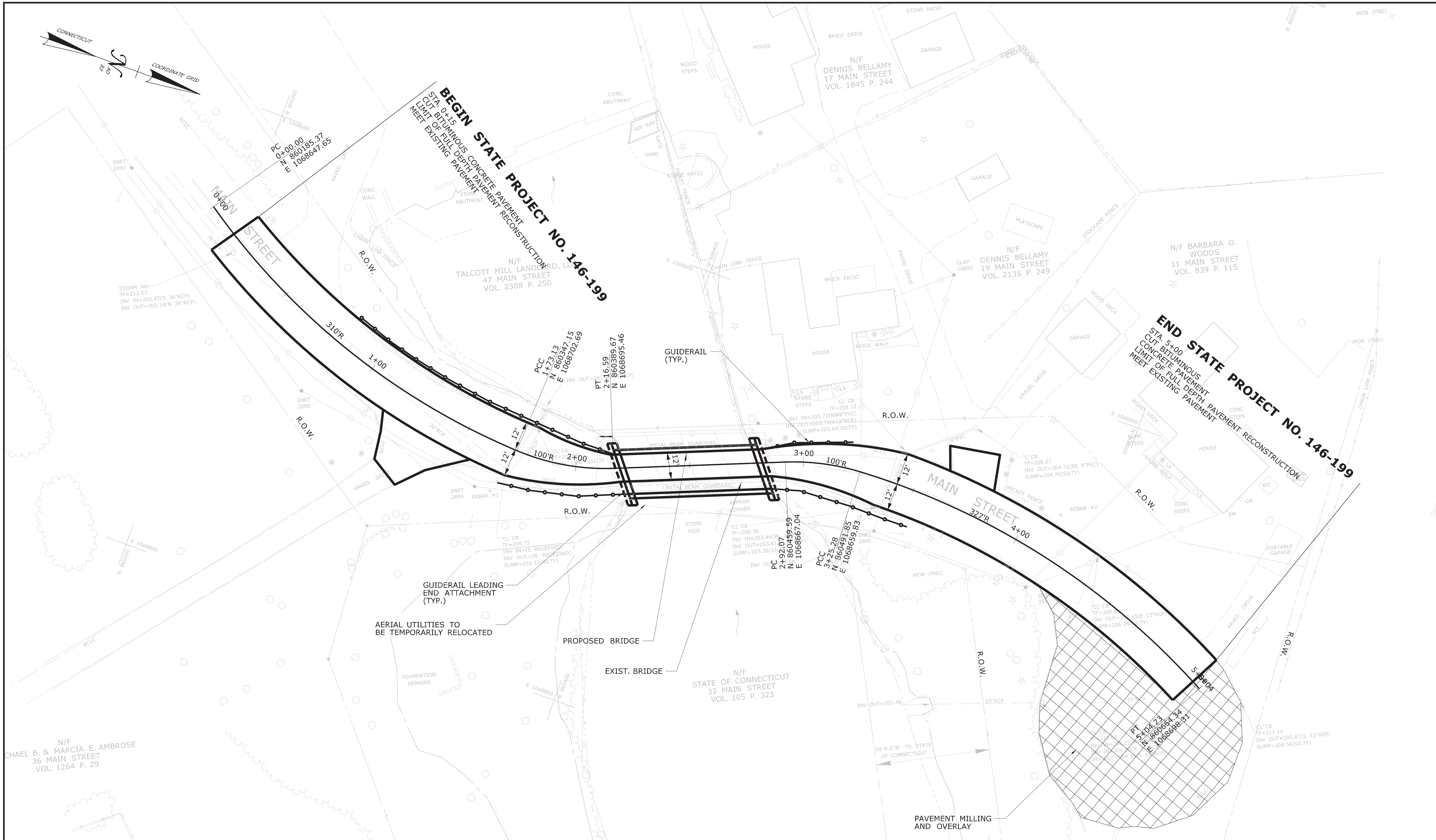
Filename: $FILEA$

SIGNATURE/
BLOCK:

PROJECT TITLE:
REPLACEMENT OF BRIDGE NO. 04575 MAIN STREET OVER TANKERHOOSEN RIVER

TOWN: **VERNON**
DRAWING TITLE: **TYPICAL SECTIONS**

PROJECT NO. **146-199**
DRAWING NO. **HWY-01**
SHEET NO. **01**



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Plotted Date: 12/13/2016

DESIGNER/DRAFTER: RBB/LAS

CHECKED BY: A.FULCO

SCALE AS NOTED

Filename: $FILEA$

TOWN OF VERNON
ENGINEERING DEPARTMENT

SIGNATURE/BLOCK:

PROJECT TITLE: REPLACEMENT OF BRIDGE NO. 04575 MAIN STREET OVER TANKERHOOSEN RIVER

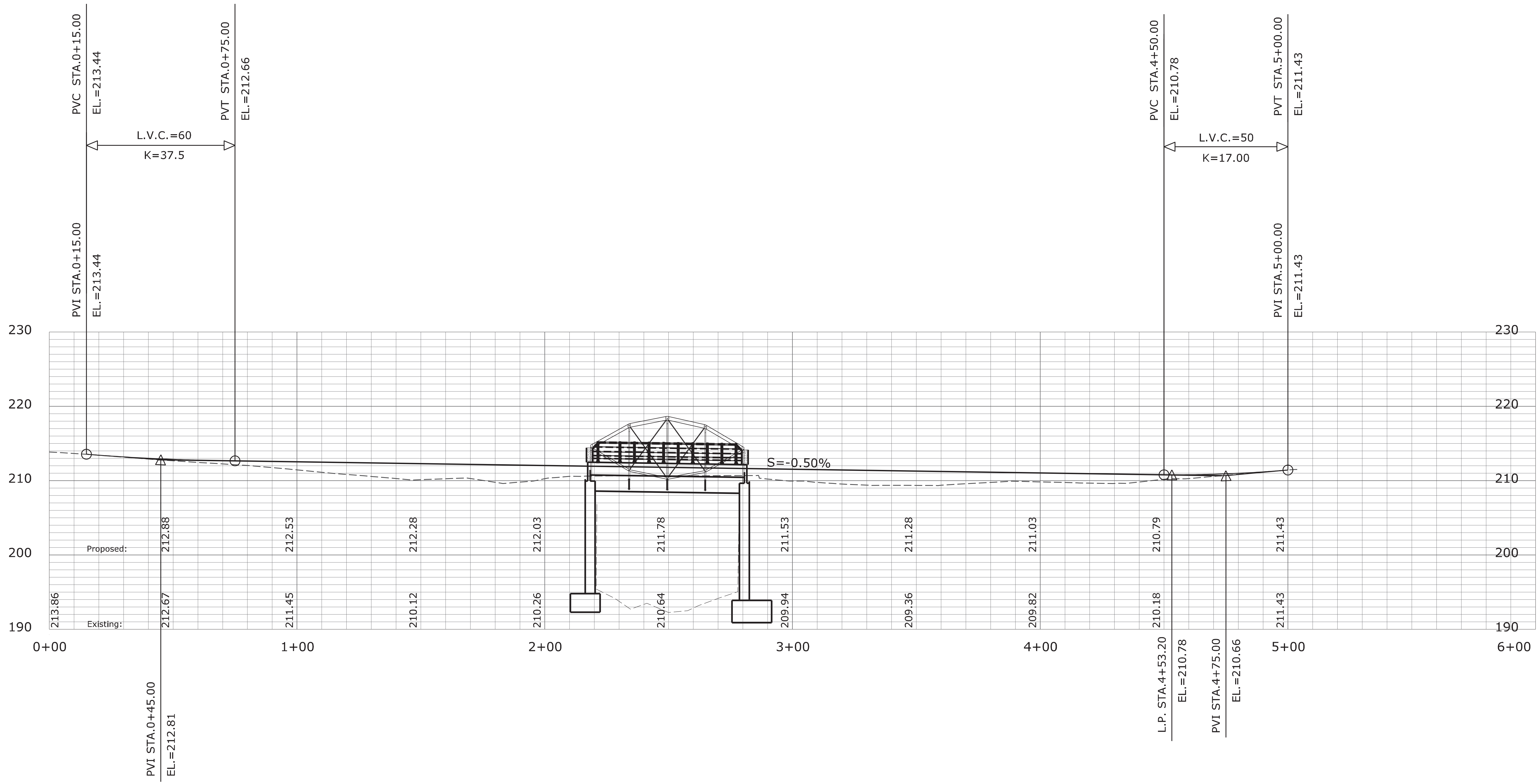
TOWN: VERNON

DRAWING TITLE: PLAN ALTERNATIVE 1

PROJECT NO. 146-199

DRAWING NO. HWY-02

SHEET NO. 02



ALTERNATIVE 1 PROFILE

PRELIMINARY DESIGN REVIEW

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Plotted Date: 12/13/2016

DESIGNER/DRAFTER: SA/KH
CHECKED BY: A.FULCO
SCALE AS NOTED

TOWN OF VERNON
ENGINEERING DEPARTMENT

Filename: $FILEA$

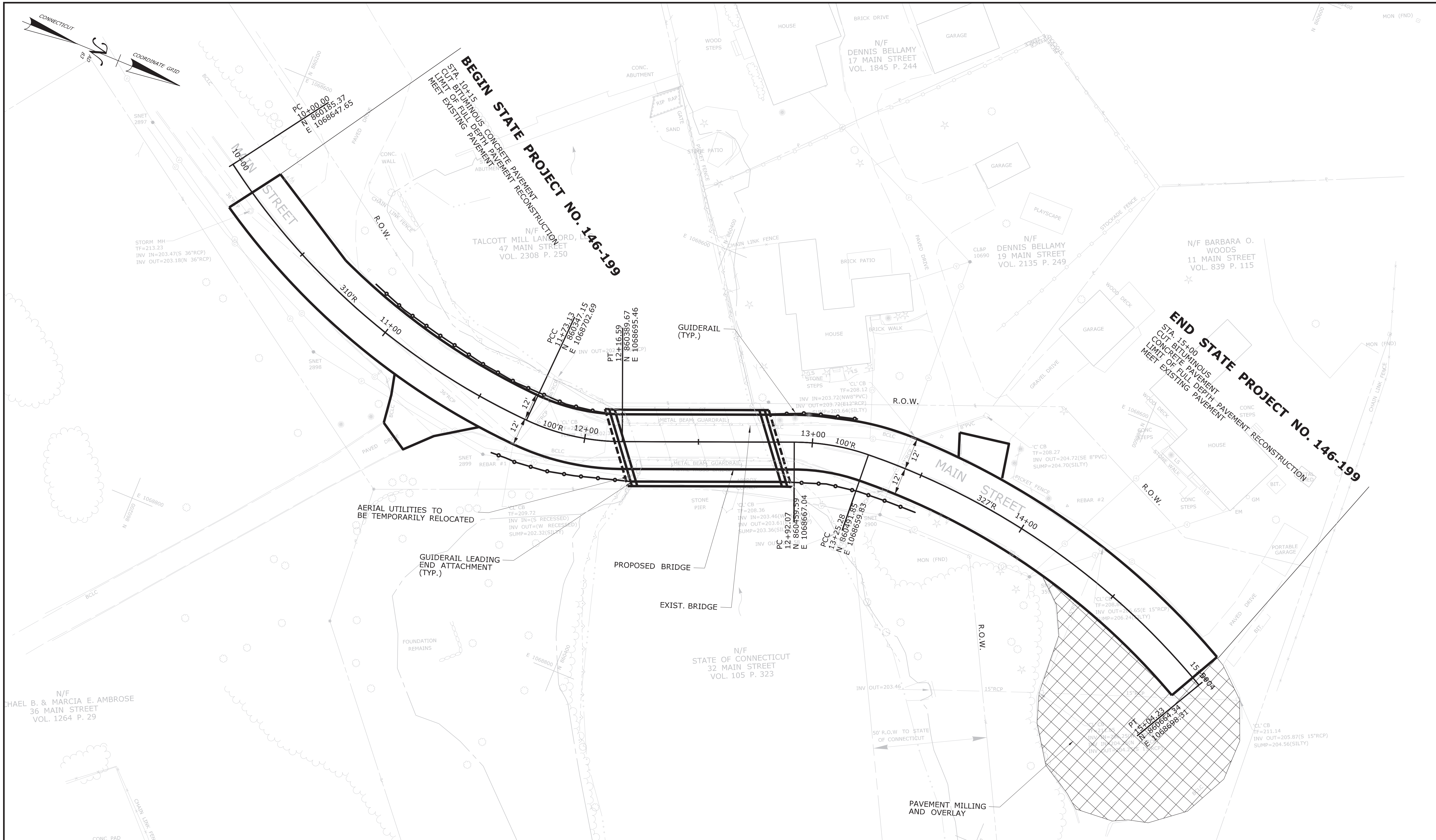
SIGNATURE/ BLOCK:

PROJECT TITLE: REPLACEMENT OF BRIDGE NO. 04575 MAIN STREET OVER TANKERHOOSEN RIVER

TOWN: VERNON

DRAWING TITLE: PROFILE

PROJECT NO. 146-199
DRAWING NO. HWY-03
SHEET NO. 03



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Plotted Date: 12/13/2016

DESIGNER/DRAFTER: RBB/LAS
CHECKED BY: A.FULCO
SCALE AS NOTED
Filename: $FILEA$

TOWN OF VERNON
ENGINEERING DEPARTMENT

SIGNATURE/BLOCK:

PROJECT TITLE:
REPLACEMENT OF BRIDGE NO. 04575 MAIN STREET OVER TANKERHOOSEN RIVER

TOWN: VERNON

DRAWING TITLE: PLAN ALTERNATIVE 2

PROJECT NO. 146-199
DRAWING NO. HWY-04
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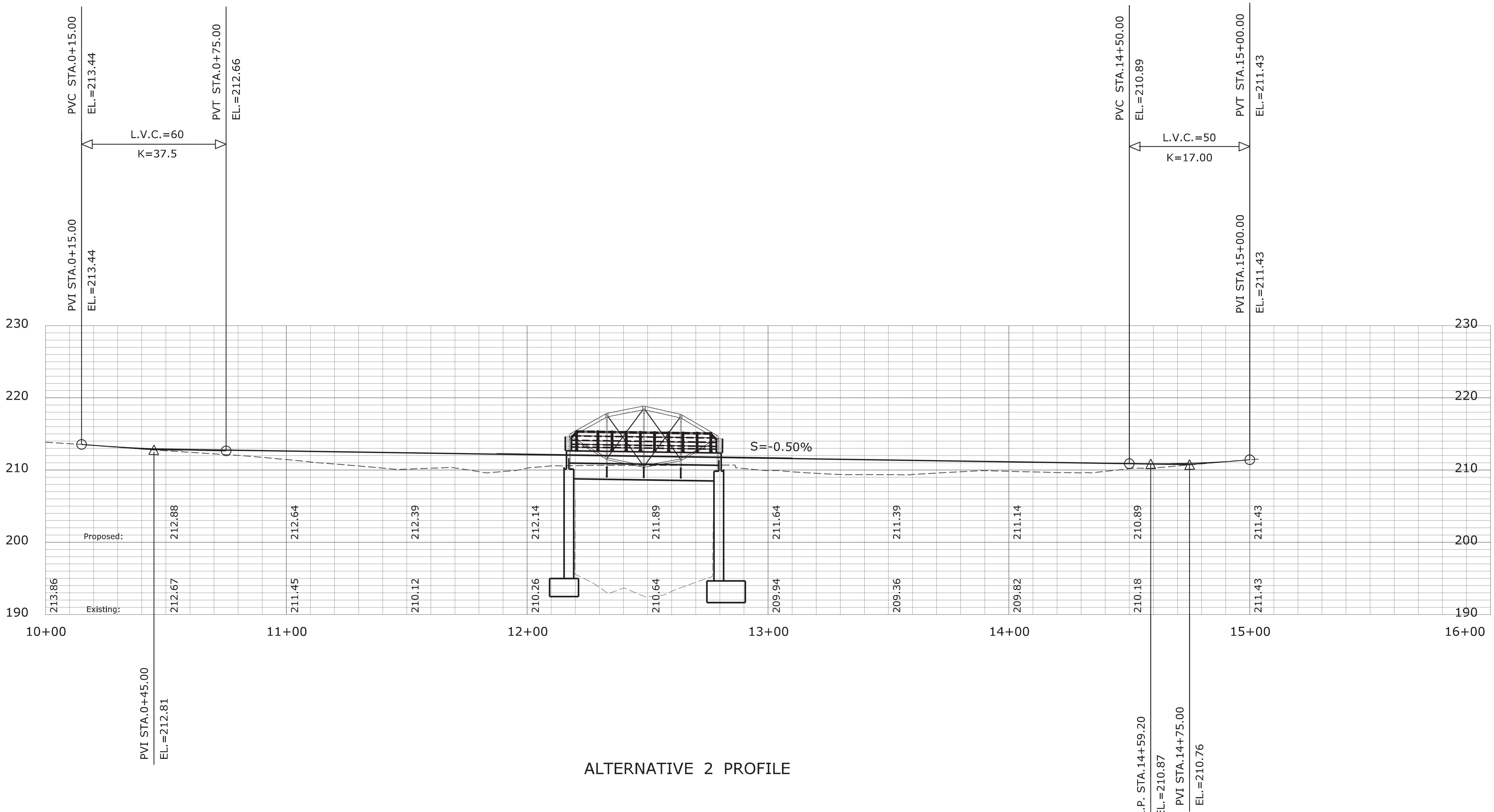

ALTERNATIVE 2 PROFILE

PRELIMINARY DESIGN REVIEW

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Plotted Date: 12/14/2016

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CHECKED BY: A.FULCO
SCALE AS NOTED

TOWN OF VERNON
ENGINEERING DEPARTMENT

Filename: $FILEA$

SIGNATURE/BLOCK:

PROJECT TITLE: REPLACEMENT OF BRIDGE NO. 04575 MAIN STREET OVER TANKERHOOSEN RIVER

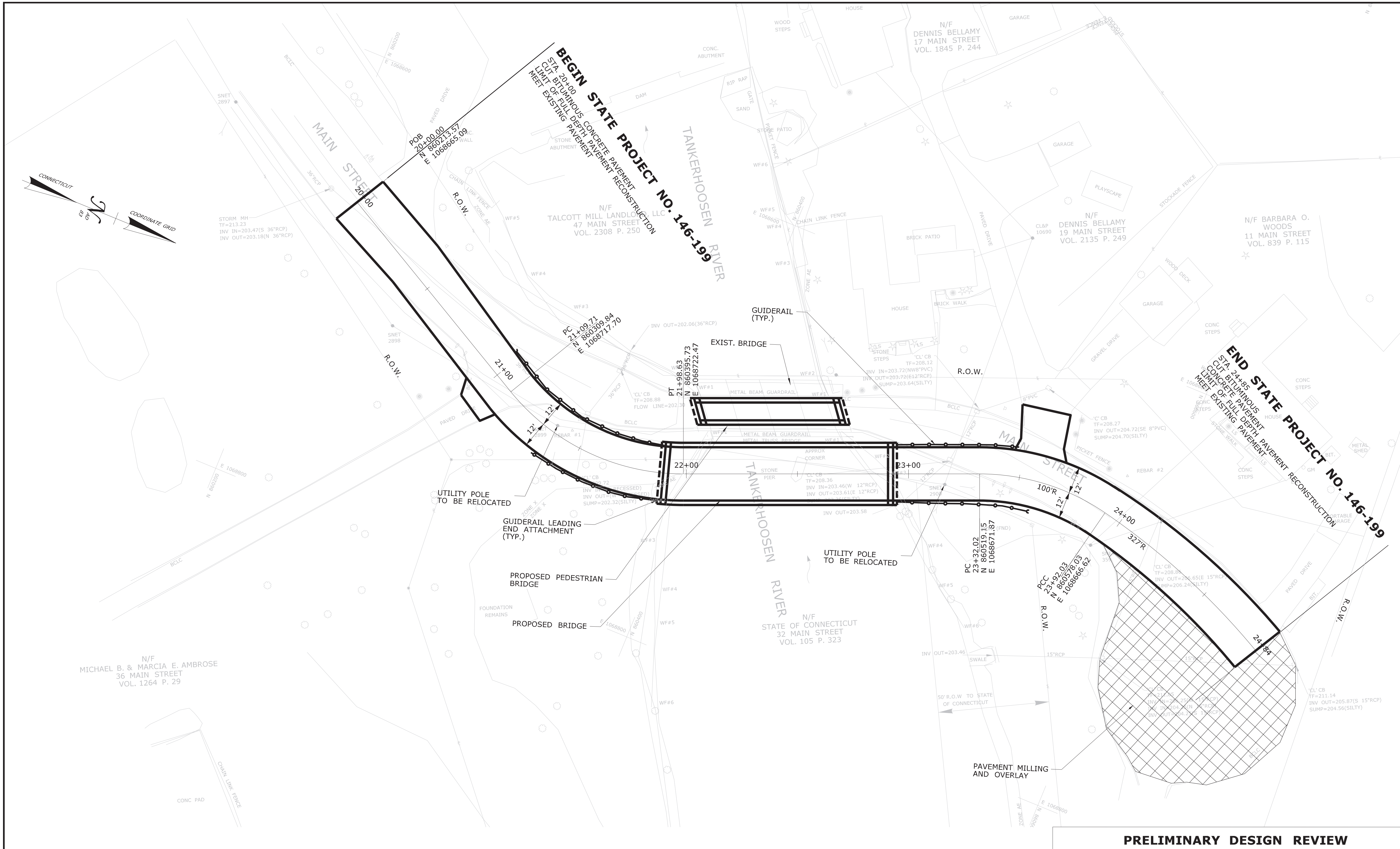
TOWN: VERNON

DRAWING TITLE: PROFILE

PROJECT NO. 146-199

DRAWING NO. HWY-05

SHEET NO. 05



PRELIMINARY DESIGN REVIEW

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Plotted Date: 12/13/2016

DESIGNER/DRAFTER: RBB/LAS
CHECKED BY: A.FULCO
SCALE AS NOTED

TOWN OF VERNON
ENGINEERING DEPARTMENT

Filename: $FILE$

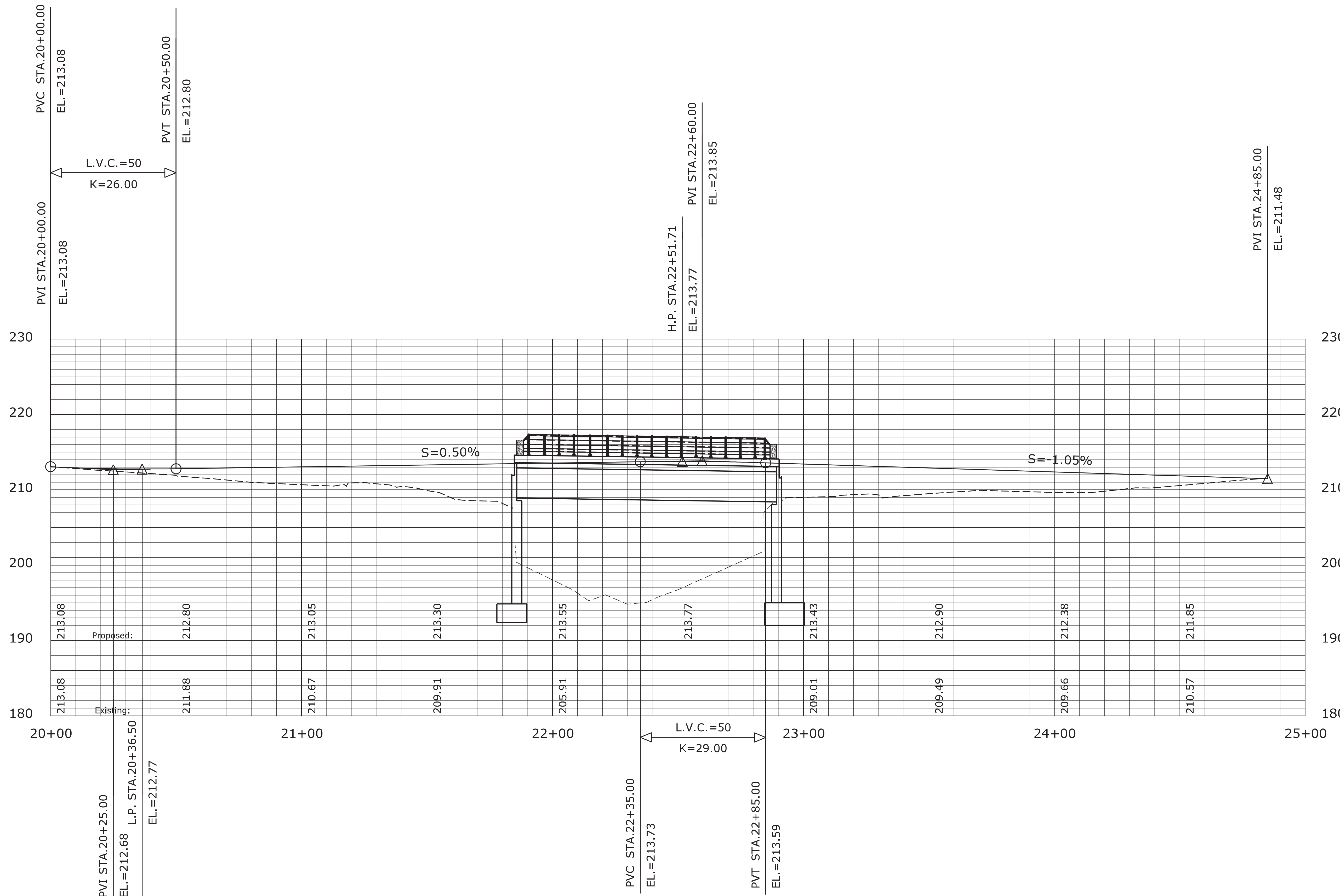
SIGNATURE/BLOCK:

PROJECT TITLE: REPLACEMENT OF BRIDGE NO. 04575 MAIN STREET OVER TANKERHOOSEN RIVER

TOWN: VERNON

DRAWING TITLE: PLAN ALTERNATIVE 3

PROJECT NO. 146-199
DRAWING NO. HWY-06
SHEET NO. 06



ALTERNATIVE 3 PROFILE

PRELIMINARY DESIGN REVIEW

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Plotted Date: 12/13/2016

DESIGNER/DRAFTER: SA/KH
CHECKED BY: A.FULCO
SCALE AS NOTED

TOWN OF VERNON
ENGINEERING DEPARTMENT

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PROJECT TITLE:
REPLACEMENT OF BRIDGE NO. 04575 MAIN STREET OVER TANKERHOOSEN RIVER

TOWN: VERNON
DRAWING TITLE: PROFILE

PROJECT NO. 146-199
DRAWING NO. HWY-07
SHEET NO. 07

Appendix D

Cost Estimate

Appendix D

Cost Estimate

PRELIMINARY ENGINEERING ESTIMATE

Replacement of Bridge No. 04575
Main Street over Tankerhoosen River
Vernon, Connecticut

State Project No. 146-199

Alternative 1: 12' Wide Steel Multi-Beam Bridge, Existing Alignment

ITEM	QUANTITY	UNIT	UNIT PRICE	AMOUNT
A. Roadway Items				
Earth Excavation	185	CY	$22.00	$4,070
Cut Bituminous Concrete Pavement	175	LF	$6.00	$1,050
Borrow	150	CY	$17.50	$2,625
Formation of Subgrade	1,100	SY	$5.00	$5,500
Sedimentation Control System	775	LF	$8.00	$6,200
Milling	700	SY	$8.00	$5,600
Processed Aggregate Base	275	CY	$45.00	$12,375
HMA S0.5	135	TON	$160.00	$21,600
HMA S0.375	220	TON	$140.00	$30,800
Material for Tack Coat	200	GAL.	$25.00	$5,000
Metal Beam Rail (Type R-B 350)	295	LF	$25.00	$7,375
R-B 350 Bridge Attachment - Vertical Shaped Parapet	4	EA	$2,600.00	$10,400
R-B End Anchorage - Type II	4	EA	$1,250.00	$5,000
Furnishing and Placing Top Soil	850	SY	$7.25	$6,163
Turf Establishment	850	SY	$3.00	$2,550
Pavement Markings	800	LF	$6.00	$4,800
Construction Field Office, Small	10	MO	$2,500.00	$25,000
Bituminous Concrete Driveway	125	SY	$40.00	$5,000
			Sub Total	**$161,108**
B. Structure Items				
Structure Excavation - Earth (Excluding Cofferdam and Dewatering)	980	CY	$20.00	$19,600
Cofferdam and Dewatering	216	LF	$450.00	$97,200
Temporary Earth Retaining System	1,500	SF	$20.00	$30,000
Removal of Existing Bridge	1,104	SF	$100.00	$110,400
Structural Steel	41,000	LBS	$5.00	$205,000
Galvanize Structural Steel	41,000	LBS	$0.60	$24,600
Class F Concrete (Superstructure)	76	CY	$1,150.00	$87,400
Class A Concrete (Substructure)	247	CY	$800.00	$197,600
Deformed Steel Bars (Epoxy Coated)	15,100	LBS	$1.65	$24,915
Deformed Steel Bars	34,000	LBS	$1.40	$47,600
Steel Laminated Elastomeric Bearings	8	EA.	$800.00	$6,400
Pervious Structure Backfill	148	CY	$56.00	$8,288
Membrane Waterproofing (Woven Glass Fabric)	137	SY	$115.00	$15,755
HMA Wearing Surface	22	TON	$210.00	$4,620
Open Bridge Rail (Pedestrian Rail)	114	LF	$320.00	$36,480
Carefully Remove, Clean, Coat, Store and Reinstall Historic Trusses	1	LS	$180,000.00	$180,000
Masonry Facing	530	SF	$105.00	$55,650
Rebuild Stone Walls	136	CY	$300.00	$40,800
Asphaltic Plug Expansion Joints	30	LF	$110.00	$3,300
			Sub Total	**$1,195,608**
C. Environmental Compliance Items				
Estimated Cost		EST	$40,000.00	**$40,000**
D. Traffic Items				
Traffic Person (Municipal Police Officer)	40	HR	$100.00	$4,000
Construction Signing	250	SF	$12.00	$3,000
Temporary Access Driveway	1	LS	$25,000.00	$25,000
Temporary Precast Concrete Barrier Curb	100	LF	$56.00	$5,600
Construction Barricade - Type III	4	EA	$140.00	$560
			Sub Total	**$38,160**
E. Minor Items (5% of Roadway, Structure and Traffic Items)		5%		**$69,744**
F. Lump Sum Items (Based on percentages of A-E)				
Cleaning & Grubbing		2%		**$30,092**
Mobilization		6.5%		**$97,800**
M&PT		2%		**$30,092**
Construction Staking		1%		**$15,046**
	CONSTRUCTION TOTAL			**$1,677,650**
			SAY	**$1,680,000**
G. Incidentals (25%) & Contingencies (20%)		45%		**$754,943**

TOTAL ESTIMATED COST (Year 2017) **$2,432,593**

Say **<u>$2,440,000</u>**

Dewberry

PRELIMINARY ENGINEERING ESTIMATE

Replacement of Bridge No. 04575
Main Street over Tankerhoosen River
Vernon, Connecticut

State Project No. 146-199

Alternative 2: 24' Wide Steel Multi-Beam Bridge, Existing Alignment

ITEM	QUANTITY	UNIT	UNIT PRICE	AMOUNT
A. Roadway Items				
Earth Excavation	215	CY	$22.00	$4,730
Cut Bituminous Concrete Pavement	175	LF	$6.00	$1,050
Borrow	200	CY	$17.50	$3,500
Formation of Subgrade	1,300	SY	$5.00	$6,500
Sedimentation Control System	775	LF	$8.00	$6,200
Milling	700	SY	$8.00	$5,600
Processed Aggregate Base	325	CY	$45.00	$14,625
HMA S0.5	150	TON	$160.00	$24,000
HMA S0.375	235	TON	$140.00	$32,900
Material for Tack Coat	240	GAL.	$25.00	$6,000
Metal Beam Rail (Type R-B 350)	295	LF	$25.00	$7,375
R-B 350 Bridge Attachment - Vertical Shaped Parapet	4	EA	$2,600.00	$10,400
R-B End Anchorage - Type II	4	EA	$1,250.00	$5,000
Furnishing and Placing Top Soil	1,000	SY	$7.25	$7,250
Turf Establishment	1,000	SY	$3.00	$3,000
Pavement Markings	800	LF	$6.00	$4,800
Construction Field Office, Small	10	MO	$2,500.00	$25,000
Bituminous Concrete Driveway	125	SY	$40.00	$5,000
			Sub Total	**$172,930**
B. Structure Items				
Structure Excavation - Earth (Excluding Cofferdam and Dewatering)	719	CY	$20.00	$14,380
Cofferdam and Dewatering	244	LF	$450.00	$109,800
Temporary Earth Retaining System	1,500	SF	$20.00	$30,000
Removal of Existing Bridge	1,104	SF	$100.00	$110,400
Structural Steel	70,400	LBS	$5.00	$352,000
Galvanize Structural Steel	70,400	LBS	$0.60	$42,240
Class F Concrete (Superstructure)	116	CY	$1,150.00	$133,400
Class A Concrete (Substructure)	302	CY	$800.00	$241,600
Deformed Steel Bars (Epoxy Coated)	23,200	LBS	$1.65	$38,280
Deformed Steel Bars	41,500	LBS	$1.40	$58,100
Steel Laminated Elastomeric Bearings	12	EA.	$800.00	$9,600
Pervious Structure Backfill	186	CY	$56.00	$10,416
Membrane Waterproofing (Woven Glass Fabric)	210	SY	$115.00	$24,150
HMA Wearing Surface	45	TON	$210.00	$9,450
Open Bridge Rail (Pedestrian Rail)	120	LF	$320.00	$38,400
Carefully Remove, Clean, Coat, Store and Reinstall Historic Trusses	1	LS	$180,000.00	$180,000
Masonry Facing	830	SF	$105.00	$87,150
Rebuild Stone Walls	136	CY	$350.00	$47,600
Asphaltic Plug Expansion Joints	60	LF	$110.00	$6,600
			Sub Total	**$1,543,566**
C. Environmental Compliance Items				
Estimated Cost		EST	$40,000.00	**$40,000**
D. Traffic Items				
Traffic Person (Municipal Police Officer)	40	HR	$100.00	$4,000
Construction Signing	250	SF	$12.00	$3,000
Temporary Access Driveway	1	LS	$25,000.00	$25,000
Temporary Precast Concrete Barrier Curb	100	LF	$56.00	$5,600
Construction Barricade - Type III	4	EA	$140.00	$560
			Sub Total	**$38,160**
E. Minor Items (5% of Roadway, Structure and Traffic Items)		5%		**$87,733**
F. Lump Sum Items (Based on percentages of A-E)				
Cleaning & Grubbing		2%		**$37,648**
Mobilization		6.5%		**$122,355**
M&PT		2%		**$37,648**
Construction Staking		1%		**$18,824**
		CONSTRUCTION TOTAL		**$2,098,864**
			SAY	**$2,100,000**
G. Incidentals (25%) & Contingencies (20%)		45%		**$944,489**

TOTAL ESTIMATED COST (Year 2017) **$3,043,352**

Say **<u>$3,050,000</u>**

Dewberry

PRELIMINARY ENGINEERING ESTIMATE

Replacement of Bridge No. 04575
Main Street over Tankerhoosen River
Vernon, Connecticut

State Project No. 146-199

Alternative 3: 24' Wide Steel Multi-Beam Bridge, New Alignment, Separate Pedestrian Bridge

ITEM	QUANTITY	UNIT	UNIT PRICE	AMOUNT
A. Roadway Items				
Earth Excavation	125	CY	$22.00	$2,750
Cut Bituminous Concrete Pavement	100	LF	$6.00	$600
Borrow	1,100	CY	$17.50	$19,250
Formation of Subgrade	1,000	SY	$5.00	$5,000
Sedimentation Control System	600	LF	$8.00	$4,800
Milling	700	SY	$8.00	$5,600
Processed Aggregate Base	250	CY	$45.00	$11,250
HMA S0.5	120	TON	$160.00	$19,200
HMA S0.375	200	TON	$140.00	$28,000
Material for Tack Coat	215	GAL.	$25.00	$5,375
Metal Beam Rail (Type R-B 350)	290	LF	$25.00	$7,250
R-B 350 Bridge Attachment - Vertical Shaped Parapet	4	EA	$2,600.00	$10,400
R-B End Anchorage - Type II	4	EA	$1,250.00	$5,000
Furnishing and Placing Top Soil	1,000	SY	$7.25	$7,250
Turf Establishment	1,000	SY	$3.00	$3,000
Pavement Markings	400	LF	$6.00	$2,400
Construction Field Office, Small	18	MO	$2,500.00	$45,000
Bituminous Concrete Driveway	100	SY	$40.00	$4,000
			Sub Total	**$186,125**
B. Structure Items				
Structure Excavation - Earth (Excluding Cofferdam and Dewatering)	1,650	CY	$20.00	$33,000
Cofferdam and Dewatering	320	LF	$450.00	$144,000
Temporary Earth Retaining System	1,500	SF	$20.00	$30,000
Removal of Existing Bridge	1,104	SF	$100.00	$110,400
Structural Steel	119,600	LBS	$5.00	$598,000
Galvanize Structural Steel	119,600	LBS	$0.60	$71,760
Class F Concrete (Superstructure)	134	CY	$1,150.00	$154,100
Class A Concrete (Substructure)	357	CY	$800.00	$285,600
Deformed Steel Bars (Epoxy Coated)	26,100	LBS	$1.65	$43,065
Deformed Steel Bars	49,600	LBS	$1.40	$69,440
Steel Laminated Elastomeric Bearings	14	EA.	$800.00	$11,200
Pervious Structure Backfill	225	CY	$56.00	$12,600
Membrane Waterproofing (Woven Glass Fabric)	194	SY	$115.00	$22,310
HMA Wearing Surface	61	TON	$210.00	$12,810
Open Bridge Rail (Pedestrian Rail)	196	LF	$320.00	$62,720
Pedestrial Hand Rail	285	LF	$120.00	$34,200
Carefully Remove, Clean, Repair, Coat, Store & Reinstall Hist. Trusses	1	LS	$220,000.00	$220,000
Structural Timber No.2 S4S (Treated) (Deck and Nailers)	3.3	MBF	$3,600.00	$11,880
Galvanized Hardware for Structural Timber Deck Construction	1,850	LBS	$5.00	$9,250
Masonry Facing	692	SF	$105.00	$72,660
Rebuild Stone Walls	581	CY	$350.00	$203,350
Asphaltic Plug Expansion Joints	54	LF	$110.00	$5,940
			Sub Total	**$2,218,285**
C. Environmental Compliance Items				
Estimated Cost		EST	$40,000.00	**$40,000**
D. Traffic Items				
Traffic Person (Municipal Police Officer)	40	HR	$100.00	$4,000
Construction Signing	250	SF	$12.00	$3,000
Temporary Access Driveway	1	LS	$25,000.00	$25,000
Temporary Precast Concrete Barrier Curb	100	LF	$56.00	$5,600
Construction Barricade - Type III	4	EA	$140.00	$560
			Sub Total	**$38,160**
E. Minor Items (5% of Roadway, Structure and Traffic Items)		5%		**$122,129**
F. Lump Sum Items (Based on percentages of A-E)				
Cleaning & Grubbing		2%		**$52,094**
Mobilization		6.5%		**$169,305**
M&PT		2%		**$52,094**
Construction Staking		1%		**$26,047**
	CONSTRUCTION TOTAL			**$2,904,239**
			SAY	**$2,910,000**
G. Incidentals (25%) & Contingencies (20%)		45%		**$1,306,907**

TOTAL ESTIMATED COST (Year 2017) **$4,211,146**

Say **<u>$4,220,000</u>**

Appendix E

Reference from CTDOT HDM

Figure 5F

LOCAL URBAN STREETS
(New Construction/Major Construction)

Design Element			*	Manual Section	Design Values (by Type of Area)		
					Suburban	Intermediate	Built-up
Design Controls	Design Forecast Year			6-3.02	20 Years	20 Years	20 Years
Design Controls	Design Speed		x	6-2.02	25 mph – 30 mph	25 mph – 30 mph	20 mph – 25 mph
Design Controls	Access Control			6-4.0	Control by Regulation	Control by Regulation	Control by Regulation
Design Controls	Level of Service			6-3.0	C – D	C – D	C – D
Design Controls	On-Street Parking			10-1.04	Sometimes	Sometimes	Sometimes
Cross Section Elements	Travel Lane Width		x	10-1.01	10′ – 11′	10′ – 11′	10′ – 11′
Cross Section Elements	Shoulder Width		x	10-1.02	2′ – 4′	2′ – 4′	2′ – 4′
Cross Section Elements	Cross Slope	Travel Lane	x	10-1.01	1.5% – 2.0% (1.5%-3.0% with curbing)	1.5% – 2.0% (1.5%-3.0% with curbing)	1.5% – 2.0% (1.5%-3.0% with curbing)
Cross Section Elements	Cross Slope	Shoulder (W < 4′)	x	10-1.02	Same as Adjacent Travel Lane		
Cross Section Elements	Cross Slope	Shoulder (W ≥ 4′)	x	10-1.02	4% – 6%	4% – 6%	4% – 6%
Cross Section Elements	Turn Lanes	Lane Width	x	10-1.03	10′ – 11′	10′ – 11′	10′ – 11′
Cross Section Elements	Turn Lanes	Shoulder Width	x	10-1.03	2′ – 4′	2′ – 4′	2′ – 4′
Cross Section Elements	Parking Lane Width			10-1.04	7′ – 10′	7′ – 11′	7′ – 11′
Cross Section Elements	Sidewalk Width			10-2.01	5′ Minimum	5′ Minimum	5′ Minimum
Cross Section Elements	Bicycle Lane	Width		15-4.0	5′	5′	5′
Cross Section Elements	Bicycle Lane	Cross Slope		15-4.0	2%	2%	2%
Cross Section Elements	Bridge Width/Cross Slope (1)		x	10-4.01	Curb-to-Curb: Meet Approach Roadway Width and Cross Slope Sidewalk Width: 5′-6″		
Cross Section Elements	Underpass Width			10-4.02	Meet Approach Roadway Width Plus Clear Zones		
Cross Section Elements	Right-of-Way Width			10-5.0	Project-by-Project Basis		
Cross Section Elements	Roadside Clear Zones		x	13-2.0	See Section 13-2.0		
Cross Section Elements	Fill/Cut Slopes			10-2.02	See Figure 5I		

* Controlling design criteria (see Section 6-6.0).

Figure 5F (Continued)

LOCAL URBAN STREETS
(New Construction/Major Construction)

Design Element			*	Manual Section	Design Values (Based on Design Speed) 30 mph	25 mph	20 mph
Alignment Elements	Stopping Sight Distance		x	7-1.0	200′	155′	115′
	Decision Sight Distance	Maneuver		7-2.0	U: 620′ SU: 535′	N/A	N/A
		Stop			490′	N/A	N/A
	Minimum Radius (e = 4%)		x	8-3.02	230′	145′	80′
	Superelevation	e_{max}		8-3.02	4.0%	4.0%	4.0%
		Rate	x		See Figure 8-3C		
	Horizontal Sight Distance			8-2.04	See Section 8-2.04		
	Maximum Grade		x	9-2.03	10%	11%	11%
	Minimum Grade			9-2.03	0.5%		
	Vertical Curvature (K-Value)	Crest		9-2.02	19	12	7
		Sag		9-3.03	37	26	17
	Minimum Vertical Clearance: Local Street Under …	New Highway Bridge	x	9-4.0	14′-6″		
		Existing Highway Bridge	x		14′-3″		
	Minimum Vertical Clearance (Local Street over Railroad)		x	9-4.0	Electrified: 22′-6″ All Others: 20′-6″		

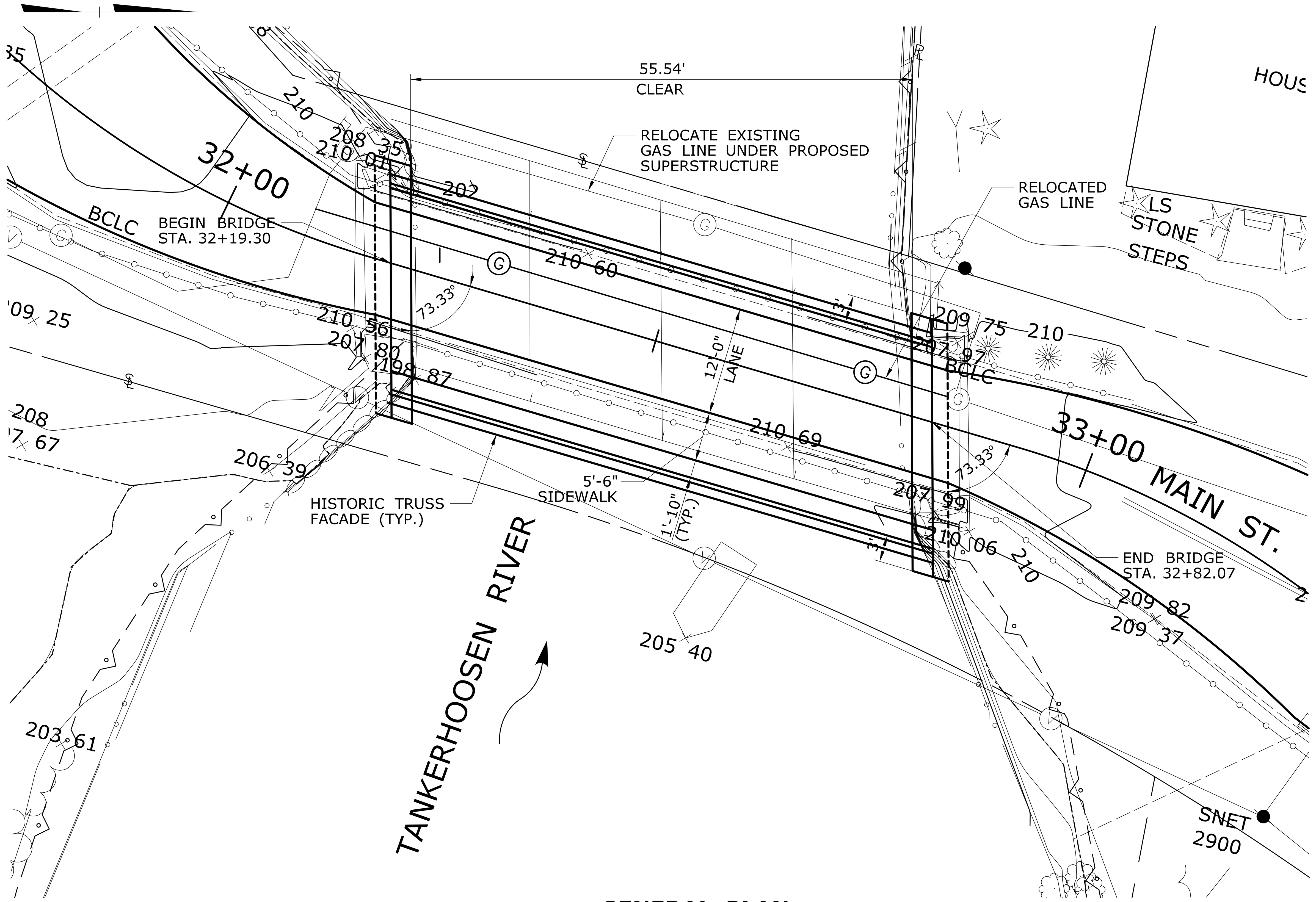
* Controlling design criteria (see Section 6-6.0). U: Urban SU: Suburban

<u>Footnote</u>:

(1) *<u>Bridge Width</u>. See Section 3-2.04 for local bridge projects.*

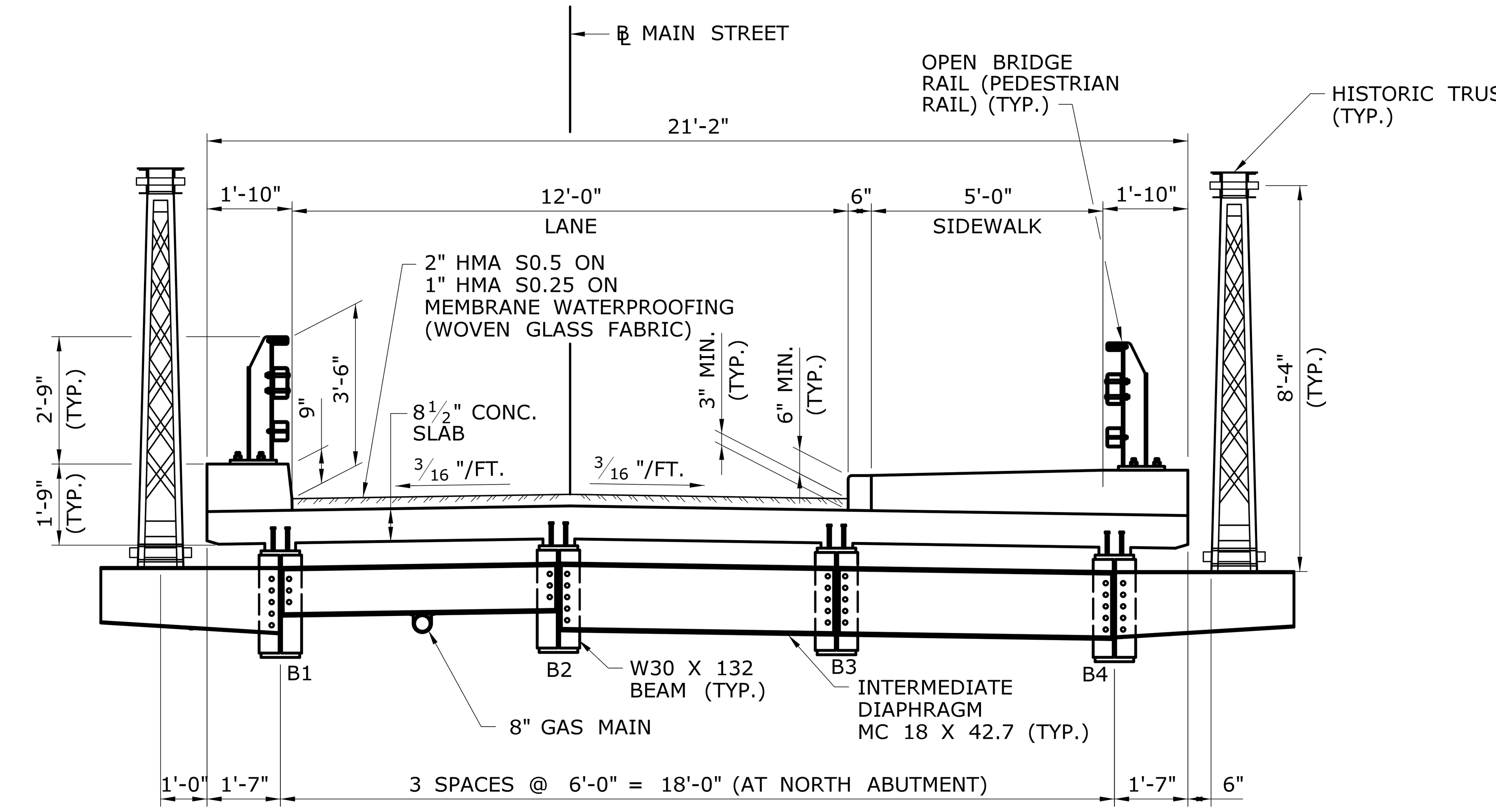
Appendix F

Bridge Alternative General-Plan, Elevation and Cross-Section



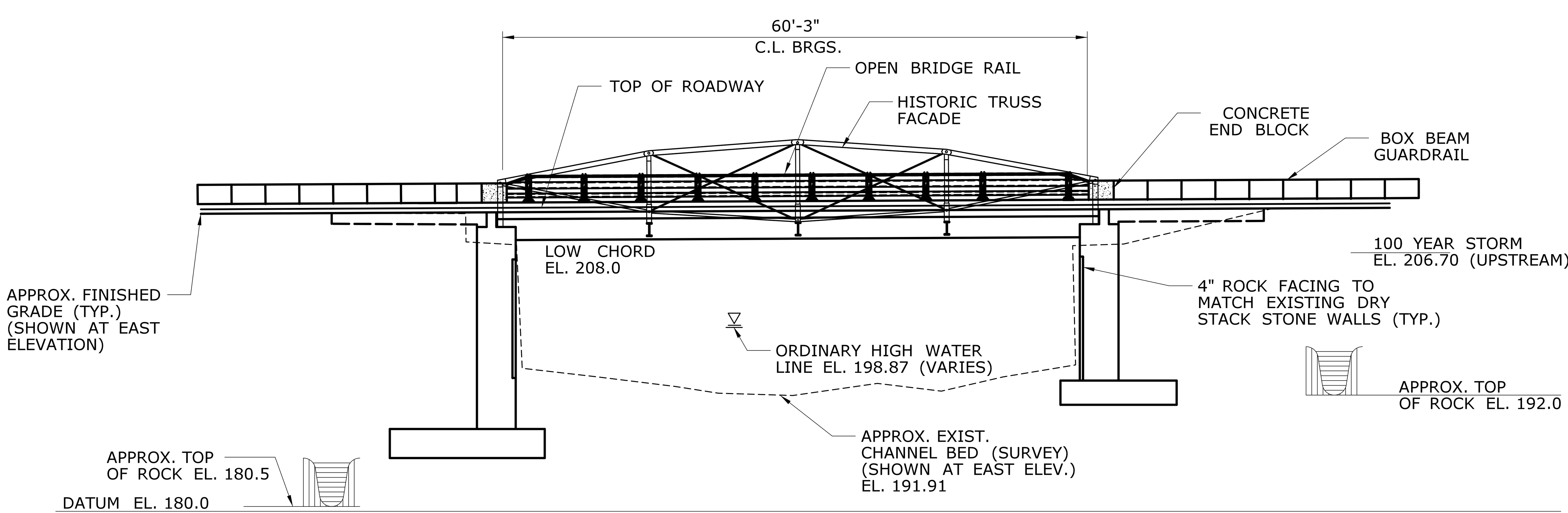
GENERAL PLAN

SCALE: 1" = 10'



CROSS SECTION - STEEL ALTERNATIVE 1

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



EAST ELEVATION

SCALE: 1" = 10'

PRELIMINARY DESIGN REVIEW

REV.	DATE	REVISION DESCRIPTION	SHEET NO.
-	-	-	-
-	-	-	-
-	-	-	-
-	-	-	-
-	-	-	-
-	-	-	-

THE INFORMATION, INCLUDING ESTIMATED QUANTITIES OF WORK, SHOWN ON THESE SHEETS IS BASED ON LIMITED INVESTIGATIONS BY THE STATE AND IS IN NO WAY WARRANTED TO INDICATE THE CONDITIONS OF ACTUAL QUANTITIES OF WORK WHICH WILL BE REQUIRED.

Plotted Date: 12/15/2016

DESIGNER/DRAFTER: **J. McROY**

CHECKED BY: **M. PEARSON**

SCALE AS NOTED

TOWN OF VERNON
ENGINEERING DEPARTMENT

Filename: ...\SB_MSH_Br04575_146_0199_ALT1.dgn

SIGNATURE/ BLOCK:

PROJECT TITLE:
REPLACEMENT OF BRIDGE NO. 04575 MAIN STREET VERNON OVER TANKERHOOSEN RIVER

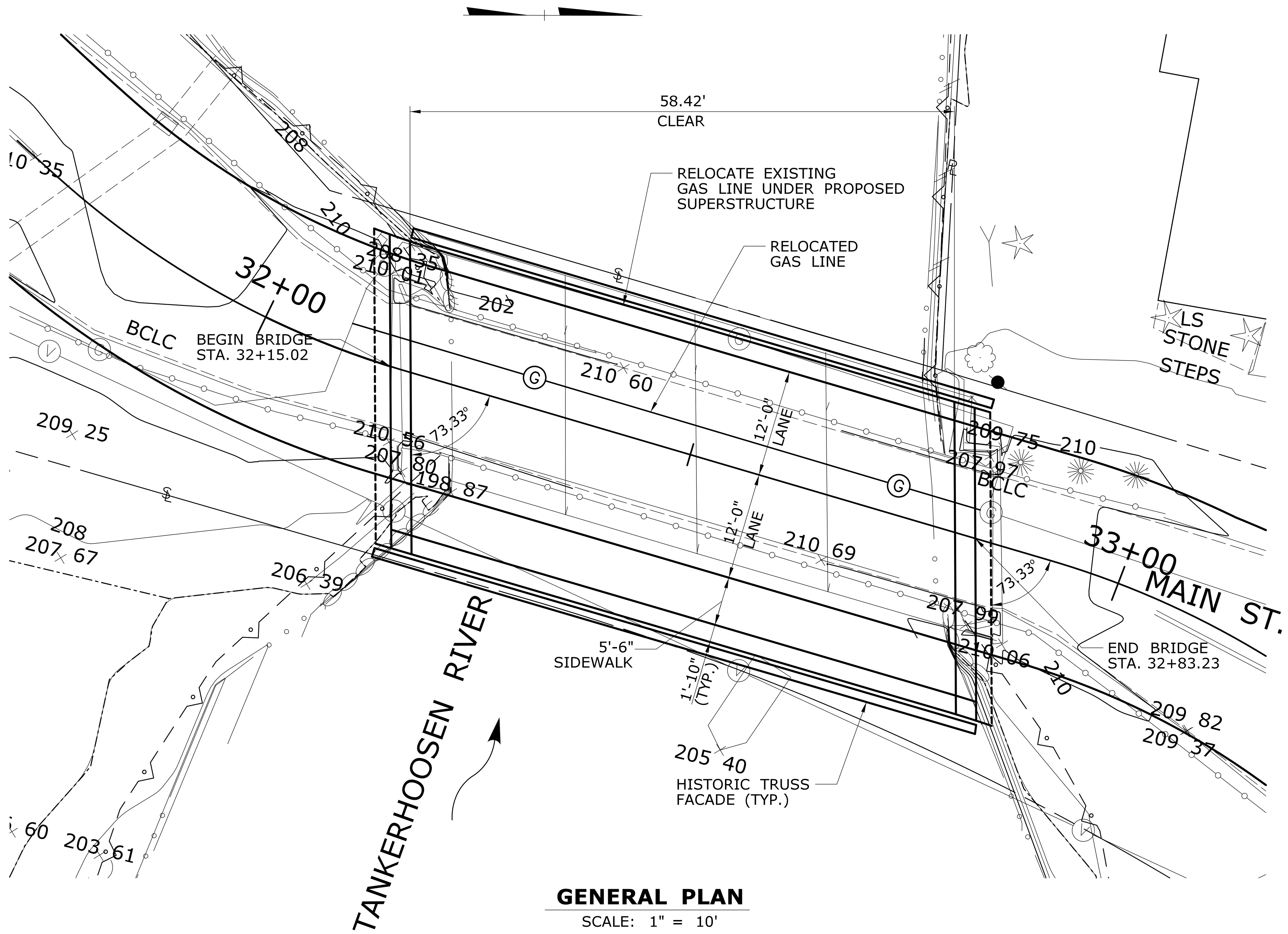
TOWN: **VERNON**

DRAWING TITLE: **GENERAL PLAN AND ELEVATION**

PROJECT NO. **146-0199**

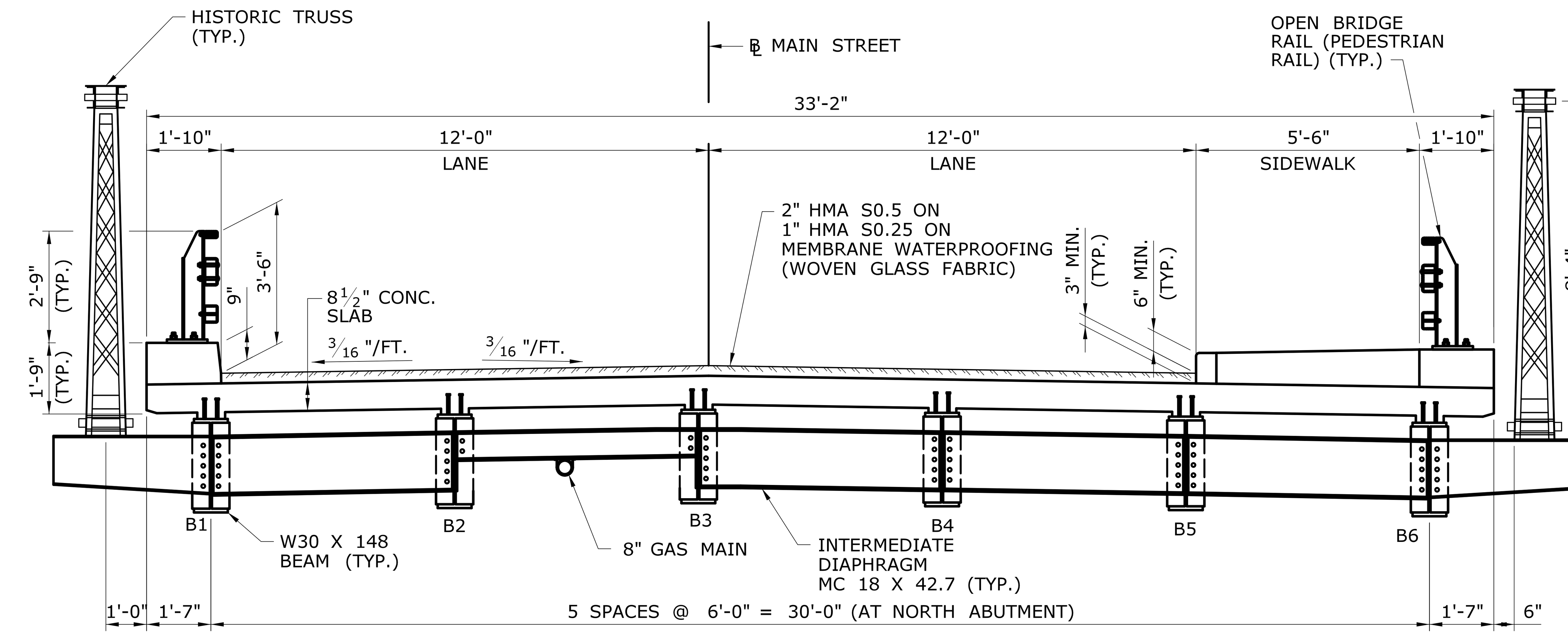
DRAWING NO. **-**

SHEET NO. **SK-1**



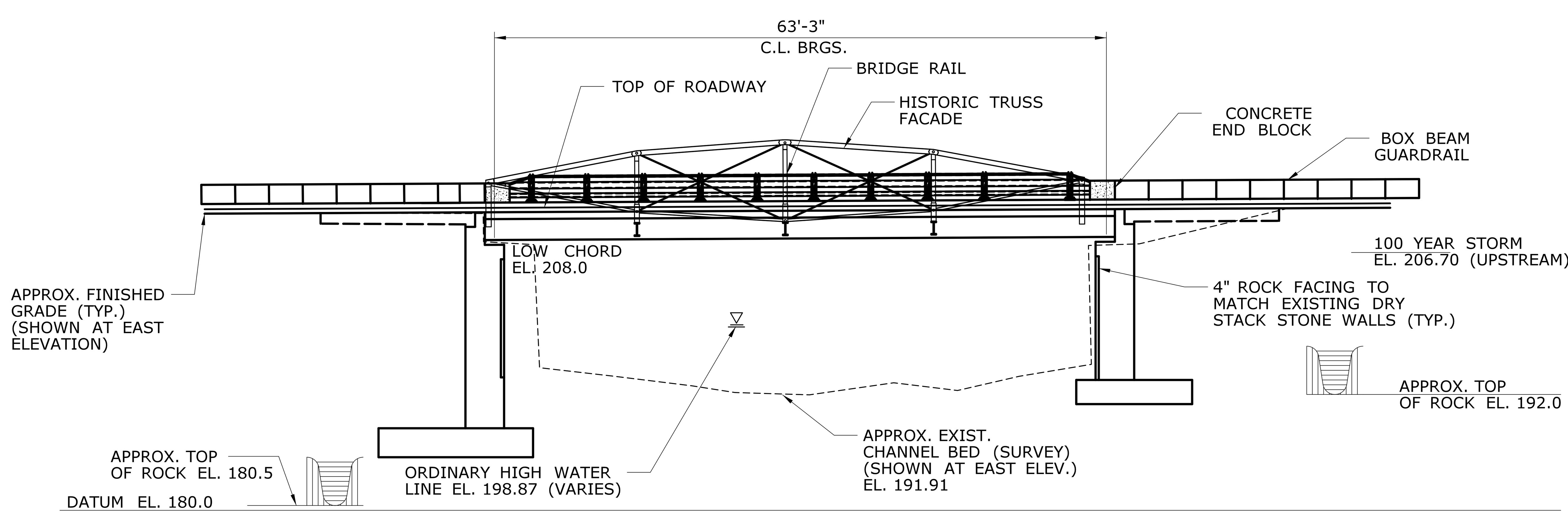
GENERAL PLAN

SCALE: 1" = 10'



CROSS SECTION - STEEL ALTERNATIVE 2

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



EAST ELEVATION

SCALE: 1" = 10'

PRELIMINARY DESIGN REVIEW

REV.	DATE	REVISION DESCRIPTION	SHEET NO.
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-	-	-	-
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-	-	-	-
-	-	-	-
-	-	-	-

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Plotted Date: 12/15/2016

DESIGNER/DRAFTER: **J. McROY**

CHECKED BY: **M. PEARSON**

SCALE AS NOTED

TOWN OF VERNON
ENGINEERING DEPARTMENT

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PROJECT TITLE:
REPLACEMENT OF BRIDGE NO. 04575 MAIN STREET VERNON OVER TANKERHOOSEN RIVER

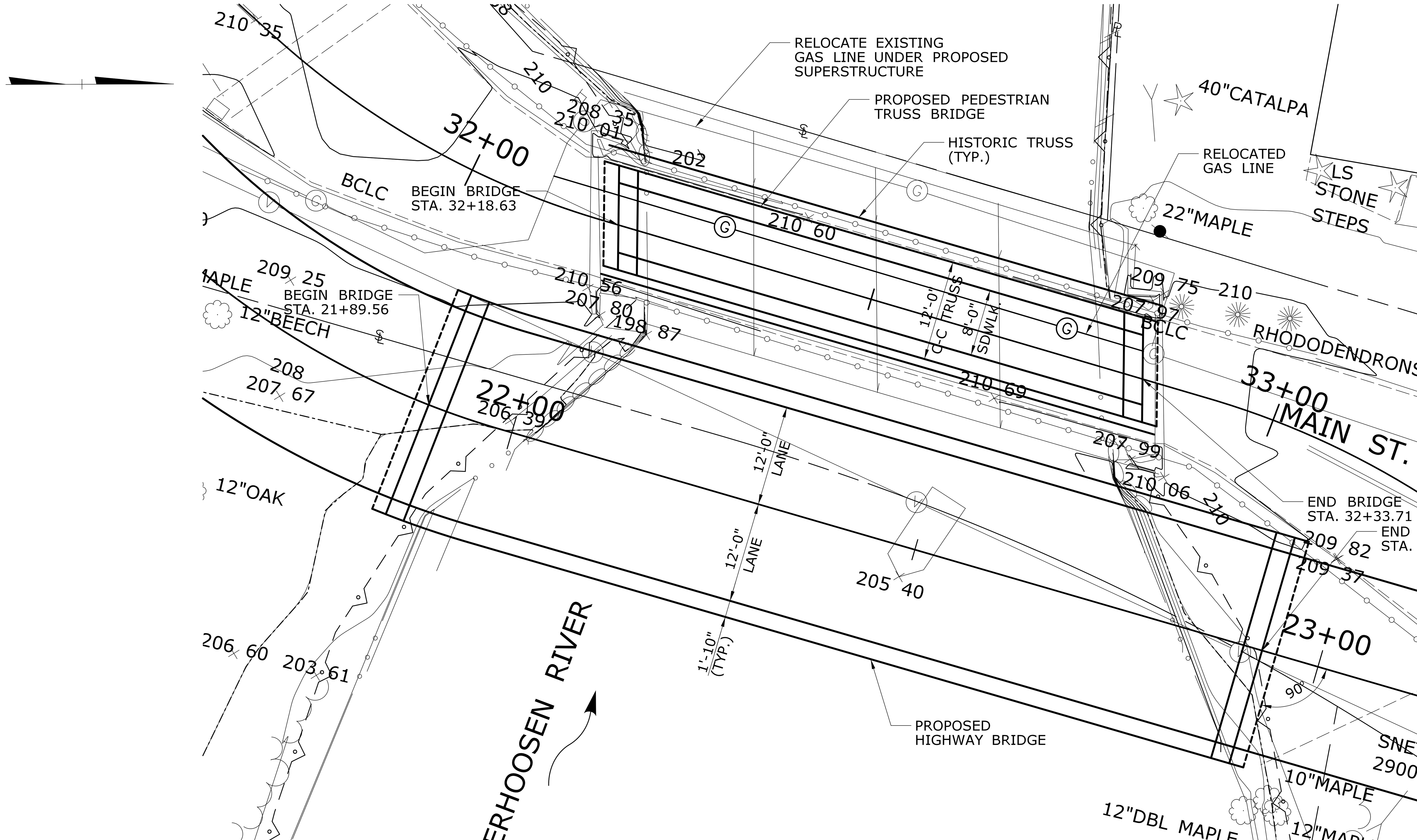
TOWN: **VERNON**

DRAWING TITLE: **GENERAL PLAN AND ELEVATION**

PROJECT NO. **146-0199**

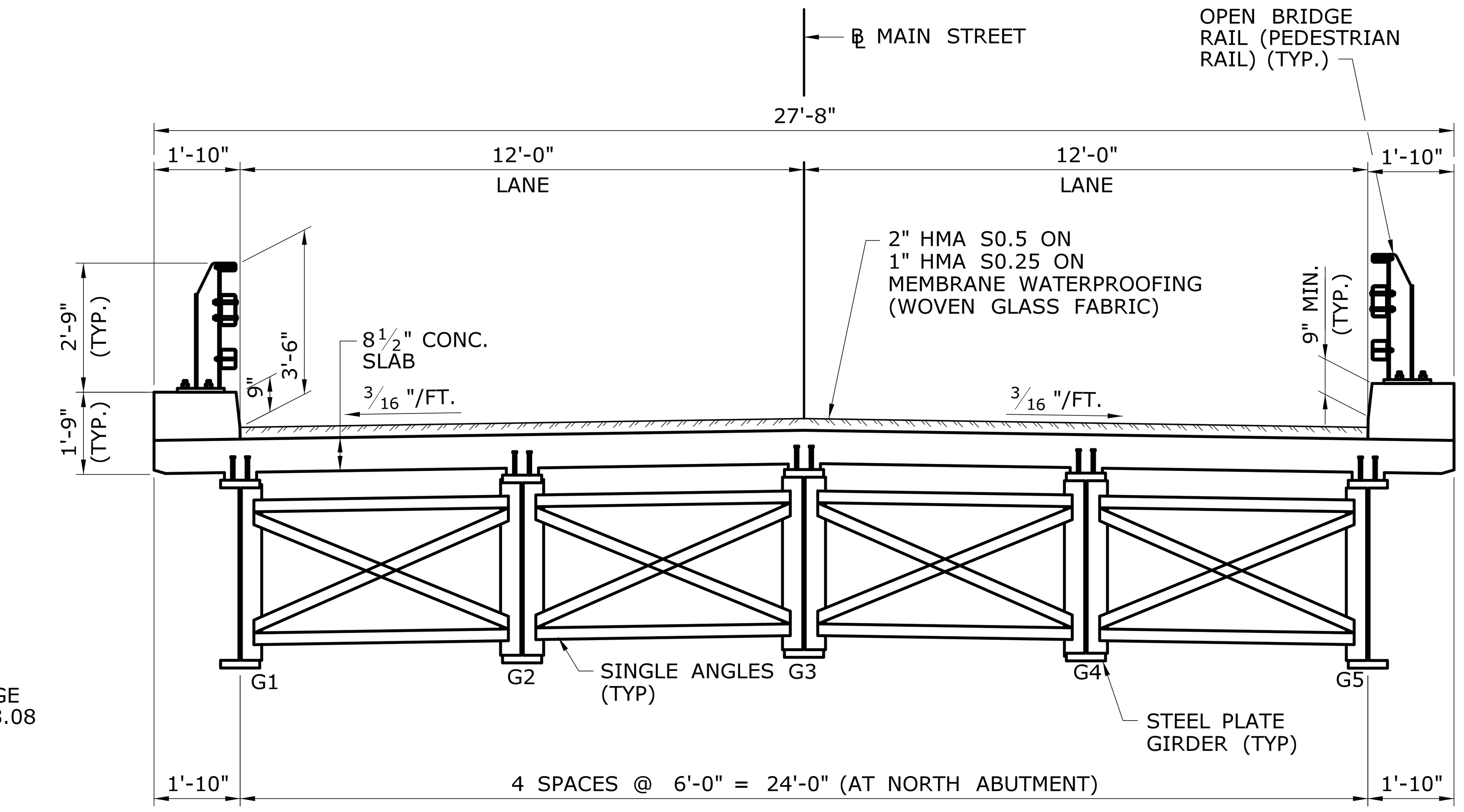
DRAWING NO. **-**

SHEET NO. **SK-2**



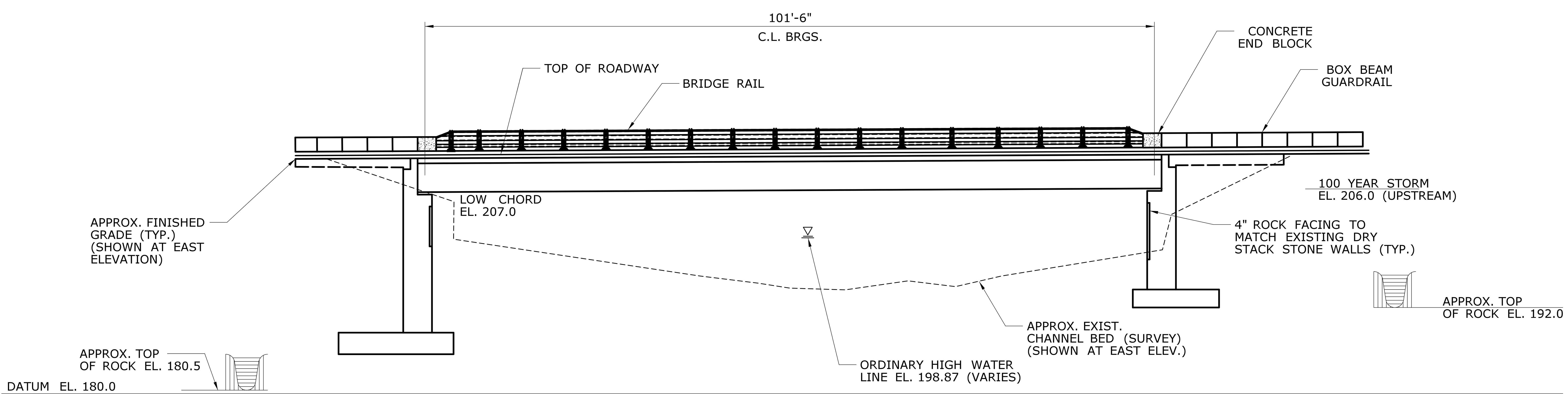
GENERAL PLAN

SCALE: 1" = 10'



CROSS SECTION - STEEL ALTERNATIVE 3 - VEHICLE

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



EAST ELEVATION

SCALE: 1" = 10'

PRELIMINARY DESIGN REVIEW

REV.	DATE	REVISION DESCRIPTION	SHEET NO.
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Plotted Date: 12/15/2016

DESIGNER/DRAFTER: **J. McROY**

CHECKED BY: **M. PEARSON**

SCALE AS NOTED

TOWN OF VERNON
ENGINEERING DEPARTMENT

Filename: ...\SB_MSH_Br04575_146_0199_ALT3_VEHICLE.dgn

SIGNATURE/ BLOCK:

PROJECT TITLE: **REPLACEMENT OF BRIDGE NO. 04575 MAIN STREET VERNON OVER TANKERHOOSEN RIVER**

TOWN: **VERNON**

DRAWING TITLE: **GENERAL PLAN AND ELEVATION**

PROJECT NO. **146-0199**

DRAWING NO. **-**

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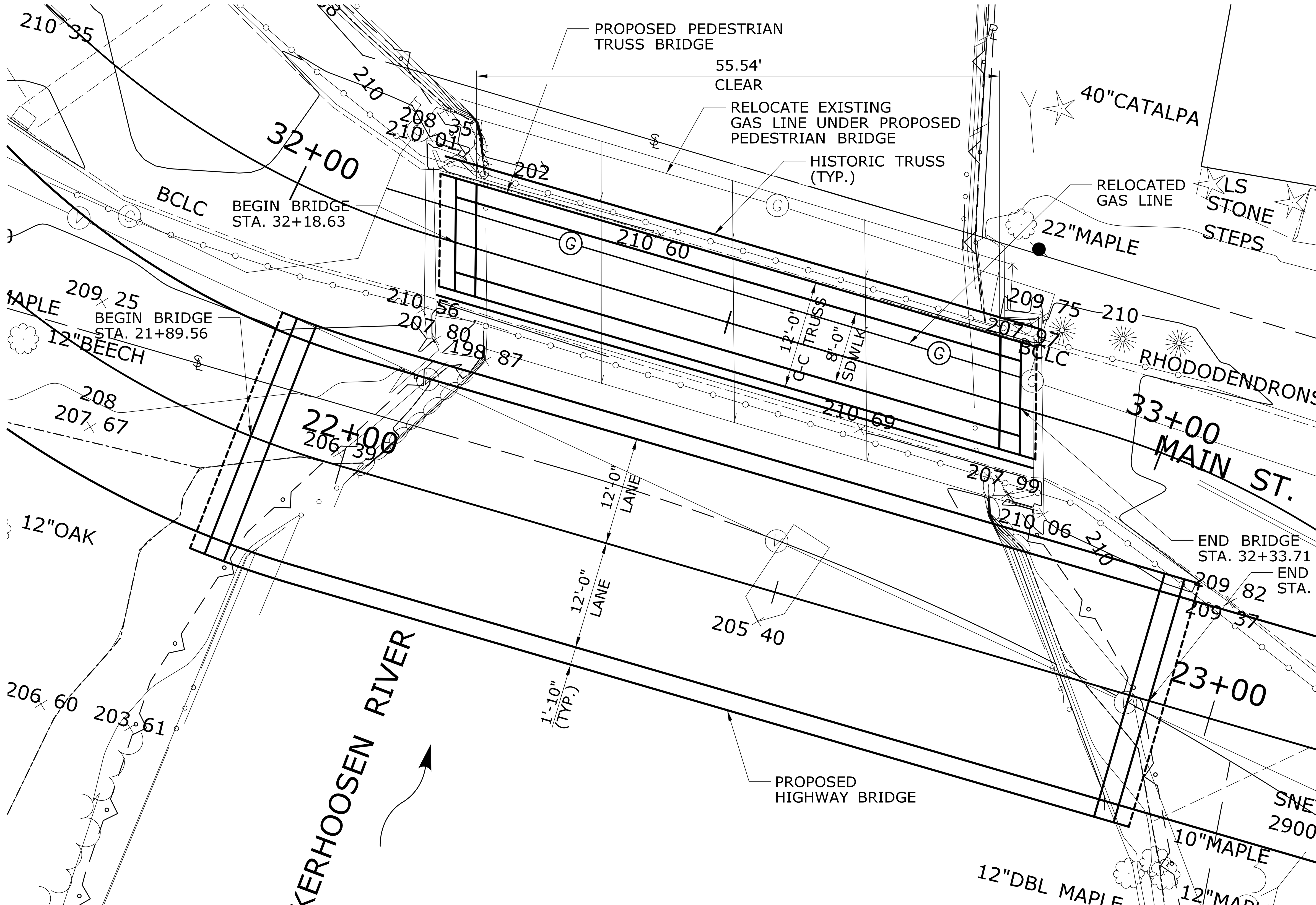
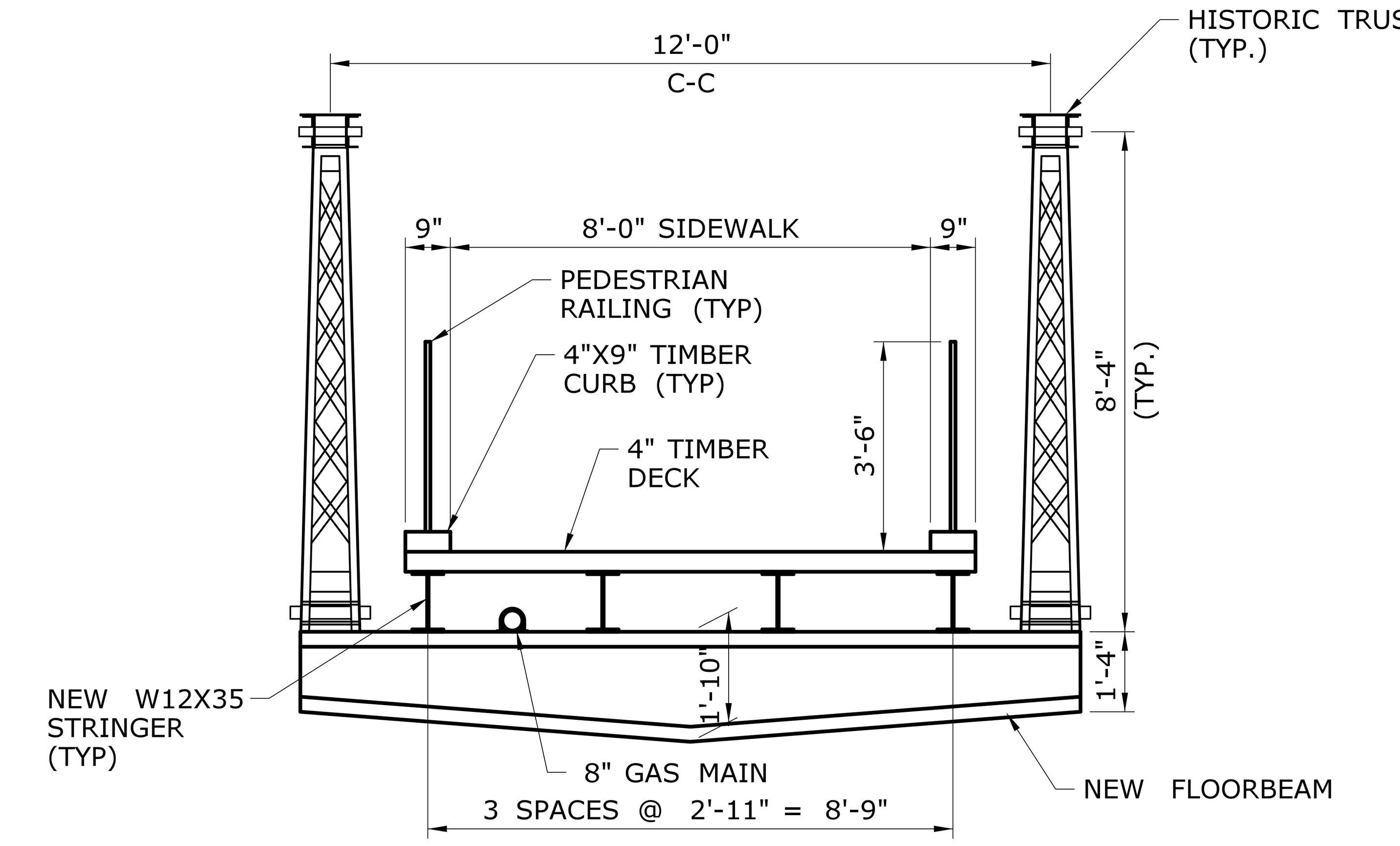


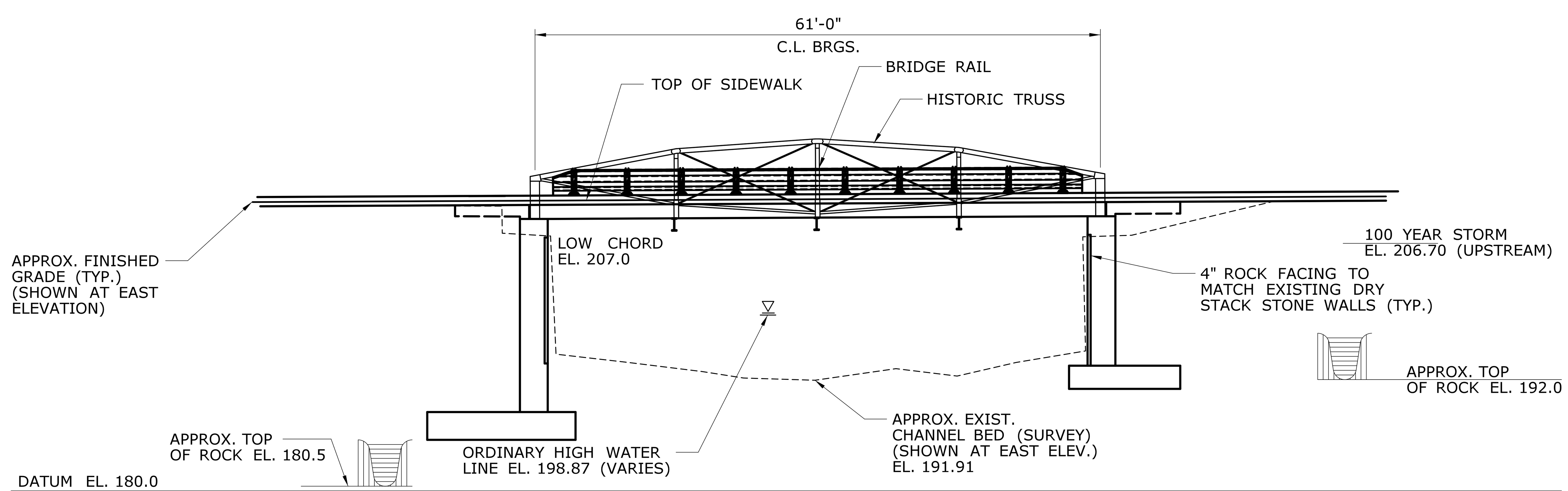
GENERAL PLAN

SCALE: 1" = 10'



CROSS SECTION - STEEL ALTERNATIVE 3 - PEDESTRIAN

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



EAST ELEVATION - PEDESTRIAN

SCALE: 1" = 10'

PRELIMINARY DESIGN REVIEW

REV.	DATE	REVISION DESCRIPTION	SHEET NO.
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-	-	-	-
-	-	-	-
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-	-	-	-
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Plotted Date: 12/15/2016

DESIGNER/DRAFTER: J. McROY

CHECKED BY: M. PEARSON

SCALE AS NOTED

TOWN OF VERNON
ENGINEERING DEPARTMENT

Filename: ...\SB_MSH_Br04575_146_0199_ALT3_PEDESTRIAN.dgn

SIGNATURE/ BLOCK:

PROJECT TITLE:
REPLACEMENT OF BRIDGE NO. 04575 MAIN STREET VERNON OVER TANKERHOOSEN RIVER

TOWN: **VERNON**

DRAWING TITLE: **GENERAL PLAN AND ELEVATION**

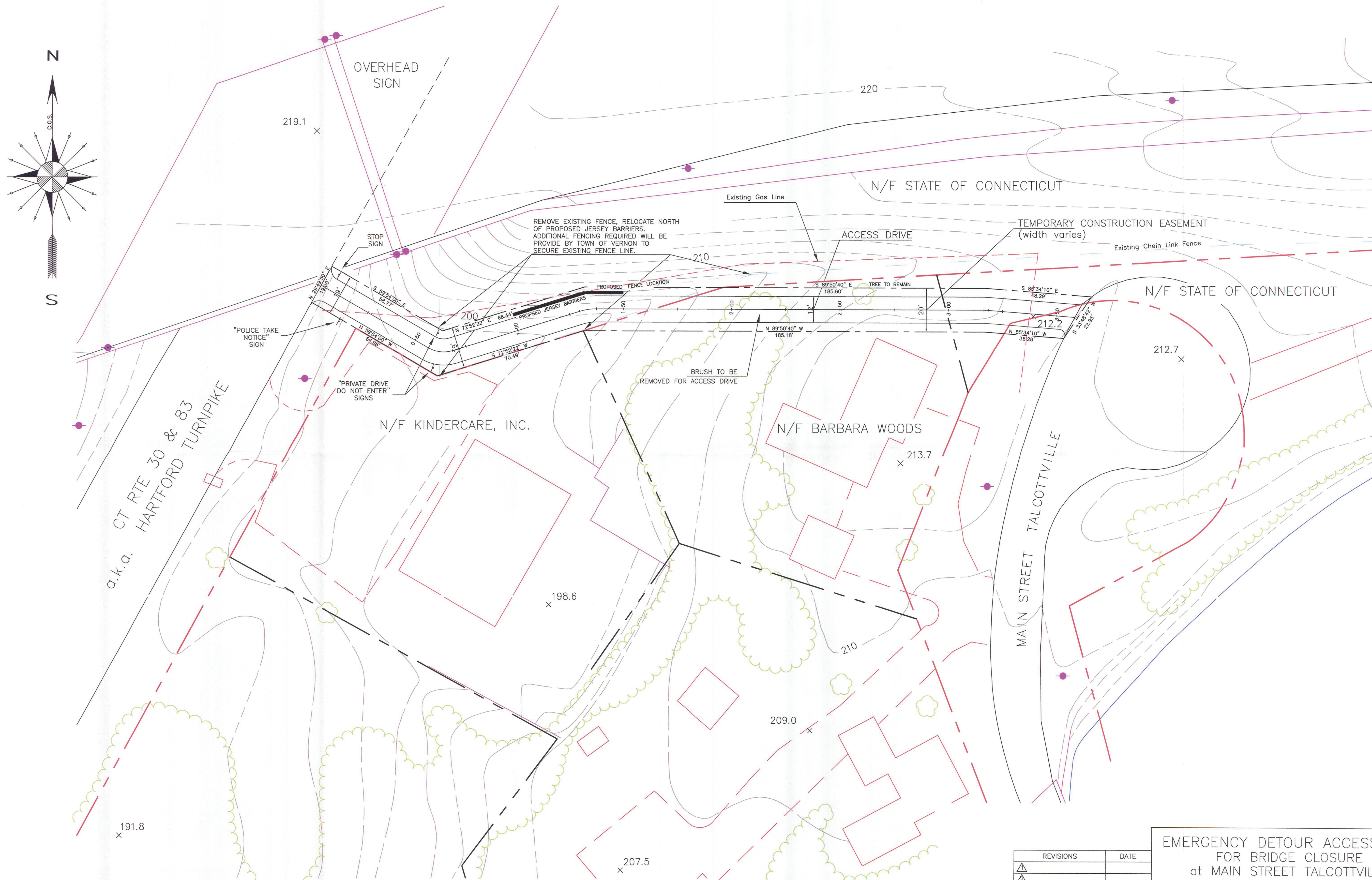
PROJECT NO. **146-0199**

DRAWING NO. **-**

SHEET NO. **SK-4**

Appendix G

Temporary Access Driveway



REVISIONS	DATE
1	
2	
3	
4	
5	
6	
COMMENTS	

EMERGENCY DETOUR ACCESS WAY FOR BRIDGE CLOSURE at MAIN STREET TALCOTTVILLE

HARTFORD TNPK (CT RT 30) AND MAIN ST (TALCOTTVILLE) VERNON CT

PROJECT NO.	SCALE	DATE	SHEET NO.
C:\ADF\ACCESS.DWG	1" = 20'	MAY 26, 1993	1 OF 1

TOWN OF VERNON, CONNECTICUT
ENGINEERING DEPARTMENT
14 PARK PLACE VERNON, CONN. 06066

Appendix H

Schedule of Property Owners and Title Roll Plan

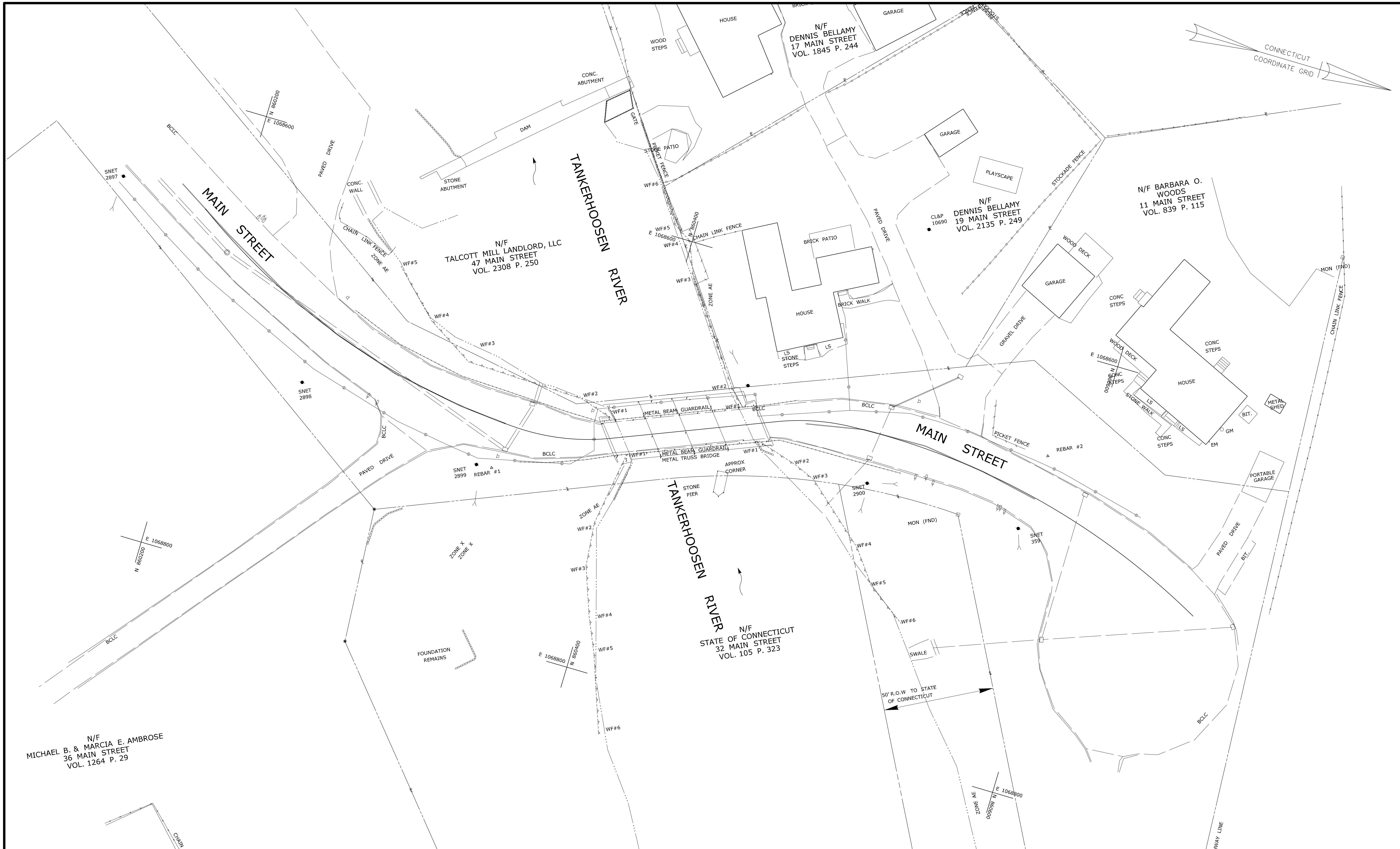
PRELIMINARY
SCHEDULE OF PROPERTY OWNERS
STATE PROJECT NO. : 146-199
MAIN STREET VERNON, CT

SERIAL NO.	OWNER	LOCATION	TAKING AREA		Excess	BUILDING	TYPE OF	TYPE OF	A,B,C,D	REMARKS
			SQ. FT	ACRES	AREA	PART	SEARCH	TAKE		
1	Barbara O. Woods, 11 Main Street	Sta. 5+00.00 Left	4,100	0.094		None	Full	Easement (Temporary)	D	Temporary Easement for temporary access driveway.
2	State of Connecticut	Sta. 5+00.00 Left	3,120	0.072		None	Full	Easement (Temporary)	D	Temporary Easement for temporary access driveway.

Prepared By: A. Fulco

Date: December 9, 2016

TAKING CLASSES
A = INDUSTRIAL AREA
B = BUSINESS
C = RESIDENTIAL (HOUSE)
D = LAND/EASEMENT



REV.	DATE	REVISION DESCRIPTION	SHEET NO.
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Plotted Date: 12/14/2016

DESIGNER/DRAFTER: **RBB/LAS**

CHECKED BY: **A. FULCO**

SCALE IN FEET 0 20 40

SCALE 1"=20'

TOWN OF VERNON
ENGINEERING DEPARTMENT

Filename: $FILEA$

SIGNATURE/ BLOCK:

PROJECT TITLE:

REPLACEMENT OF BRIDGE NO. 04575 MAIN STREET OVER TANKERHOOSEN RIVER

TOWN: **VERNON**

DRAWING TITLE: **TITLE ROLL PLAN**

PROJECT NO. **135-328**

DRAWING NO.

SHEET NO. **TR-01**

Appendix I

Preliminary Structural Calculations

Bridge 1

Superstructure

Pier/Abutment Locations

Roadway: RDWY01

Offset to Bridge CL: 0.0000 ft

No.	Type	Name	Input Method	Station/Distance(ft)	Skew/Bearing
1	Abutment	Support 01	Station	12+16.8750	SKEW 16 40 00.12
2	Abutment	Support 02	Distance from Support 01	60.2500	SKEW 16 40 00.12

Member Definition

Member Group: Group01

Member 01:

Std Section	No.	Ref. Span	Start (ft)	Length (ft)	Material	Section			
	1	1	0.0000	60.2500	Grade 50	W30X132			

Member 02:

Std Section	No.	Ref. Span	Start (ft)	Length (ft)	Material	Section			
	1	1	0.0000	60.2500	Grade 50	W30X132			

Member 03:

Std Section	No.	Ref. Span	Start (ft)	Length (ft)	Material	Section			
	1	1	0.0000	60.2500	Grade 50	W30X132			

Member 04:

Std Section	No.	Ref. Span	Start (ft)	Length (ft)	Material	Section			
	1	1	0.0000	60.2500	Grade 50	W30X132			

Date:	12/13/2016	Main Street Alt_1.lbs	
Time:	5:02 PM	Bentley LEAP Bridge Steel [AASHTO LRFD Specifications]	v16.01.00.05

Code Checker Results

Group01 Member 01

POI Location: 30.125 ft (1.50) Mid Bracing Point:

Strength Limit State (Article 6.10.6)

Final Default Strength I Strength I Final

Article	Equation	Parameter	Value	Perf. Ratio	Result
6.10.6.2 – Flexure					
6.10.6.2.2 – Composite Sections in Positive Flexure					
	Is Compact?				Compact
	Straight Bridge?				Straight
	6.10.6.2.2 $Flange\ F_y \le 70ksi$	*Fyt*	50.000	0.7143	True
		Fyb	50.000		
	6.10.2.1.1-1 $\frac{D}{t_w} \le 150$	*D*	28.300	0.3068	True
		tw	0.615		
	6.10.6.2.2-1 $\frac{2D_{cp}}{t_w} \le 3.76\sqrt{\frac{E}{F_{yc}}}$	*Dcp*	0.000	0.0000	True
6.10.7.1 – Compact Sections					
	6.10.7.1.1-1 $M_u + \frac{1}{3} f_l S_{xt} \le \phi_f M_n$	*Mu*	1936.878	0.8211	Passed
		fl	23.968		
		Sxt	506.220		
		Φf Mn	2769.514		
	6.10.7.1.2-1 $M_n = M_p$	*Mp*	3077.511		
	6.10.7.1.2-2 $M_n = M_p\left(1.07 - \frac{0.7D_p}{D_t}\right)$	*Mn*	2769.514		
		Mp	3077.511		
		Dp	9.610		
		Dt	39.550		
	6.10.7.1.2-3 $M_n \le 1.3R_h M_y$	*1.3RhMy*	2742.024		
		My	2109.249		
6.10.7.3 – Ductility					
	6.10.7.3-1 $D_p \le 0.42D_t$	*Dp*	9.610	0.5785	Passed
		0.42 Dt	16.611		
6.10.6.3 – Shear					

6.10.9.1 – General						
	6.10.9.1-1	$V_u \le \phi_v V_n$	*Vu*	24.268	0.0481	Passed
			ΦVn	504.730		
6.10.9.2 – Unstiffened Webs						
		$d_0 \le 1.5D$	*d0*	---	---	---
			D	---		
		$d_0 \le 3.0D$	*d0*	144.600	1.703	Unstiffened
			D	28.300		
	6.10.9.2-1	$V_n = V_{cr} = CV_p$	*Vn*	504.730		
	6.10.9.2-2	$V_p = 0.58F_{yw}Dt_w$	*Vp*	504.730		
	6.10.9.3.2-4	$C = 1.0$	*C*	1.000		
	6.10.9.3.2-5	$C = \frac{1.12}{\frac{D}{t_w}}\sqrt{\frac{Ek}{F_{yw}}}$	*C*	---		
	6.10.9.3.2-6	$C = \frac{1.57}{\left(\frac{D}{t_w}\right)^2}\left(\frac{Ek}{F_{yw}}\right)$	*C*	---		
		$k = 5$	*k*	5.000		

Service Limit State (Article 6.10.4)

Final Default Service II Service II Final

Article		Equation	Parameter	Value	Perf. Ratio	Result
6.10.4.2 – Permanent Deformations						
6.10.4.2.1 – General						
		Slab Effective Negative?				True
		Continuous Shear Connectors?				True
		$f_{slab} < 0.9f_r$	*fslab*	---	---	---
			0.9 fr	---		
		Is 6.10.1.7 *met?*				True
		$f_{slab} < 2f_r$	*fslab*	---	---	---
			2 fr	---		
6.10.1.6 – Lateral Flange Stress Considerations						
	6.10.1.6-2	$L_b \le 1.2L_p\sqrt{\frac{C_bR_b}{f_{bu}/F_{yc}}}$	*Lb*	144.600		
				150.674		

	6.10.1.6-4	$f_l = \left(\frac{0.85}{1-\frac{f_{bu}}{F_{cr}}}\right) f_{l1} \geq f_{l1}$	*fl1*	17.331		
			fl	17.331		
	6.10.1.6-1	$f_l \leq 0.6F_{yf}$	*Fyf*	50.000	0.5777	
			fl	17.331		
6.10.4.2.2 – Flexure						
		Is Section Composite?				True
		Is Flexure Negative?				False
	6.10.4.2.2-1	$f_f \leq 0.95R_hF_{yf}$	*ff*	14.572	0.3068	Passed
			*0.95Rh*Fyf*	47.500		
	6.10.4.2.2-2	$f_f + \frac{f_l}{2} \leq 0.95R_hF_{yf}$	*ff*	34.856	0.9162	Passed
			fl	17.331		
			*0.95Rh*Fyf*	47.500		
Top Flange	6.10.4.2.2-3	$f_f + \frac{f_l}{2} \leq 0.80R_hF_{yf}$	*ff*	14.572	---	---
			fl	0.000		
			*0.8*Rh*Fyf*	---		
Bottom Flange	6.10.4.2.2-3	$f_f + \frac{f_l}{2} \leq 0.80R_hF_{yf}$	*ff*	34.856	---	---
			fl	17.331		
			*0.8*Rh*Fyf*	---		
	6.10.4.2.2-4	$f_c \leq F_{crw}$	*fc*	---	---	---
			Fcrw	---		

Group01 Member 02

POI Location: 30.125 ft (1.50) Mid Bracing Point:

Strength Limit State (Article 6.10.6)

Final Default Strength I Strength I Final

Article		Equation	Parameter	Value	Perf. Ratio	Result
6.10.6.2 – Flexure						
6.10.6.2.2 – Composite Sections in Positive Flexure						
		Is Compact?				Compact
		Straight Bridge?				Straight
	6.10.6.2.2	*Flange* $F_y \leq 70ksi$	*Fyt*	50.000	0.7143	True
			Fyb	50.000		

	6.10.2.1.1-1	$\frac{D}{t_w} \le 150$	*D*	28.300	0.3068	True
			tw	0.615		
	6.10.6.2.2-1	$\frac{2D_{cp}}{t_w} \le 3.76\sqrt{\frac{E}{F_{yc}}}$	*Dcp*	0.000	0.0000	True
6.10.7.1 – Compact Sections						
	6.10.7.1.1-1	$M_u + \frac{1}{3} f_l S_{xt} \le \phi_f M_n$	*Mu*	1836.535	0.6837	Passed
			fl	17.456		
			Sxt	515.001		
			Φf Mn	3051.303		
	6.10.7.1.2-1	$M_n = M_p$	*Mp*	3276.858		
	6.10.7.1.2-2	$M_n = M_p\left(1.07 - \frac{0.7D_p}{D_t}\right)$	*Mn*	3051.303		
			Mp	3276.858		
			Dp	7.844		
			Dt	39.550		
	6.10.7.1.2-3	$M_n \le 1.3 R_h M_y$	*1.3RhMy*	2789.588		
			My	2145.837		
6.10.7.3 – Ductility						
	6.10.7.3-1	$D_p \le 0.42 D_t$	*Dp*	7.844	0.4722	Passed
			0.42 Dt	16.611		
6.10.6.3 – Shear						
6.10.9.1 – General						
	6.10.9.1-1	$V_u \le \phi_v V_n$	*Vu*	45.754	0.0907	Passed
			ΦVn	504.730		
6.10.9.2 – Unstiffened Webs						
		$d_0 \le 1.5D$	*d0*	---	---	---
			D	---		
		$d_0 \le 3.0D$	*d0*	144.600	1.703	Unstiffened
			D	28.300		
	6.10.9.2-1	$V_n = V_{cr} = CV_p$	*Vn*	504.730		
	6.10.9.2-2	$V_p = 0.58 F_{yw} D t_w$	*Vp*	504.730		
	6.10.9.3.2-4	$C = 1.0$	*C*	1.000		
	6.10.9.3.2-5	$C = \frac{1.12}{\frac{D}{t_w}}\sqrt{\frac{Ek}{F_{yw}}}$	*C*	---		

	6.10.9.3.2-6 $C = \frac{1.57}{\left(\frac{D}{t_w}\right)^2}\left(\frac{Ek}{F_{yw}}\right)$	C	---		
	$k = 5$	k	5.000		

Service Limit State (Article 6.10.4)

Final Default Service II | Service II | Final

Article	Equation	Parameter	Value	Perf. Ratio	Result
6.10.4.2 – Permanent Deformations					
6.10.4.2.1 – General					
	Slab Effective Negative?				True
	Continuous Shear Connectors?				True
	$f_{slab} < 0.9 f_r$	*fslab*	---	---	---
		0.9 fr	---		
	Is 6.10.1.7 *met?*				True
	$f_{slab} < 2 f_r$	*fslab*	---	---	---
		2 fr	---		
6.10.1.6 – Lateral Flange Stress Considerations					
	6.10.1.6-2 $L_b \le 1.2 L_p \sqrt{\frac{C_b R_b}{f_{bu} / F_{yc}}}$	*Lb*	144.600		
			157.604		
	6.10.1.6-4 $f_l = \left(\frac{0.85}{1 - \frac{f_{bu}}{F_{cr}}}\right) f_{l1} \ge f_{l1}$	*fl1*	12.867		
		fl	12.867		
	6.10.1.6-1 $f_l \le 0.6 F_{yf}$	*Fyf*	50.000	0.4289	
		fl	12.867		
6.10.4.2.2 – Flexure					
	Is Section Composite?				True
	Is Flexure Negative?				False
	6.10.4.2.2-1 $f_f \le 0.95 R_h F_{yf}$	*ff*	13.377	0.2816	Passed
		*0.95Rh*Fyf*	47.500		
	6.10.4.2.2-2 $f_f + \frac{f_l}{2} \le 0.95 R_h F_{yf}$	*ff*	32.813	0.8262	Passed
		fl	12.867		
		*0.95Rh*Fyf*	47.500		

Top Flange	6.10.4.2.2-3	$f_f + \frac{f_l}{2} \leq 0.80 R_h F_{yf}$	*ff*	13.377	---	---
			fl	0.000		
			*0.8*Rh*Fyf*	---		
Bottom Flange	6.10.4.2.2-3	$f_f + \frac{f_l}{2} \leq 0.80 R_h F_{yf}$	*ff*	32.813	---	---
			fl	12.867		
			*0.8*Rh*Fyf*	---		
	6.10.4.2.2-4	$f_c \leq F_{crw}$	*fc*	---	---	---
			Fcrw	---		

Group01 Member 03

POI Location: 30.125 ft (1.50) Mid Bracing Point:

Strength Limit State (Article 6.10.6)

Final Default Strength I Strength I Final

Article		Equation	Parameter	Value	Perf. Ratio	Result
6.10.6.2 – Flexure						
6.10.6.2.2 – Composite Sections in Positive Flexure						
		Is Compact?				Compact
		Straight Bridge?				Straight
	6.10.6.2.2	$Flange\ F_y \leq 70ksi$	*Fyt*	50.000	0.7143	True
			Fyb	50.000		
	6.10.2.1.1-1	$\frac{D}{t_w} \leq 150$	*D*	28.300	0.3068	True
			tw	0.615		
	6.10.6.2.2-1	$\frac{2D_{cp}}{t_w} \leq 3.76\sqrt{\frac{E}{F_{yc}}}$	*Dcp*	0.000	0.0000	True
6.10.7.1 – Compact Sections						
	6.10.7.1.1-1	$M_u + \frac{1}{3} f_l S_{xt} \leq \phi_f M_n$	*Mu*	1835.651	0.6882	Passed
			fl	18.470		
			Sxt	515.001		
			Φf Mn	3051.303		
	6.10.7.1.2-1	$M_n = M_p$	*Mp*	3276.858		
	6.10.7.1.2-2	$M_n = M_p\left(1.07 - \frac{0.7D_p}{D_t}\right)$	*Mn*	3051.303		
			Mp	3276.858		
			Dp	7.844		
			Dt	39.550		

	6.10.7.1.2-3	$M_n \le 1.3R_nM_y$	*1.3RhMy*	2789.588		
			My	2145.837		
6.10.7.3 – Ductility						
	6.10.7.3-1	$D_p \le 0.42D_t$	*Dp*	7.844	0.4722	Passed
			0.42 Dt	16.611		
6.10.6.3 – Shear						
6.10.9.1 – General						
	6.10.9.1-1	$V_u \le \phi_v V_n$	*Vu*	45.596	0.0903	Passed
			ΦVn	504.730		
6.10.9.2 – Unstiffened Webs						
		$d_0 \le 1.5D$	*d0*	---	---	---
			D	---		
		$d_0 \le 3.0D$	*d0*	144.600	1.703	Unstiffened
			D	28.300		
	6.10.9.2-1	$V_n = V_{cr} = CV_p$	*Vn*	504.730		
	6.10.9.2-2	$V_p = 0.58F_{yw}Dt_w$	*Vp*	504.730		
	6.10.9.3.2-4	$C = 1.0$	*C*	1.000		
	6.10.9.3.2-5	$C = \frac{1.12}{\frac{D}{t_w}}\sqrt{\frac{Ek}{F_{yw}}}$	*C*	---		
	6.10.9.3.2-6	$C = \frac{1.57}{\left(\frac{D}{t_w}\right)^2}\left(\frac{Ek}{F_{yw}}\right)$	*C*	---		
		$k = 5$	*k*	5.000		

Service Limit State (Article 6.10.4)

Final Default Service II   Service II   Final

Article	Equation	Parameter	Value	Perf. Ratio	Result
6.10.4.2 – Permanent Deformations					
6.10.4.2.1 – General					
	Slab Effective Negative?				True
	Continuous Shear Connectors?				True
	$f_{slab} < 0.9f_r$	*fslab*	---	---	---
		0.9 fr	---		
	Is 6.10.1.7 *met?*				True

		$f_{slab} < 2f_r$	*fslab*	---	---	---
			2 fr	---		
6.10.1.6 – Lateral Flange Stress Considerations						
	6.10.1.6-2	$L_b \le 1.2L_p\sqrt{\dfrac{C_bR_b}{f_{bu}/F_{yc}}}$	*Lb*	144.600		
				157.605		
	6.10.1.6-4	$f_l = \left(\dfrac{0.85}{1-\dfrac{f_{bu}}{F_{cr}}}\right) f_{l1} \ge f_{l1}$	*fl1*	13.614		
			fl	13.614		
	6.10.1.6-1	$f_l \le 0.6F_{yf}$	*Fyf*	50.000	0.4538	
			fl	13.614		
6.10.4.2.2 – Flexure						
		Is Section Composite?				True
		Is Flexure Negative?				False
	6.10.4.2.2-1	$f_f \le 0.95R_hF_{yf}$	*ff*	13.376	0.2816	Passed
			*0.95Rh*Fyf*	47.500		
	6.10.4.2.2-2	$f_f + \dfrac{f_l}{2} \le 0.95R_hF_{yf}$	*ff*	32.799	0.8338	Passed
			fl	13.614		
			*0.95Rh*Fyf*	47.500		
Top Flange	6.10.4.2.2-3	$f_f + \dfrac{f_l}{2} \le 0.80R_hF_{yf}$	*ff*	13.376	---	---
			fl	0.000		
			*0.8*Rh*Fyf*	---		
Bottom Flange	6.10.4.2.2-3	$f_f + \dfrac{f_l}{2} \le 0.80R_hF_{yf}$	*ff*	32.799	---	---
			fl	13.614		
			*0.8*Rh*Fyf*	---		
	6.10.4.2.2-4	$f_c \le F_{crw}$	*fc*	---	---	---
			Fcrw	---		

Group01 Member 04

POI Location: 30.125 ft (1.50) Mid Bracing Point:

Strength Limit State (Article 6.10.6)

Final Default Strength I Strength I Final

Article	Equation	Parameter	Value	Perf. Ratio	Result
6.10.6.2 – Flexure					
6.10.6.2.2 – Composite Sections in Positive Flexure					

		Is Compact?				Compact
		Straight Bridge?				Straight
	6.10.6.2.2	$Flange\ F_y \le 70ksi$	*Fyt*	50.000	0.7143	True
			Fyb	50.000		
	6.10.2.1.1-1	$\frac{D}{t_w} \le 150$	*D*	28.300	0.3068	True
			tw	0.615		
	6.10.6.2.2-1	$\frac{2D_{cp}}{t_w} \le 3.76\sqrt{\frac{E}{F_{yc}}}$	*Dcp*	0.000	0.0000	True
6.10.7.1 – Compact Sections						
	6.10.7.1.1-1	$M_u + \frac{1}{3} f_l S_{xt} \le \phi_f M_n$	*Mu*	1932.610	0.8222	Passed
			fl	24.500		
			Sxt	506.220		
			Φf Mn	2769.514		
	6.10.7.1.2-1	$M_n = M_p$	*Mp*	3077.511		
	6.10.7.1.2-2	$M_n = M_p\left(1.07 - \frac{0.7D_p}{D_t}\right)$	*Mn*	2769.514		
			Mp	3077.511		
			Dp	9.610		
			Dt	39.550		
	6.10.7.1.2-3	$M_n \le 1.3R_h M_y$	*1.3RhMy*	2742.024		
			My	2109.249		
6.10.7.3 – Ductility						
	6.10.7.3-1	$D_p \le 0.42D_t$	*Dp*	9.610	0.5785	Passed
			0.42 Dt	16.611		
6.10.6.3 – Shear						
6.10.9.1 – General						
	6.10.9.1-1	$V_u \le \phi_v V_n$	*Vu*	24.270	0.0481	Passed
			ΦVn	504.730		
6.10.9.2 – Unstiffened Webs						
		$d_0 \le 1.5D$	*d0*	---	---	---
			D	---		
		$d_0 \le 3.0D$	*d0*	144.600	1.703	Unstiffened
			D	28.300		
	6.10.9.2-1	$V_n = V_{cr} = CV_p$	*Vn*	504.730		
	6.10.9.2-2	$V_p = 0.58F_{yw}Dt_w$	*Vp*	504.730		
	6.10.9.3.2-4	$C = 1.0$	*C*	1.000		

	6.10.9.3.2-5 $C = \frac{1.12}{\frac{D}{t_w}} \sqrt{\frac{Ek}{F_{yw}}}$	C	---		
	6.10.9.3.2-6 $C = \frac{1.57}{\left(\frac{D}{t_w}\right)^2} \left(\frac{Ek}{F_{yw}}\right)$	C	---		
	$k = 5$	k	5.000		

Service Limit State (Article 6.10.4)

Final Default Service II — Service II — Final

Article	Equation	Parameter	Value	Perf. Ratio	Result
6.10.4.2 – Permanent Deformations					
6.10.4.2.1 – General					
	Slab Effective Negative?				True
	Continuous Shear Connectors?				True
	$f_{slab} < 0.9 f_r$	*fslab*	---	---	---
		0.9 fr	---		
	Is 6.10.1.7 *met?*				True
	$f_{slab} < 2 f_r$	*fslab*	---	---	---
		2 fr	---		
6.10.1.6 – Lateral Flange Stress Considerations					
	6.10.1.6-2 $L_b \le 1.2 L_p \sqrt{\frac{C_b R_b}{f_{bu} / F_{yc}}}$	*Lb*	144.600		
			150.697		
	6.10.1.6-4 $f_l = \left(\frac{0.85}{1 - \frac{f_{bu}}{F_{cr}}}\right) f_{l1} \ge f_{l1}$	*fl1*	17.717		
		fl	17.717		
	6.10.1.6-1 $f_l \le 0.6 F_{yf}$	*Fyf*	50.000	0.5906	
		fl	17.717		
6.10.4.2.2 – Flexure					
	Is Section Composite?				True
	Is Flexure Negative?				False
	6.10.4.2.2-1 $f_f \le 0.95 R_h F_{yf}$	*ff*	14.566	0.3066	Passed
		*0.95Rh*Fyf*	47.500		

	6.10.4.2.2-2	$f_f + \frac{f_l}{2} \le 0.95 R_h F_{yf}$	*ff*	34.789	0.9189	Passed
			fl	17.717		
			*0.95Rh*Fyf*	47.500		
Top Flange	6.10.4.2.2-3	$f_f + \frac{f_l}{2} \le 0.80 R_h F_{yf}$	*ff*	14.566	---	---
			fl	0.000		
			*0.8*Rh*Fyf*	---		
Bottom Flange	6.10.4.2.2-3	$f_f + \frac{f_l}{2} \le 0.80 R_h F_{yf}$	*ff*	34.789	---	---
			fl	17.717		
			*0.8*Rh*Fyf*	---		
	6.10.4.2.2-4	$f_c \le F_{crw}$	*fc*	---	---	---
			Fcrw	---		

Bridge 1

Superstructure

Pier/Abutment Locations

Roadway: RDWY01

Offset to Bridge CL: 0.0000 ft

No.	Type	Name	Input Method	Station/Distance(ft)	Skew/Bearing
1	Abutment	Support 01	Station	12+16.8750	SKEW 16 40 00.12
2	Abutment	Support 02	Distance from Support 01	63.2500	SKEW 16 40 00.12

Member Definition

Member Group: Group01

Member 01:

Std Section	No.	Ref. Span	Start (ft)	Length (ft)	Material	Section			
	1	1	0.0000	63.2500	Grade 50	W30X148			

Member 02:

Std Section	No.	Ref. Span	Start (ft)	Length (ft)	Material	Section			
	1	1	0.0000	63.2500	Grade 50	W30X148			

Member 03:

Std Section	No.	Ref. Span	Start (ft)	Length (ft)	Material	Section			
	1	1	0.0000	63.2500	Grade 50	W30X148			

Member 04:

Std Section	No.	Ref. Span	Start (ft)	Length (ft)	Material	Section			
	1	1	0.0000	63.2500	Grade 50	W30X148			

Date:	12/13/2016	Main Street Alt_2.lbs	
Time:	4:56 PM	Bentley LEAP Bridge Steel [AASHTO LRFD Specifications]	

Member 05:

Std Section	No.	Ref. Span	Start (ft)	Length (ft)	Material	Section			
	1	1	0.0000	63.2500	Grade 50	W30X148			

Member 06:

Std Section	No.	Ref. Span	Start (ft)	Length (ft)	Material	Section			
	1	1	0.0000	63.2500	Grade 50	W30X148			

Code Checker Results

Group01 Member 01

POI Location: 31.625 ft (1.50) Mid Bracing Point:

Strength Limit State (Article 6.10.6)

Final Default Strength I Strength I Final

Article	Equation		Parameter	Value	Perf. Ratio	Result
6.10.6.2 – Flexure						
6.10.6.2.2 – Composite Sections in Positive Flexure						
		Is Compact?				Compact
		Straight Bridge?				Straight
	6.10.6.2.2	$Flange\,F_y \leq 70ksi$	*Fyt*	50.000	0.7143	True
			Fyb	50.000		
	6.10.2.1.1-1	$\frac{D}{t_w} \leq 150$	*D*	28.340	0.2907	True
			tw	0.650		
	6.10.6.2.2-1	$\frac{2D_{cp}}{t_w} \leq 3.76\sqrt{\frac{E}{F_{yc}}}$	*Dcp*	0.000	0.0000	True
6.10.7.1 – Compact Sections						
	6.10.7.1.1-1	$M_u + \frac{1}{3} f_l S_{xt} \leq \phi_f M_n$	*Mu*	2312.404	0.8867	Passed
			fl	24.706		
			Sxt	565.402		
			Φf Mn	3045.346		
	6.10.7.1.2-1	$M_n = M_p$	*Mp*	3383.683		
	6.10.7.1.2-2	$M_n = M_p\left(1.07 - \frac{0.7D_p}{D_t}\right)$	*Mn*	3045.346		
			Mp	3383.683		
			Dp	9.658		
			Dt	39.770		
	6.10.7.1.2-3	$M_n \leq 1.3R_h M_y$	*1.3RhMy*	3062.594		
			My	2355.841		
6.10.7.3 – Ductility						
	6.10.7.3-1	$D_p \leq 0.42D_t$	*Dp*	9.658	0.5782	Passed
			0.42 Dt	16.703		
6.10.6.3 – Shear						

6.10.9.1 – General						
	6.10.9.1-1	$V_u \le \phi_v V_n$	*Vu*	24.403	0.0457	Passed
			ΦVn	534.209		
6.10.9.2 – Unstiffened Webs						
		$d_0 \le 1.5D$	*d0*	---	---	---
			D	---		
		$d_0 \le 3.0D$	*d0*	151.800	1.785	Unstiffened
			D	28.340		
	6.10.9.2-1	$V_n = V_{cr} = CV_p$	*Vn*	534.209		
	6.10.9.2-2	$V_p = 0.58F_{yw}Dt_w$	*Vp*	534.209		
	6.10.9.3.2-4	$C = 1.0$	*C*	1.000		
	6.10.9.3.2-5	$C = \frac{1.12}{\frac{D}{t_w}}\sqrt{\frac{Ek}{F_{yw}}}$	*C*	---		
	6.10.9.3.2-6	$C = \frac{1.57}{\left(\frac{D}{t_w}\right)^2}\left(\frac{Ek}{F_{yw}}\right)$	*C*	---		
		$k = 5$	*k*	5.000		

Service Limit State (Article 6.10.4)

Final Default Service II   Service II   Final

Article		Equation	Parameter	Value	Perf. Ratio	Result
6.10.4.2 – Permanent Deformations						
6.10.4.2.1 – General						
		Slab Effective Negative?				True
		Continuous Shear Connectors?				True
		$f_{slab} < 0.9f_r$	*fslab*	---	---	---
			0.9 fr	---		
		Is 6.10.1.7 *met?*				True
		$f_{slab} < 2f_r$	*fslab*	---	---	---
			2 fr	---		
6.10.1.6 – Lateral Flange Stress Considerations						
	6.10.1.6-2	$L_b \le 1.2L_p\sqrt{\frac{C_bR_b}{f_{bu}/F_{yc}}}$	*Lb*	151.800		
				143.168		

	6.10.1.6-4	$f_l = \left(\frac{0.85}{1 - \frac{f_{bu}}{F_{cr}}} \right) f_{l1} \geq f_{l1}$	*fl1*	16.928		
			fl	17.212		
	6.10.1.6-1	$f_l \leq 0.6 F_{yf}$	*Fyf*	50.000	0.5737	
			fl	17.212		
6.10.4.2.2 – Flexure						
		Is Section Composite?				True
		Is Flexure Negative?				False
	6.10.4.2.2-1	$f_f \leq 0.95 R_h F_{yf}$	*ff*	16.278	0.3427	Passed
			*0.95Rh*Fyf*	47.500		
	6.10.4.2.2-2	$f_f + \frac{f_l}{2} \leq 0.95 R_h F_{yf}$	*ff*	36.387	0.9472	Passed
			fl	17.212		
			*0.95Rh*Fyf*	47.500		
Top Flange	6.10.4.2.2-3	$f_f + \frac{f_l}{2} \leq 0.80 R_h F_{yf}$	*ff*	16.278	---	---
			fl	0.000		
			*0.8*Rh*Fyf*	---		
Bottom Flange	6.10.4.2.2-3	$f_f + \frac{f_l}{2} \leq 0.80 R_h F_{yf}$	*ff*	36.387	---	---
			fl	17.212		
			*0.8*Rh*Fyf*	---		
	6.10.4.2.2-4	$f_c \leq F_{crw}$	*fc*	---	---	---
			Fcrw	---		

Group01 Member 02

POI Location: 31.625 ft (1.50) Mid Bracing Point:

Strength Limit State (Article 6.10.6)

Final Default Strength I Strength I Final

Article	Equation	Parameter	Value	Perf. Ratio	Result
6.10.6.2 – Flexure					
6.10.6.2.2 – Composite Sections in Positive Flexure					
	Is Compact?				Compact
	Straight Bridge?				Straight
6.10.6.2.2	$Flange\ F_y \leq 70 ksi$	*Fyt*	50.000	0.7143	True
		Fyb	50.000		

	6.10.2.1.1-1	$\frac{D}{t_w} \le 150$	D	28.340	0.2907	True
			tw	0.650		
	6.10.6.2.2-1	$\frac{2D_{cp}}{t_w} \le 3.76\sqrt{\frac{E}{F_{yc}}}$	Dcp	0.000	0.0000	True
6.10.7.1 – Compact Sections						
	6.10.7.1.1-1	$M_u + \frac{1}{3} f_l S_{xt} \le \phi_f M_n$	Mu	2482.481	0.8559	Passed
			fl	19.511		
			Sxt	573.820		
			Φf Mn	3263.838		
	6.10.7.1.2-1	$M_n = M_p$	Mp	3594.524		
	6.10.7.1.2-2	$M_n = M_p\left(1.07 - \frac{0.7D_p}{D_t}\right)$	Mn	3263.838		
			Mp	3594.524		
			Dp	9.204		
			Dt	39.770		
	6.10.7.1.2-3	$M_n \le 1.3R_hM_y$	1.3RhMy	3108.190		
			My	2390.915		
6.10.7.3 – Ductility						
	6.10.7.3-1	$D_p \le 0.42D_t$	Dp	9.204	0.5510	Passed
			0.42 Dt	16.703		
6.10.6.3 – Shear						
6.10.9.1 – General						
	6.10.9.1-1	$V_u \le \phi_v V_n$	Vu	47.939	0.0897	Passed
			ΦVn	534.209		
6.10.9.2 – Unstiffened Webs						
		$d_0 \le 1.5D$	d0	---	---	---
			D	---		
		$d_0 \le 3.0D$	d0	151.800	1.785	Unstiffened
			D	28.340		
	6.10.9.2-1	$V_n = V_{cr} = CV_p$	Vn	534.209		
	6.10.9.2-2	$V_p = 0.58F_{yw}Dt_w$	Vp	534.209		
	6.10.9.3.2-4	$C = 1.0$	C	1.000		
	6.10.9.3.2-5	$C = \frac{1.12}{\frac{D}{t_w}}\sqrt{\frac{Ek}{F_{yw}}}$	C	---		

	6.10.9.3.2-6 $C = \frac{1.57}{\left(\frac{D}{t_w}\right)^2}\left(\frac{Ek}{F_{yw}}\right)$	C	---		
	$k = 5$	k	5.000		

Service Limit State (Article 6.10.4)

Final Default Service II — Service II — Final

Article	Equation	Parameter	Value	Perf. Ratio	Result
6.10.4.2 – Permanent Deformations					
6.10.4.2.1 – General					
	Slab Effective Negative?				True
	Continuous Shear Connectors?				True
	$f_{slab} < 0.9 f_r$	*fslab*	---	---	---
		0.9 fr	---		
	Is 6.10.1.7 *met?*				True
	$f_{slab} < 2 f_r$	*fslab*	---	---	---
		2 fr	---		
6.10.1.6 – Lateral Flange Stress Considerations					
	6.10.1.6-2 $L_b \le 1.2 L_p \sqrt{\frac{C_b R_b}{f_{bu} / F_{yc}}}$	*Lb*	151.800		
			148.008		
	6.10.1.6-4 $f_l = \left(\frac{0.85}{1 - \frac{f_{bu}}{F_{cr}}}\right) f_{l1} \ge f_{l1}$	*fl1*	13.648		
		fl	13.704		
	6.10.1.6-1 $f_l \le 0.6 F_{yf}$	*Fyf*	50.000	0.4568	
		fl	13.704		
6.10.4.2.2 – Flexure					
	Is Section Composite?				True
	Is Flexure Negative?				False
	6.10.4.2.2-1 $f_f \le 0.95 R_h F_{yf}$	*ff*	15.408	0.3244	Passed
		*0.95Rh*Fyf*	47.500		
	6.10.4.2.2-2 $f_f + \frac{f_l}{2} \le 0.95 R_h F_{yf}$	*ff*	38.245	0.9494	Passed
		fl	13.704		
		*0.95Rh*Fyf*	47.500		

Top Flange	6.10.4.2.2-3	$f_f + \frac{f_l}{2} \leq 0.80 R_h F_{yf}$	*ff*	15.408	---	---
			fl	0.000		
			*0.8*Rh*Fyf*	---		
Bottom Flange	6.10.4.2.2-3	$f_f + \frac{f_l}{2} \leq 0.80 R_h F_{yf}$	*ff*	38.245	---	---
			fl	13.704		
			*0.8*Rh*Fyf*	---		
	6.10.4.2.2-4	$f_c \leq F_{crw}$	*fc*	---	---	---
			Fcrw	---		

Group01 Member 03

POI Location: 31.625 ft (1.50) Mid Bracing Point:

Strength Limit State (Article 6.10.6)

Final Default Strength I Strength I Final

Article	Equation		Parameter	Value	Perf. Ratio	Result
6.10.6.2 – Flexure						
6.10.6.2.2 – Composite Sections in Positive Flexure						
		Is Compact?				Compact
		Straight Bridge?				Straight
	6.10.6.2.2	*Flange* $F_y \leq 70ksi$	*Fyt*	50.000	0.7143	True
			Fyb	50.000		
	6.10.2.1.1-1	$\frac{D}{t_w} \leq 150$	*D*	28.340	0.2907	True
			tw	0.650		
	6.10.6.2.2-1	$\frac{2D_{cp}}{t_w} \leq 3.76\sqrt{\frac{E}{F_{yc}}}$	*Dcp*	0.000	0.0000	True
6.10.7.1 – Compact Sections						
	6.10.7.1.1-1	$M_u + \frac{1}{3} f_l S_{xt} \leq \phi_f M_n$	*Mu*	2348.800	0.7612	Passed
			fl	8.529		
			Sxt	572.337		
			Φf Mn	3263.838		
	6.10.7.1.2-1	$M_n = M_p$	*Mp*	3594.524		
	6.10.7.1.2-2	$M_n = M_p\left(1.07 - \frac{0.7D_p}{D_t}\right)$	*Mn*	3263.838		
			Mp	3594.524		
			Dp	9.204		
			Dt	39.770		

	6.10.7.1.2-3	$M_n \leq 1.3R_hM_y$	*1.3RhMy*	3100.158		
			My	2384.737		
6.10.7.3 – Ductility						
	6.10.7.3-1	$D_p \leq 0.42D_t$	*Dp*	9.204	0.5510	Passed
			0.42 Dt	16.703		
6.10.6.3 – Shear						
6.10.9.1 – General						
	6.10.9.1-1	$V_u \leq \phi_v V_n$	*Vu*	56.603	0.1060	Passed
			ΦVn	534.209		
6.10.9.2 – Unstiffened Webs						
		$d_0 \leq 1.5D$	*d0*	---	---	---
			D	---		
		$d_0 \leq 3.0D$	*d0*	151.800	1.785	Unstiffened
			D	28.340		
	6.10.9.2-1	$V_n = V_{cr} = CV_p$	*Vn*	534.209		
	6.10.9.2-2	$V_p = 0.58F_{yw}Dt_w$	*Vp*	534.209		
	6.10.9.3.2-4	$C = 1.0$	*C*	1.000		
	6.10.9.3.2-5	$C = \frac{1.12}{\frac{D}{t_w}}\sqrt{\frac{Ek}{F_{yw}}}$	*C*	---		
	6.10.9.3.2-6	$C = \frac{1.57}{\left(\frac{D}{t_w}\right)^2}\left(\frac{Ek}{F_{yw}}\right)$	*C*	---		
		$k = 5$	*k*	5.000		

Service Limit State (Article 6.10.4)

Final Default Service II | Service II | Final

Article	Equation	Parameter	Value	Perf. Ratio	Result
6.10.4.2 – Permanent Deformations					
6.10.4.2.1 – General					
	Slab Effective Negative?				True
	Continuous Shear Connectors?				True
	$f_{slab} < 0.9f_r$	*fslab*	---	---	---
		0.9fr	---		
	Is 6.10.1.7 *met?*				True

	$f_{slab} < 2f_r$	fslab	---	---	---
		2fr	---		
6.10.1.6 – Lateral Flange Stress Considerations					
	6.10.1.6-2 $L_b \le 1.2L_p\sqrt{\frac{C_b R_b}{f_{bu}/F_{yc}}}$	Lb	151.800		
			147.058		
	6.10.1.6-4 $f_l = \left(\frac{0.85}{1-\frac{f_{bu}}{F_{cr}}}\right) f_{l1} \ge f_{l1}$	fl1	5.951		
		fl	5.989		
	6.10.1.6-1 $f_l \le 0.6F_{yf}$	Fyf	50.000	0.1996	
		fl	5.989		
6.10.4.2.2 – Flexure					
	Is Section Composite?				True
	Is Flexure Negative?				False
	6.10.4.2.2-1 $f_f \le 0.95R_h F_{yf}$	ff	15.529	0.3269	Passed
		0.95Rh*Fyf	47.500		
	6.10.4.2.2-2 $f_f + \frac{f_l}{2} \le 0.95R_h F_{yf}$	ff	36.531	0.8321	Passed
		fl	5.989		
		0.95Rh*Fyf	47.500		
Top Flange	6.10.4.2.2-3 $f_f + \frac{f_l}{2} \le 0.80R_h F_{yf}$	ff	15.529	---	---
		fl	0.000		
		0.8*Rh*Fyf	---		
Bottom Flange	6.10.4.2.2-3 $f_f + \frac{f_l}{2} \le 0.80R_h F_{yf}$	ff	36.531	---	---
		fl	5.989		
		0.8*Rh*Fyf	---		
	6.10.4.2.2-4 $f_c \le F_{crw}$	fc	---	---	---
		Fcrw	---		

Group01 Member 04

POI Location: 31.625 ft (1.50) Mid Bracing Point:

Strength Limit State (Article 6.10.6)

Final Default Strength I Strength I Final

Article	Equation	Parameter	Value	Perf. Ratio	Result
6.10.6.2 – Flexure					
6.10.6.2.2 – Composite Sections in Positive Flexure					

		Is Compact?				Compact
		Straight Bridge?				Straight
	6.10.6.2.2	$Flange\ F_y \le 70ksi$	*Fyt*	50.000	0.7143	True
			Fyb	50.000		
	6.10.2.1.1-1	$\frac{D}{t_w} \le 150$	*D*	28.340	0.2907	True
			tw	0.650		
	6.10.6.2.2-1	$\frac{2D_{cp}}{t_w} \le 3.76\sqrt{\frac{E}{F_{yc}}}$	*Dcp*	0.000	0.0000	True
6.10.7.1 – Compact Sections						
	6.10.7.1.1-1	$M_u + \frac{1}{3} f_l S_{xt} \le \phi_f M_n$	*Mu*	2345.333	0.7455	Passed
			fl	5.531		
			Sxt	572.337		
			Φf Mn	3263.838		
	6.10.7.1.2-1	$M_n = M_p$	*Mp*	3594.524		
	6.10.7.1.2-2	$M_n = M_p\left(1.07 - \frac{0.7D_p}{D_t}\right)$	*Mn*	3263.838		
			Mp	3594.524		
			Dp	9.204		
			Dt	39.770		
	6.10.7.1.2-3	$M_n \le 1.3R_hM_y$	*1.3RhMy*	3100.158		
			My	2384.737		
6.10.7.3 – Ductility						
	6.10.7.3-1	$D_p \le 0.42D_t$	*Dp*	9.204	0.5510	Passed
			0.42 Dt	16.703		
6.10.6.3 – Shear						
6.10.9.1 – General						
	6.10.9.1-1	$V_u \le \phi_v V_n$	*Vu*	57.187	0.1071	Passed
			ΦVn	534.209		
6.10.9.2 – Unstiffened Webs						
		$d_0 \le 1.5D$	*d0*	---	---	---
			D	---		
		$d_0 \le 3.0D$	*d0*	151.800	1.785	Unstiffened
			D	28.340		
	6.10.9.2-1	$V_n = V_{cr} = CV_p$	*Vn*	534.209		
	6.10.9.2-2	$V_p = 0.58F_{yw}Dt_w$	*Vp*	534.209		
	6.10.9.3.2-4	$C = 1.0$	*C*	1.000		

	6.10.9.3.2-5	$C = \frac{1.12}{\frac{D}{t_w}}\sqrt{\frac{Ek}{F_{yw}}}$	C	---		
	6.10.9.3.2-6	$C = \frac{1.57}{\left(\frac{D}{t_w}\right)^2}\left(\frac{Ek}{F_{yw}}\right)$	C	---		
		$k = 5$	k	5.000		

Service Limit State (Article 6.10.4)

Final Default Service II — Service II — Final

Article		Equation	Parameter	Value	Perf. Ratio	Result
6.10.4.2 – Permanent Deformations						
6.10.4.2.1 – General						
		Slab Effective Negative?				True
		Continuous Shear Connectors?				True
		$f_{slab} < 0.9 f_r$	*fslab*	---	---	---
			0.9 fr	---		
		Is 6.10.1.7 *met?*				True
		$f_{slab} < 2 f_r$	*fslab*	---	---	---
			2 fr	---		
6.10.1.6 – Lateral Flange Stress Considerations						
	6.10.1.6-2	$L_b \le 1.2 L_p \sqrt{\frac{C_b R_b}{f_{bu} / F_{yc}}}$	*Lb*	151.800		
				147.068		
	6.10.1.6-4	$f_l = \left(\frac{0.85}{1 - \frac{f_{bu}}{F_{cr}}}\right) f_{l1} \ge f_{l1}$	*fl1*	3.852		
			fl	3.877		
	6.10.1.6-1	$f_l \le 0.6 F_{yf}$	*Fyf*	50.000	0.1292	
			fl	3.877		
6.10.4.2.2 – Flexure						
		Is Section Composite?				True
		Is Flexure Negative?				False
	6.10.4.2.2-1	$f_f \le 0.95 R_h F_{yf}$	*ff*	15.525	0.3268	Passed
			*0.95Rh*Fyf*	47.500		

	6.10.4.2.2-2	$f_f + \frac{f_l}{2} \le 0.95R_h F_{yf}$	*ff*	36.484	0.8089	Passed
			fl	3.877		
			*0.95Rh*Fyf*	47.500		
Top Flange	6.10.4.2.2-3	$f_f + \frac{f_l}{2} \le 0.80R_h F_{yf}$	*ff*	15.525	---	---
			fl	0.000		
			*0.8*Rh*Fyf*	---		
Bottom Flange	6.10.4.2.2-3	$f_f + \frac{f_l}{2} \le 0.80R_h F_{yf}$	*ff*	36.484	---	---
			fl	3.877		
			*0.8*Rh*Fyf*	---		
	6.10.4.2.2-4	$f_c \le F_{crw}$	*fc*	---	---	---
			Fcrw	---		

Group01 Member 05

POI Location: 31.625 ft (1.50) Mid Bracing Point:

Strength Limit State (Article 6.10.6)

Final Default Strength I — Strength I — Final

Article		Equation	Parameter	Value	Perf. Ratio	Result
6.10.6.2 – Flexure						
6.10.6.2.2 – Composite Sections in Positive Flexure						
		Is Compact?				Compact
		Straight Bridge?				Straight
	6.10.6.2.2	$Flange\ F_y \le 70ksi$	*Fyt*	50.000	0.7143	True
			Fyb	50.000		
	6.10.2.1.1-1	$\frac{D}{t_w} \le 150$	*D*	28.340	0.2907	True
			tw	0.650		
	6.10.6.2.2-1	$\frac{2D_{cp}}{t_w} \le 3.76\sqrt{\frac{E}{F_{yc}}}$	*Dcp*	0.000	0.0000	True
6.10.7.1 – Compact Sections						
	6.10.7.1.1-1	$M_u + \frac{1}{3} f_l S_{xt} \le \phi_f M_n$	*Mu*	2457.590	0.8422	Passed
			fl	18.271		
			Sxt	573.820		
			Φf Mn	3263.838		
	6.10.7.1.2-1	$M_n = M_p$	*Mp*	3594.524		

	6.10.7.1.2-2	$M_n = M_p\left(1.07 - \frac{0.7D_p}{D_t}\right)$	*Mn*	3263.838		
			Mp	3594.524		
			Dp	9.204		
			Dt	39.770		
	6.10.7.1.2-3	$M_n \le 1.3R_hM_y$	*1.3RhMy*	3108.190		
			My	2390.915		
6.10.7.3 – Ductility						
	6.10.7.3-1	$D_p \le 0.42D_t$	*Dp*	9.204	0.5510	Passed
			0.42 Dt	16.703		
6.10.6.3 – Shear						
6.10.9.1 – General						
	6.10.9.1-1	$V_u \le \phi_v V_n$	*Vu*	48.766	0.0913	Passed
			ΦVn	534.209		
6.10.9.2 – Unstiffened Webs						
		$d_0 \le 1.5D$	*d0*	---	---	---
			D	---		
		$d_0 \le 3.0D$	*d0*	151.800	1.785	Unstiffened
			D	28.340		
	6.10.9.2-1	$V_n = V_{cr} = CV_p$	*Vn*	534.209		
	6.10.9.2-2	$V_p = 0.58F_{yw}Dt_w$	*Vp*	534.209		
	6.10.9.3.2-4	$C = 1.0$	*C*	1.000		
	6.10.9.3.2-5	$C = \frac{1.12}{\frac{D}{t_w}}\sqrt{\frac{Ek}{F_{yw}}}$	*C*	---		
	6.10.9.3.2-6	$C = \frac{1.57}{\left(\frac{D}{t_w}\right)^2}\left(\frac{Ek}{F_{yw}}\right)$	*C*	---		
		$k = 5$	*k*	5.000		

<u>Service Limit State (Article 6.10.4)</u>

<u>Final Default Service II</u> <u>Service II</u> <u>Final</u>

Article	Equation	Parameter	Value	Perf. Ratio	Result
6.10.4.2 – Permanent Deformations					
6.10.4.2.1 – General					
	Slab Effective Negative?				True

		Continuous Shear Connectors?				True
		$f_{slab} < 0.9 f_r$	*fslab*	---	---	---
			0.9 fr	---		
		Is 6.10.1.7 met?				True
		$f_{slab} < 2 f_r$	*fslab*	---	---	---
			2 fr	---		
6.10.1.6 – Lateral Flange Stress Considerations						
	6.10.1.6-2	$L_b \le 1.2 L_p \sqrt{\frac{C_b R_b}{f_{bu} / F_{yc}}}$	*Lb*	151.800		
				148.084		
	6.10.1.6-4	$f_l = \left(\frac{0.85}{1 - \frac{f_{bu}}{F_{cr}}} \right) f_{l1} \ge f_{l1}$	*fl1*	12.784		
			fl	12.834		
	6.10.1.6-1	$f_l \le 0.6 F_{yf}$	*Fyf*	50.000	0.4278	
			fl	12.834		
6.10.4.2.2 – Flexure						
		Is Section Composite?				True
		Is Flexure Negative?				False
	6.10.4.2.2-1	$f_f \le 0.95 R_h F_{yf}$	*ff*	15.382	0.3238	Passed
			*0.95Rh*Fyf*	47.500		
	6.10.4.2.2-2	$f_f + \frac{f_l}{2} \le 0.95 R_h F_{yf}$	*ff*	37.905	0.9331	Passed
			fl	12.834		
			*0.95Rh*Fyf*	47.500		
Top Flange	6.10.4.2.2-3	$f_f + \frac{f_l}{2} \le 0.80 R_h F_{yf}$	*ff*	15.382	---	---
			fl	0.000		
			*0.8*Rh*Fyf*	---		
Bottom Flange	6.10.4.2.2-3	$f_f + \frac{f_l}{2} \le 0.80 R_h F_{yf}$	*ff*	37.905	---	---
			fl	12.834		
			*0.8*Rh*Fyf*	---		
	6.10.4.2.2-4	$f_c \le F_{crw}$	*fc*	---	---	---
			Fcrw	---		

Group01 Member 06

POI Location: 31.625 ft (1.50) Mid Bracing Point:

Strength Limit State (Article 6.10.6)

Final Default Strength I   Strength I   Final

Article	Equation		Parameter	Value	Perf. Ratio	Result
6.10.6.2 – Flexure						
6.10.6.2.2 – Composite Sections in Positive Flexure						
		Is Compact?				Compact
		Straight Bridge?				Straight
	6.10.6.2.2	$Flange\ F_y \le 70ksi$	*Fyt*	50.000	0.7143	True
			Fyb	50.000		
	6.10.2.1.1-1	$\frac{D}{t_w} \le 150$	*D*	28.340	0.2907	True
			tw	0.650		
	6.10.6.2.2-1	$\frac{2D_{cp}}{t_w} \le 3.76\sqrt{\frac{E}{F_{yc}}}$	*Dcp*	0.000	0.0000	True
6.10.7.1 – Compact Sections						
	6.10.7.1.1-1	$M_u + \frac{1}{3} f_l S_{xt} \le \phi_f M_n$	*Mu*	2254.398	0.8591	Passed
			fl	23.039		
			Sxt	565.402		
			Φf Mn	3045.346		
	6.10.7.1.2-1	$M_n = M_p$	*Mp*	3383.683		
	6.10.7.1.2-2	$M_n = M_p\left(1.07 - \frac{0.7D_p}{D_t}\right)$	*Mn*	3045.346		
			Mp	3383.683		
			Dp	9.658		
			Dt	39.770		
	6.10.7.1.2-3	$M_n \le 1.3R_h M_y$	*1.3RhMy*	3062.594		
			My	2355.841		
6.10.7.3 – Ductility						
	6.10.7.3-1	$D_p \le 0.42D_t$	*Dp*	9.658	0.5782	Passed
			0.42 Dt	16.703		
6.10.6.3 – Shear						
6.10.9.1 – General						
	6.10.9.1-1	$V_u \le \phi_v V_n$	*Vu*	22.567	0.0422	Passed
			ΦVn	534.209		
6.10.9.2 – Unstiffened Webs						
		$d_0 \le 1.5D$	*d0*	---	---	---
			D	---		

	$d_0 \le 3.0D$	d0	151.800	1.785	Unstiffened
		D	28.340		
6.10.9.2-1	$V_n = V_{cr} = CV_p$	Vn	534.209		
6.10.9.2-2	$V_p = 0.58F_{yw}Dt_w$	Vp	534.209		
6.10.9.3.2-4	$C = 1.0$	C	1.000		
6.10.9.3.2-5	$C = \frac{1.12}{\frac{D}{t_w}}\sqrt{\frac{Ek}{F_{yw}}}$	C	---		
6.10.9.3.2-6	$C = \frac{1.57}{\left(\frac{D}{t_w}\right)^2}\left(\frac{Ek}{F_{yw}}\right)$	C	---		
	$k = 5$	k	5.000		

Service Limit State (Article 6.10.4)

Final Default Service II　　　Service II　　　Final

Article	Equation	Parameter	Value	Perf. Ratio	Result
6.10.4.2 – Permanent Deformations					
6.10.4.2.1 – General					
	Slab Effective Negative?				True
	Continuous Shear Connectors?				True
	$f_{slab} < 0.9f_r$	fslab	---	---	---
		0.9 fr	---		
	Is 6.10.1.7 *met?*				True
	$f_{slab} < 2f_r$	fslab	---	---	---
		2 fr	---		
6.10.1.6 – Lateral Flange Stress Considerations					
6.10.1.6-2	$L_b \le 1.2L_p\sqrt{\frac{C_bR_b}{f_{bu}/F_{yc}}}$	Lb	151.800		
			143.517		
6.10.1.6-4	$f_l = \left(\frac{0.85}{1-\frac{f_{bu}}{F_{cr}}}\right)f_{l1} \ge f_{l1}$	fl1	15.807		
		fl	16.057		
6.10.1.6-1	$f_l \le 0.6F_{yf}$	Fyf	50.000	0.5352	
		fl	16.057		
6.10.4.2.2 – Flexure					
	Is Section Composite?				True

		Is Flexure Negative?				False
	6.10.4.2.2-1	$f_f \le 0.95 R_h F_{yf}$	*ff*	16.174	0.3405	Passed
			*0.95Rh*Fyf*	47.500		
	6.10.4.2.2-2	$f_f + \frac{f_l}{2} \le 0.95 R_h F_{yf}$	*ff*	35.576	0.9180	Passed
			fl	16.057		
			*0.95Rh*Fyf*	47.500		
Top Flange	6.10.4.2.2-3	$f_f + \frac{f_l}{2} \le 0.80 R_h F_{yf}$	*ff*	16.174	---	---
			fl	0.000		
			*0.8*Rh*Fyf*	---		
Bottom Flange	6.10.4.2.2-3	$f_f + \frac{f_l}{2} \le 0.80 R_h F_{yf}$	*ff*	35.576	---	---
			fl	16.057		
			*0.8*Rh*Fyf*	---		
	6.10.4.2.2-4	$f_c \le F_{crw}$	*fc*	---	---	---
			Fcrw	---		

Bridge 1

Superstructure

Pier/Abutment Locations

Roadway: RDWY01

Offset to Bridge CL: 0.0000 ft

No.	Type	Name	Input Method	Station/Distance(ft)	Skew/Bearing
1	Abutment	Support 01	Station	0+00.0000	NORMAL
2	Abutment	Support 02	Station	1+03.0000	NORMAL

Member Definition

Member Group: Group01

Member 01:

WEB	No.	Ref. Span	Start (ft)	Length (ft)	Material	Thick (in)	Start Height (in)	Variation	End Height (in)
	1	1	0.0000	103.0000	Grade 50	0.6250	48.0000	None	48.0000
Top Flange	**No.**	**Ref. Span**	**Start (ft)**	**Length (ft)**	**Material**	**Thick (in)**	**Start Width (in)**	**Variation**	**End Width (in)**
	1	1	0.0000	103.0000	Grade 50	1.0000	20.0000	None	20.0000
Bottom Flange	**No.**	**Ref. Span**	**Start (ft)**	**Length (ft)**	**Material**	**Thick (in)**	**Start Width (in)**	**Variation**	**End Width (in)**
	1	1	0.0000	103.0000	Grade 50	1.0000	20.0000	None	20.0000

Member 02:

WEB	No.	Ref. Span	Start (ft)	Length (ft)	Material	Thick (in)	Start Height (in)	Variation	End Height (in)
	1	1	0.0000	103.0000	Grade 50	0.6250	48.0000	None	48.0000
Top Flange	**No.**	**Ref. Span**	**Start (ft)**	**Length (ft)**	**Material**	**Thick (in)**	**Start Width (in)**	**Variation**	**End Width (in)**

Top Flange	No.	Ref. Span	Start (ft)	Length (ft)	Material	Thick (in)	Start Width (in)	Variation	End Width (in)
	1	1	0.0000	103.0000	Grade 50	1.0000	20.0000	None	20.0000
Bottom Flange	**No.**	**Ref. Span**	**Start (ft)**	**Length (ft)**	**Material**	**Thick (in)**	**Start Width (in)**	**Variation**	**End Width (in)**
	1	1	0.0000	103.0000	Grade 50	1.0000	20.0000	None	20.0000

Member 03:

WEB	No.	Ref. Span	Start (ft)	Length (ft)	Material	Thick (in)	Start Height (in)	Variation	End Height (in)
	1	1	0.0000	103.0000	Grade 50	0.6250	48.0000	None	48.0000
Top Flange	**No.**	**Ref. Span**	**Start (ft)**	**Length (ft)**	**Material**	**Thick (in)**	**Start Width (in)**	**Variation**	**End Width (in)**
	1	1	0.0000	103.0000	Grade 50	1.0000	20.0000	None	20.0000
Bottom Flange	**No.**	**Ref. Span**	**Start (ft)**	**Length (ft)**	**Material**	**Thick (in)**	**Start Width (in)**	**Variation**	**End Width (in)**
	1	1	0.0000	103.0000	Grade 50	1.0000	20.0000	None	20.0000

Member 04:

WEB	No.	Ref. Span	Start (ft)	Length (ft)	Material	Thick (in)	Start Height (in)	Variation	End Height (in)
	1	1	0.0000	103.0000	Grade 50	0.6250	48.0000	None	48.0000
Top Flange	**No.**	**Ref. Span**	**Start (ft)**	**Length (ft)**	**Material**	**Thick (in)**	**Start Width (in)**	**Variation**	**End Width (in)**
	1	1	0.0000	103.0000	Grade 50	1.0000	20.0000	None	20.0000
Bottom Flange	**No.**	**Ref. Span**	**Start (ft)**	**Length (ft)**	**Material**	**Thick (in)**	**Start Width (in)**	**Variation**	**End Width (in)**
	1	1	0.0000	103.0000	Grade 50	1.0000	20.0000	None	20.0000

Member 05:

WEB	No.	Ref. Span	Start (ft)	Length (ft)	Material	Thick (in)	Start Height (in)	Variation	End Height (in)
	1	1	0.0000	103.0000	Grade 50	0.6250	48.0000	None	48.0000

Date:	12/13/2016	Main Street Alt_3_vehicle.lbs	
Time:	3:34 PM	Bentley LEAP Bridge Steel [AASHTO LRFD Specifications]	

Top Flange	**No.**	**Ref. Span**	**Start (ft)**	**Length (ft)**	**Material**	**Thick (in)**	**Start Width (in)**	**Variation**	**End Width (in)**
	1	1	0.0000	103.0000	Grade 50	1.0000	20.0000	None	20.0000
Bottom Flange	**No.**	**Ref. Span**	**Start (ft)**	**Length (ft)**	**Material**	**Thick (in)**	**Start Width (in)**	**Variation**	**End Width (in)**
	1	1	0.0000	103.0000	Grade 50	1.0000	20.0000	None	20.0000

Code Checker Results

Group01 Member 01

POI Location: 51.500 ft (1.50) Cross-Frame (right bay); Slab Start; Slab End:

Strength Limit State (Article 6.10.6)

Final Default Strength I Strength I Final

Article	Equation		Parameter	Value	Perf. Ratio	Result
6.10.6.2 – Flexure						
6.10.6.2.2 – Composite Sections in Positive Flexure						
		Is Compact?				Compact
		Straight Bridge?				Straight
	6.10.6.2.2	$Flange\ F_y \le 70ksi$	*Fyt*	50.000	0.7143	True
			Fyb	50.000		
	6.10.2.1.1-1	$\frac{D}{t_w} \le 150$	*D*	48.000	0.5120	True
			tw	0.625		
	6.10.6.2.2-1	$\frac{2D_{cp}}{t_w} \le 3.76\sqrt{\frac{E}{F_{yc}}}$	*Dcp*	0.000	0.0000	True
6.10.7.1 – Compact Sections						
	6.10.7.1.1-1	$M_u + \frac{1}{3} f_l S_{xt} \le \phi_f M_n$	*Mu*	7024.392	0.9692	Passed
			fl	6.308		
			Sxt	1357.012		
			Φf Mn	7492.703		
	6.10.7.1.2-1	$M_n = M_p$	*Mp*	7872.006		
	6.10.7.1.2-2	$M_n = M_p\left(1.07 - \frac{0.7D_p}{D_t}\right)$	*Mn*	7492.703		
			Mp	7872.006		
			Dp	9.961		
			Dt	59.000		
	6.10.7.1.2-3	$M_n \le 1.3R_h M_y$	*1.3RhMy*	7350.481		
			My	5654.216		
6.10.7.3 – Ductility						
	6.10.7.3-1	$D_p \le 0.42D_t$	*Dp*	9.961	0.4020	Passed
			0.42 Dt	24.780		
6.10.6.3 – Shear						

6.10.9.1 – General						
	6.10.9.1-1	$V_u \le \phi_v V_n$	*Vu*	40.376	0.0511	Passed
			ΦVn	790.904		
6.10.9.3 – Stiffened Webs						
6.10.9.3.2 - Interior Panels						
		$d_0 \le 1.5D$	*d0*	---	---	---
			D	---		
		$d_0 \le 3.0D$	*d0*	108.000	0.750	Stiffened
			D	48.000		
	6.10.9.3.2-1	$\frac{2Dt_w}{b_{fc}t_{fc}+b_{ft}t_{ft}} \le 2.5$		1.500	0.600	Passed
	6.10.9.3.2-2	$V_n = V_p\left(C+\frac{0.87(1-C)}{\sqrt{1+\left(\frac{d_0}{D}\right)^2}}\right)$	*Vn*	790.904		
	6.10.9.3.2-3	$V_p = 0.58F_{yw}Dt_w$	*Vp*	870.000		
	6.10.9.3.2-4	$C = 1.0$	*C*	---		
	6.10.9.3.2-5	$C = \frac{1.12}{\frac{D}{t_w}}\sqrt{\frac{Ek}{F_{yw}}}$	*C*	0.859		
	6.10.9.3.2-6	$C = \frac{1.57}{\left(\frac{D}{t_w}\right)^2}\left(\frac{Ek}{F_{yw}}\right)$	*C*	---		
	6.10.9.3.2-7	$k = 5+\frac{5}{\left(\frac{d_0}{D}\right)^2}$	*k*	5.988		
	6.10.9.3.2-8	$V_n = V_p\left(C+\frac{0.87(1-C)}{\sqrt{1+\left(\frac{d_0}{D}\right)^2}+\frac{d_0}{D}}\right)$	*Vn*	---		

<u>Service Limit State (Article 6.10.4)</u>

<u>Final Default Service II</u> <u>Service II</u> <u>Final</u>

Article	Equation	Parameter	Value	Perf. Ratio	Result
6.10.4.2 – Permanent Deformations					

6.10.4.2.1 – General					
	Slab Effective Negative?				True
	Continuous Shear Connectors?				True
	$f_{slab} < 0.9 f_r$	*fslab*	---	---	---
		0.9 fr	---		
	Is 6.10.1.7 *met*?				True
	$f_{slab} < 2 f_r$	*fslab*	---	---	---
		2 fr	---		
6.10.1.6 – Lateral Flange Stress Considerations					
	6.10.1.6-2 $L_b \le 1.2 L_p \sqrt{\frac{C_b R_b}{f_{bu} / F_{yc}}}$	*Lb*	108.000		
			214.504		
	6.10.1.6-4 $f_l = \left(\frac{0.85}{1 - \frac{f_{bu}}{F_{cr}}} \right) f_{l1} \ge f_{l1}$	*fl1*	4.690		
		fl	4.690		
	6.10.1.6-1 $f_l \le 0.6 F_{yf}$	*Fyf*	50.000	0.1563	
		fl	4.690		
6.10.4.2.2 – Flexure					
	Is Section Composite?				True
	Is Flexure Negative?				False
	6.10.4.2.2-1 $f_f \le 0.95 R_h F_{yf}$	*ff*	25.802	0.5432	Passed
		*0.95Rh*Fyf*	47.500		
	6.10.4.2.2-2 $f_f + \frac{f_l}{2} \le 0.95 R_h F_{yf}$	*ff*	44.015	0.9760	Passed
		fl	4.690		
		*0.95Rh*Fyf*	47.500		
Top Flange	6.10.4.2.2-3 $f_f + \frac{f_l}{2} \le 0.80 R_h F_{yf}$	*ff*	25.802	---	---
		fl	0.000		
		*0.8*Rh*Fyf*	---		
Bottom Flange	6.10.4.2.2-3 $f_f + \frac{f_l}{2} \le 0.80 R_h F_{yf}$	*ff*	44.015	---	---
		fl	4.690		
		*0.8*Rh*Fyf*	---		
	6.10.4.2.2-4 $f_c \le F_{crw}$	*fc*	---	---	---
		Fcrw	---		

Strength Limit State (Article 6.10.6)

Final Default Strength I | Strength I | Final

Article	Equation		Parameter	Value	Perf. Ratio	Result
6.10.6.2 – Flexure						
6.10.6.2.2 – Composite Sections in Positive Flexure						
		Is Compact?				Compact
		Straight Bridge?				Straight
	6.10.6.2.2	$Flange\ F_y \leq 70ksi$	*Fyt*	50.000	0.7143	True
			Fyb	50.000		
	6.10.2.1.1-1	$\frac{D}{t_w} \leq 150$	*D*	48.000	0.5120	True
			tw	0.625		
	6.10.6.2.2-1	$\frac{2D_{cp}}{t_w} \leq 3.76\sqrt{\frac{E}{F_{yc}}}$	*Dcp*	0.000	0.0000	True
6.10.7.1 – Compact Sections						
	6.10.7.1.1-1	$M_u + \frac{1}{3} f_l S_{xt} \leq \phi_f M_n$	*Mu*	7117.252	0.9495	Passed
			fl	4.780		
			Sxt	1373.022		
			Φf Mn	7688.084		
	6.10.7.1.2-1	$M_n = M_p$	*Mp*	8058.153		
	6.10.7.1.2-2	$M_n = M_p\left(1.07 - \frac{0.7D_p}{D_t}\right)$	*Mn*	7688.084		
			Mp	8058.153		
			Dp	9.771		
			Dt	59.000		
	6.10.7.1.2-3	$M_n \leq 1.3R_h M_y$	*1.3RhMy*	7437.202		
			My	5720.925		
6.10.7.3 – Ductility						
	6.10.7.3-1	$D_p \leq 0.42D_t$	*Dp*	9.771	0.3943	Passed
			0.42 Dt	24.780		
6.10.6.3 – Shear						
6.10.9.1 – General						
	6.10.9.1-1	$V_u \leq \phi_v V_n$	*Vu*	76.503	0.0967	Passed
			ΦVn	790.904		
6.10.9.3 – Stiffened Webs						
6.10.9.3.2 - Interior Panels						

	$d_0 \le 1.5D$	*d0*	---	---	---
		D	---		
	$d_0 \le 3.0D$	*d0*	108.000	0.750	Stiffened
		D	48.000		
	6.10.9.3.2-1 $\frac{2Dt_w}{b_{fc}t_{fc}+b_{ft}t_{ft}} \le 2.5$		1.500	0.600	Passed
	6.10.9.3.2-2 $V_n = V_p\left(C+\frac{0.87(1-C)}{\sqrt{1+\left(\frac{d_0}{D}\right)^2}}\right)$	*Vn*	790.904		
	6.10.9.3.2-3 $V_p = 0.58F_{yw}Dt_w$	*Vp*	870.000		
	6.10.9.3.2-4 $C = 1.0$	*C*	---		
	6.10.9.3.2-5 $C = \frac{1.12}{\frac{D}{t_w}}\sqrt{\frac{Ek}{F_{yw}}}$	*C*	0.859		
	6.10.9.3.2-6 $C = \frac{1.57}{\left(\frac{D}{t_w}\right)^2}\left(\frac{Ek}{F_{yw}}\right)$	*C*	---		
	6.10.9.3.2-7 $k = 5+\frac{5}{\left(\frac{d_0}{D}\right)^2}$	*k*	5.988		
	6.10.9.3.2-8 $V_n = V_p\left(C+\frac{0.87(1-C)}{\sqrt{1+\left(\frac{d_0}{D}\right)^2}+\frac{d_0}{D}}\right)$	*Vn*	---		

Service Limit State (Article 6.10.4)

Final Default Service II — Service II — Final

Article	Equation	Parameter	Value	Perf. Ratio	Result
6.10.4.2 – Permanent Deformations					
6.10.4.2.1 – General					
	Slab Effective Negative?				True
	Continuous Shear Connectors?				True
	$f_{slab} < 0.9f_r$	*fslab*	---	---	---
		0.9fr	---		

	Is 6.10.1.7 *met*?				True
	$f_{slab} < 2f_r$	*fslab*	---	---	---
		2 fr	---		
6.10.1.6 – Lateral Flange Stress Considerations					
	6.10.1.6-2 $L_b \le 1.2L_p\sqrt{\frac{C_bR_b}{f_{bu}/F_{yc}}}$	*Lb*	108.000		
			221.926		
	6.10.1.6-4 $f_l = \left(\frac{0.85}{1-\frac{f_{bu}}{F_{cr}}}\right) f_{l1} \ge f_{l1}$	*fl1*	3.555		
		fl	3.555		
	6.10.1.6-1 $f_l \le 0.6F_{yf}$	*Fyf*	50.000	0.1185	
		fl	3.555		
6.10.4.2.2 – Flexure					
	Is Section Composite?				True
	Is Flexure Negative?				False
	6.10.4.2.2-1 $f_f \le 0.95R_hF_{yf}$	*ff*	24.208	0.5096	Passed
		*0.95Rh*Fyf*	47.500		
	6.10.4.2.2-2 $f_f + \frac{f_l}{2} \le 0.95R_hF_{yf}$	*ff*	43.963	0.9630	Passed
		fl	3.555		
		*0.95Rh*Fyf*	47.500		
Top Flange	6.10.4.2.2-3 $f_f + \frac{f_l}{2} \le 0.80R_hF_{yf}$	*ff*	24.208	---	---
		fl	0.000		
		*0.8*Rh*Fyf*	---		
Bottom Flange	6.10.4.2.2-3 $f_f + \frac{f_l}{2} \le 0.80R_hF_{yf}$	*ff*	43.963	---	---
		fl	3.555		
		*0.8*Rh*Fyf*	---		
	6.10.4.2.2-4 $f_c \le F_{crw}$	*fc*	---	---	---
		Fcrw	---		

Group01 Member 03

<u>POI Location: 51.500 ft (1.50) Cross-Frame (left bay); Cross-Frame (right bay); Slab Start; Slab End;</u>

<u>Strength Limit State (Article 6.10.6)</u>

<u>Final Default Strength I</u> <u>Strength I</u> <u>Final</u>

Article	Equation	Parameter	Value	Perf. Ratio	Result
6.10.6.2 – Flexure					

6.10.6.2.2 – Composite Sections in Positive Flexure

		Is Compact?				Compact
		Straight Bridge?				Straight
	6.10.6.2.2	$Flange\ F_y \leq 70ksi$	*Fyt*	50.000	0.7143	True
			Fyb	50.000		
	6.10.2.1.1-1	$\frac{D}{t_w} \leq 150$	*D*	48.000	0.5120	True
			tw	0.625		
	6.10.6.2.2-1	$\frac{2D_{cp}}{t_w} \leq 3.76\sqrt{\frac{E}{F_{yc}}}$	*Dcp*	0.000	0.0000	True

6.10.7.1 – Compact Sections

	6.10.7.1.1-1	$M_u + \frac{1}{3} f_l S_{xt} \leq \phi_f M_n$	*Mu*	6809.911	0.8888	Passed
			fl	0.612		
			Sxt	1373.025		
			Φf Mn	7688.084		
	6.10.7.1.2-1	$M_n = M_p$	*Mp*	8058.153		
	6.10.7.1.2-2	$M_n = M_p\left(1.07 - \frac{0.7D_p}{D_t}\right)$	*Mn*	7688.084		
			Mp	8058.153		
			Dp	9.771		
			Dt	59.000		
	6.10.7.1.2-3	$M_n \leq 1.3R_h M_y$	*1.3RhMy*	7437.220		
			My	5720.938		

6.10.7.3 – Ductility

	6.10.7.3-1	$D_p \leq 0.42D_t$	*Dp*	9.771	0.3943	Passed
			0.42 Dt	24.780		

6.10.6.3 – Shear

6.10.9.1 – General

	6.10.9.1-1	$V_u \leq \phi_v V_n$	*Vu*	70.049	0.0886	Passed
			ΦVn	790.904		

6.10.9.3 – Stiffened Webs

6.10.9.3.2 - Interior Panels

	$d_0 \leq 1.5D$	*d0*	---	---	---
		D	---		
	$d_0 \leq 3.0D$	*d0*	108.000	0.750	Stiffened
		D	48.000		

	6.10.9.3.2-1	$\frac{2Dt_w}{b_{fc}t_{fc}+b_{ft}t_{ft}} \le 2.5$		1.500	0.600	Passed
	6.10.9.3.2-2	$V_n = V_p\left(C+\frac{0.87(1-C)}{\sqrt{1+\left(\frac{d_0}{D}\right)^2}}\right)$	*Vn*	790.904		
	6.10.9.3.2-3	$V_p = 0.58F_{yw}Dt_w$	*Vp*	870.000		
	6.10.9.3.2-4	$C = 1.0$	*C*	---		
	6.10.9.3.2-5	$C = \frac{1.12}{\frac{D}{t_w}}\sqrt{\frac{Ek}{F_{yw}}}$	*C*	0.859		
	6.10.9.3.2-6	$C = \frac{1.57}{\left(\frac{D}{t_w}\right)^2}\left(\frac{Ek}{F_{yw}}\right)$	*C*	---		
	6.10.9.3.2-7	$k = 5+\frac{5}{\left(\frac{d_0}{D}\right)^2}$	*k*	5.988		
	6.10.9.3.2-8	$V_n = V_p\left(C+\frac{0.87(1-C)}{\sqrt{1+\left(\frac{d_0}{D}\right)^2}+\frac{d_0}{D}}\right)$	*Vn*	---		

Service Limit State (Article 6.10.4)

Final Default Service II | Service II | Final

Article	Equation	Parameter	Value	Perf. Ratio	Result
6.10.4.2 – Permanent Deformations					
6.10.4.2.1 – General					
	Slab Effective Negative?				True
	Continuous Shear Connectors?				True
	$f_{slab} < 0.9f_r$	*fslab*	---	---	---
		0.9 fr	---		
	Is 6.10.1.7 *met?*				True
	$f_{slab} < 2f_r$	*fslab*	---	---	---
		2 fr	---		
6.10.1.6 – Lateral Flange Stress Considerations					

	6.10.1.6-2	$L_b \le 1.2L_p\sqrt{\frac{C_b R_b}{f_{bu}/F_{yc}}}$	Lb	108.000		
				223.728		
	6.10.1.6-4	$f_l = \left(\frac{0.85}{1-\frac{f_{bu}}{F_{cr}}}\right) f_{l1} \ge f_{l1}$	fl1	0.455		
			fl	0.455		
	6.10.1.6-1	$f_l \le 0.6F_{yf}$	Fyf	50.000	0.0152	
			fl	0.455		
6.10.4.2.2 – Flexure						
		Is Section Composite?				True
		Is Flexure Negative?				False
	6.10.4.2.2-1	$f_f \le 0.95R_h F_{yf}$	ff	23.801	0.5011	Passed
			0.95Rh*Fyf	47.500		
	6.10.4.2.2-2	$f_f + \frac{f_l}{2} \le 0.95R_h F_{yf}$	ff	42.196	0.8931	Passed
			fl	0.455		
			0.95Rh*Fyf	47.500		
Top Flange	6.10.4.2.2-3	$f_f + \frac{f_l}{2} \le 0.80R_h F_{yf}$	ff	23.801	---	---
			fl	0.000		
			0.8*Rh*Fyf	---		
Bottom Flange	6.10.4.2.2-3	$f_f + \frac{f_l}{2} \le 0.80R_h F_{yf}$	ff	42.196	---	---
			fl	0.455		
			0.8*Rh*Fyf	---		
	6.10.4.2.2-4	$f_c \le F_{crw}$	fc	---	---	---
			Fcrw	---		

Group01 Member 04

POI Location: 51.500 ft (1.50) Cross-Frame (left bay); Cross-Frame (right bay); Slab Start; Slab End;

Strength Limit State (Article 6.10.6)

Final Default Strength I Strength I Final

Article		Equation	Parameter	Value	Perf. Ratio	Result
6.10.6.2 – Flexure						
6.10.6.2.2 – Composite Sections in Positive Flexure						
		Is Compact?				Compact
		Straight Bridge?				Straight

	6.10.6.2.2	$Flange\ F_y \leq 70ksi$	*Fyt*	50.000	0.7143	True
			Fyb	50.000		
	6.10.2.1.1-1	$\frac{D}{t_w} \leq 150$	*D*	48.000	0.5120	True
			tw	0.625		
	6.10.6.2.2-1	$\frac{2D_{cp}}{t_w} \leq 3.76\sqrt{\frac{E}{F_{yc}}}$	*Dcp*	0.000	0.0000	True
6.10.7.1 – Compact Sections						
	6.10.7.1.1-1	$M_u + \frac{1}{3} f_l S_{xt} \leq \phi_f M_n$	*Mu*	7112.920	0.9471	Passed
			fl	4.417		
			Sxt	1373.022		
			Φf Mn	7688.084		
	6.10.7.1.2-1	$M_n = M_p$	*Mp*	8058.153		
	6.10.7.1.2-2	$M_n = M_p\left(1.07 - \frac{0.7D_p}{D_t}\right)$	*Mn*	7688.084		
			Mp	8058.153		
			Dp	9.771		
			Dt	59.000		
	6.10.7.1.2-3	$M_n \leq 1.3R_h M_y$	*1.3RhMy*	7437.202		
			My	5720.925		
6.10.7.3 – Ductility						
	6.10.7.3-1	$D_p \leq 0.42D_t$	*Dp*	9.771	0.3943	Passed
			0.42 Dt	24.780		
6.10.6.3 – Shear 6.10.9.1 – General						
	6.10.9.1-1	$V_u \leq \phi_v V_n$	*Vu*	76.430	0.0966	Passed
			ΦVn	790.904		
6.10.9.3 – Stiffened Webs 6.10.9.3.2 - Interior Panels						
		$d_0 \leq 1.5D$	*d0*	---	---	---
			D	---		
		$d_0 \leq 3.0D$	*d0*	108.000	0.750	Stiffened
			D	48.000		
	6.10.9.3.2-1	$\frac{2Dt_w}{b_{fc}t_{fc} + b_{ft}t_{ft}} \leq 2.5$		1.500	0.600	Passed

	6.10.9.3.2-2 $V_n = V_p\left(C + \frac{0.87(1-C)}{\sqrt{1+\left(\frac{d_0}{D}\right)^2}}\right)$	*Vn*	790.904		
	6.10.9.3.2-3 $V_p = 0.58F_{yw}Dt_w$	*Vp*	870.000		
	6.10.9.3.2-4 $C = 1.0$	*C*	---		
	6.10.9.3.2-5 $C = \frac{1.12}{\frac{D}{t_w}}\sqrt{\frac{Ek}{F_{yw}}}$	*C*	0.859		
	6.10.9.3.2-6 $C = \frac{1.57}{\left(\frac{D}{t_w}\right)^2}\left(\frac{Ek}{F_{yw}}\right)$	*C*	---		
	6.10.9.3.2-7 $k = 5 + \frac{5}{\left(\frac{d_0}{D}\right)^2}$	*k*	5.988		
	6.10.9.3.2-8 $V_n = V_p\left(C + \frac{0.87(1-C)}{\sqrt{1+\left(\frac{d_0}{D}\right)^2} + \frac{d_0}{D}}\right)$	*Vn*	---		

Service Limit State (Article 6.10.4)

Final Default Service II Service II Final

Article	Equation	Parameter	Value	Perf. Ratio	Result
6.10.4.2 – Permanent Deformations					
6.10.4.2.1 – General					
	Slab Effective Negative?				True
	Continuous Shear Connectors?				True
	$f_{slab} < 0.9f_r$	*fslab*	---	---	---
		0.9 fr	---		
	Is 6.10.1.7 *met?*				True
	$f_{slab} < 2f_r$	*fslab*	---	---	---
		2 fr	---		
6.10.1.6 – Lateral Flange Stress Considerations					
	6.10.1.6-2 $L_b \le 1.2L_p\sqrt{\frac{C_bR_b}{f_{bu}/F_{yc}}}$	*Lb*	108.000		
			222.026		

	6.10.1.6-4	$f_l = \left(\frac{0.85}{1-\frac{f_{bu}}{F_{cr}}}\right) f_{l1} \geq f_{l1}$	*fl1*	3.286		
			fl	3.286		
	6.10.1.6-1	$f_l \leq 0.6F_{yf}$	*Fyf*	50.000	0.1095	
			fl	3.286		
6.10.4.2.2 – Flexure						
		Is Section Composite?				True
		Is Flexure Negative?				False
	6.10.4.2.2-1	$f_f \leq 0.95R_hF_{yf}$	*ff*	24.202	0.5095	Passed
			*0.95Rh*Fyf*	47.500		
	6.10.4.2.2-2	$f_f + \frac{f_l}{2} \leq 0.95R_hF_{yf}$	*ff*	43.938	0.9596	Passed
			fl	3.286		
			*0.95Rh*Fyf*	47.500		
Top Flange	6.10.4.2.2-3	$f_f + \frac{f_l}{2} \leq 0.80R_hF_{yf}$	*ff*	24.202	---	---
			fl	0.000		
			*0.8*Rh*Fyf*	---		
Bottom Flange	6.10.4.2.2-3	$f_f + \frac{f_l}{2} \leq 0.80R_hF_{yf}$	*ff*	43.938	---	---
			fl	3.286		
			*0.8*Rh*Fyf*	---		
	6.10.4.2.2-4	$f_c \leq F_{crw}$	*fc*	---	---	---
			Fcrw	---		

Group01 Member 05

POI Location: 51.500 ft (1.50) Cross-Frame (left bay): Slab Start: Slab End:

Strength Limit State (Article 6.10.6)

Final Default Strength I Strength I Final

Article		Equation	Parameter	Value	Perf. Ratio	Result
6.10.6.2 – Flexure						
6.10.6.2.2 – Composite Sections in Positive Flexure						
		Is Compact?				Compact
		Straight Bridge?				Straight
	6.10.6.2.2	*Flange* $F_y \leq 70ksi$	*Fyt*	50.000	0.7143	True
			Fyb	50.000		

	6.10.2.1.1-1	$\frac{D}{t_w} \le 150$	D	48.000	0.5120	True
			tw	0.625		
	6.10.6.2.2-1	$\frac{2D_{cp}}{t_w} \le 3.76\sqrt{\frac{E}{F_{yc}}}$	Dcp	0.000	0.0000	True
6.10.7.1 – Compact Sections						
	6.10.7.1.1-1	$M_u + \frac{1}{3} f_l S_{xt} \le \phi_f M_n$	Mu	7004.704	0.9661	Passed
			fl	6.210		
			Sxt	1357.012		
			Φf Mn	7492.703		
	6.10.7.1.2-1	$M_n = M_p$	Mp	7872.006		
	6.10.7.1.2-2	$M_n = M_p\left(1.07 - \frac{0.7D_p}{D_t}\right)$	Mn	7492.703		
			Mp	7872.006		
			Dp	9.961		
			Dt	59.000		
	6.10.7.1.2-3	$M_n \le 1.3 R_h M_y$	1.3RhMy	7350.481		
			My	5654.216		
6.10.7.3 – Ductility						
	6.10.7.3-1	$D_p \le 0.42 D_t$	Dp	9.961	0.4020	Passed
			0.42 Dt	24.780		
6.10.6.3 – Shear 6.10.9.1 – General						
	6.10.9.1-1	$V_u \le \phi_v V_n$	Vu	39.156	0.0495	Passed
			ΦVn	790.904		
6.10.9.3 – Stiffened Webs 6.10.9.3.2 - Interior Panels						
		$d_0 \le 1.5D$	d0	---	---	---
			D	---		
		$d_0 \le 3.0D$	d0	108.000	0.750	Stiffened
			D	48.000		
	6.10.9.3.2-1	$\frac{2Dt_w}{b_{fc}t_{fc} + b_{ft}t_{ft}} \le 2.5$		1.500	0.600	Passed
	6.10.9.3.2-2	$V_n = V_p\left(C + \frac{0.87(1-C)}{\sqrt{1+\left(\frac{d_0}{D}\right)^2}}\right)$	Vn	790.904		

	6.10.9.3.2-3 $V_p = 0.58F_{yw}Dt_w$	*Vp*	870.000		
	6.10.9.3.2-4 $C = 1.0$	*C*	---		
	6.10.9.3.2-5 $C = \frac{1.12}{\frac{D}{t_w}}\sqrt{\frac{Ek}{F_{yw}}}$	*C*	0.859		
	6.10.9.3.2-6 $C = \frac{1.57}{\left(\frac{D}{t_w}\right)^2}\left(\frac{Ek}{F_{yw}}\right)$	*C*	---		
	6.10.9.3.2-7 $k = 5 + \frac{5}{\left(\frac{d_0}{D}\right)^2}$	*k*	5.988		
	6.10.9.3.2-8 $V_n = V_p\left(C + \frac{0.87(1-C)}{\sqrt{1+\left(\frac{d_0}{D}\right)^2} + \frac{d_0}{D}}\right)$	*Vn*	---		

Service Limit State (Article 6.10.4)

Final Default Service II — Service II — Final

Article	Equation	Parameter	Value	Perf. Ratio	Result
6.10.4.2 – Permanent Deformations					
6.10.4.2.1 – General					
	Slab Effective Negative?				True
	Continuous Shear Connectors?				True
	$f_{slab} < 0.9f_r$	*fslab*	---	---	---
		0.9 fr	---		
	Is 6.10.1.7 *met?*				True
	$f_{slab} < 2f_r$	*fslab*	---	---	---
		2 fr	---		
6.10.1.6 – Lateral Flange Stress Considerations					
	6.10.1.6-2 $L_b \le 1.2L_p\sqrt{\frac{C_bR_b}{f_{bu}/F_{yc}}}$	*Lb*	108.000		
			214.764		
	6.10.1.6-4 $f_l = \left(\frac{0.85}{1-\frac{f_{bu}}{F_{cr}}}\right)f_{l1} \ge f_{l1}$	*fl1*	4.616		
		fl	4.616		

	6.10.1.6-1	$f_l \le 0.6F_{yf}$	*Fyf*	50.000	0.1539	
			fl	4.616		
6.10.4.2.2 – Flexure						
		Is Section Composite?				True
		Is Flexure Negative?				False
	6.10.4.2.2-1	$f_f \le 0.95R_hF_{yf}$	*ff*	25.770	0.5425	Passed
			*0.95Rh*Fyf*	47.500		
	6.10.4.2.2-2	$f_f + \frac{f_l}{2} \le 0.95R_hF_{yf}$	*ff*	43.900	0.9728	Passed
			fl	4.616		
			*0.95Rh*Fyf*	47.500		
Top Flange	6.10.4.2.2-3	$f_f + \frac{f_l}{2} \le 0.80R_hF_{yf}$	*ff*	25.770	---	---
			fl	0.000		
			*0.8*Rh*Fyf*	---		
Bottom Flange	6.10.4.2.2-3	$f_f + \frac{f_l}{2} \le 0.80R_hF_{yf}$	*ff*	43.900	---	---
			fl	4.616		
			*0.8*Rh*Fyf*	---		
	6.10.4.2.2-4	$f_c \le F_{crw}$	*fc*	---	---	---
			Fcrw	---		

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Calculation Sheet

Designer TJS Date 11/16 Checker DAF Date 11/16
Title VERNON Job No.
Subject PEDESTRIAN BRIDGE - ALTERNATE 3 Sheet No. 1 of

REFERENCES

1. AASHTO LRFD BRIDGE DESIGN SPECS, 7TH EDITION, 2014
2. AASHTO MANUAL OF BRIDGE EVALUATION, 2ND EDITION, 2011
3. AASHTO LRFD GUIDE SPEC FOR PEDESTRIAN BRIDGES, 2009
4. CONNDOT BRIDGE SAFETY INSPECTION REPORT, 11/20/16
5. DEWBERRY FIELD NOTES, 2016

SCOPE

EVALUATE EXISTING TRUSS CAPACITY FOR USE AS A PEDESTRIAN BRIDGE. EXISTING FLOOR BEAMS WILL BE REMOVED. PROVIDE NEW DECK INCLUDING LONGITUDINAL STRINGERS & FLOOR BEAMS. ASSUME NO VEHICLE ACCESS ON PED. BRIDGE. LIVE LOAD BASED ON UNIFORM PEDESTRIAN LOADING ONLY.

METHODOLOGY

USE STAAD SOFTWARE TO ANALYZE MEMBER FORCES IN TRUSS

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FIELD NOTES

JOB NO. 50075033
BRIDGE NO:
DATE: 10/28/2016
SHEET 2 OF
CREW: DAL, DAF

SECTIONS

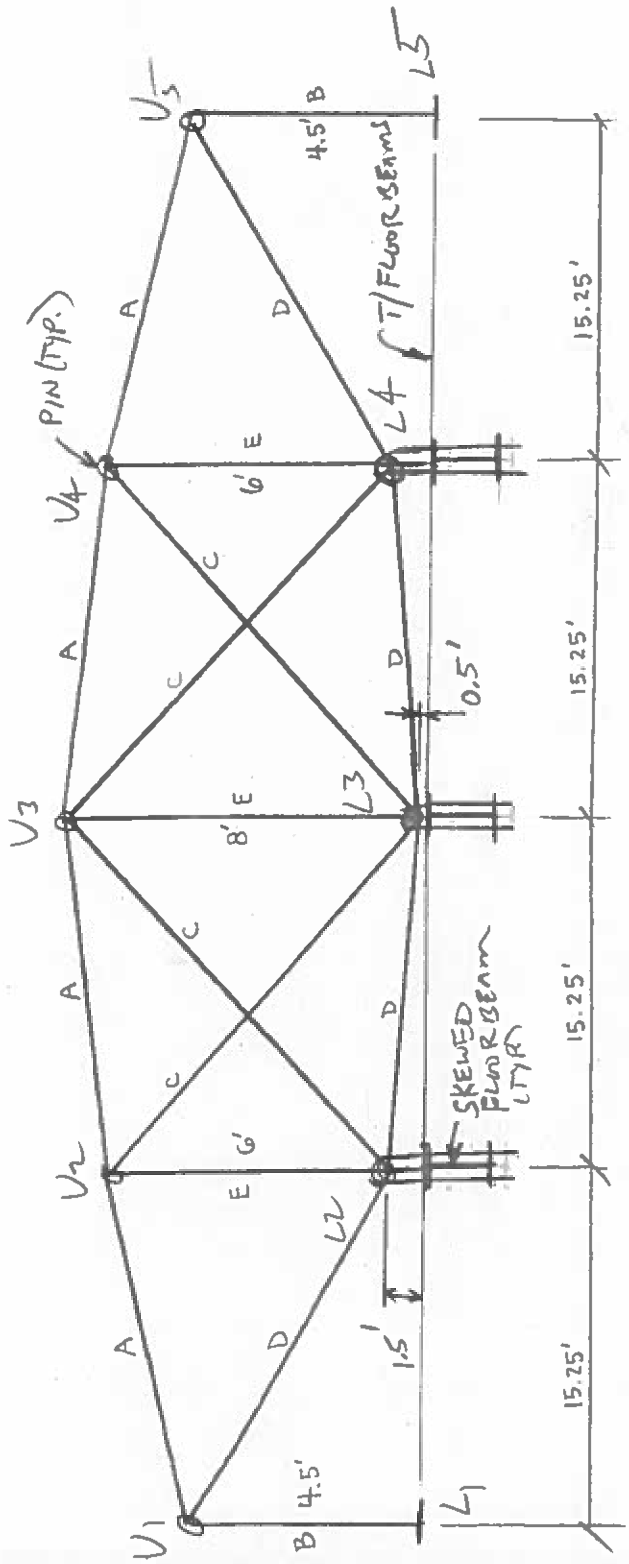
A: BUILT UP TOP CHORD
4-∠ 2"x2"x 3/16"
1- 12 1/4" x 3/8" TOP PL
2- 6 1/8" x 3/8" WEB PL

B: BUILT UP END POST
4-∠ 2x2x 3/16
1- 12" x 3/8" TOP PL
2- 6 1/8" x 3/8" WEB PL

C: TENSION ROD
1- 1 1/4" ⌀ ROD

D: EYEBARS
2- 3" x 7/8" AT MIDSPAN
w/ 8" ⌀ HEAD AT PIN
ASSUMED - NOT FIELD MEASURED

E: BUILT UP VERTICALS
4-∠ 1 3/4" x 1 3/4" x 3/16"



TRUSS ELEVATION

NOTE: ALL PINS 2.5" ⌀

~HAIRLINE-CRACKS-WITHOUT-EFFLORESCENCE
MAP-CRACKS-WITHOUT-EFFLORESCENCE
HOLLOW-AREA
SHALLOW-AREA
SCALE-AREA
SPALL-AREA
SPALL-WITH-EXPOSED-REBAR
HONEY-COMBING

REVISION 1	DATE	CREW	COMPANY	REVISION 3	DATE	CREW	COMPANY
REVISION 2	DATE	CREW	COMPANY	REVISION 4	DATE	CREW	COMPANY

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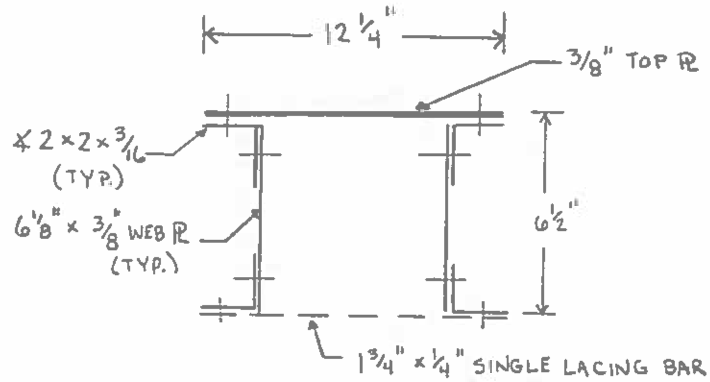
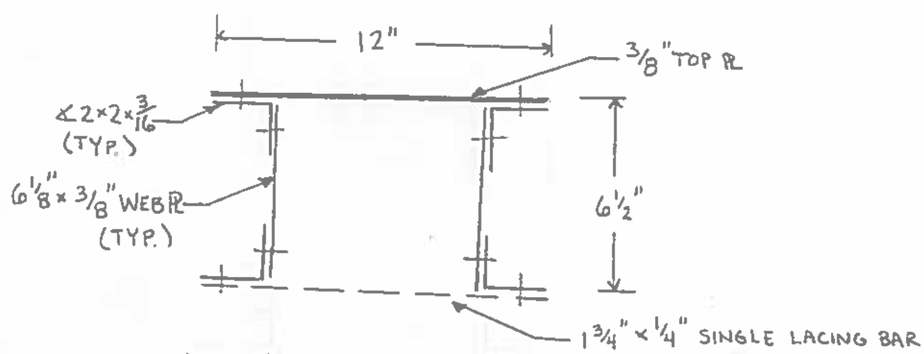
New Haven, CT 06510

FIELD NOTES

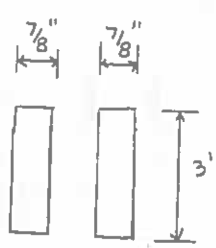
JOB NO. 50075033	BRIDGE NO:
DATE: 10/28/2016	SHEET 3 OF
CREW: DAL, DAF	



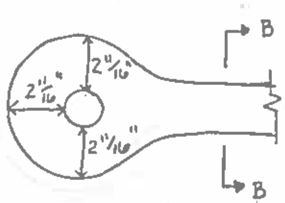
AS-BUILT TOP CHORD



AS-BUILT END POST



SECTION B-B



ASSUMED HEAD DIMENSIONS. NOT FIELD MEASURED

EYEBARS

REVISION △1 DATE	CREW	COMPANY	REVISION △3 DATE	CREW	COMPANY
REVISION △2 DATE	CREW	COMPANY	REVISION △4 DATE	CREW	COMPANY

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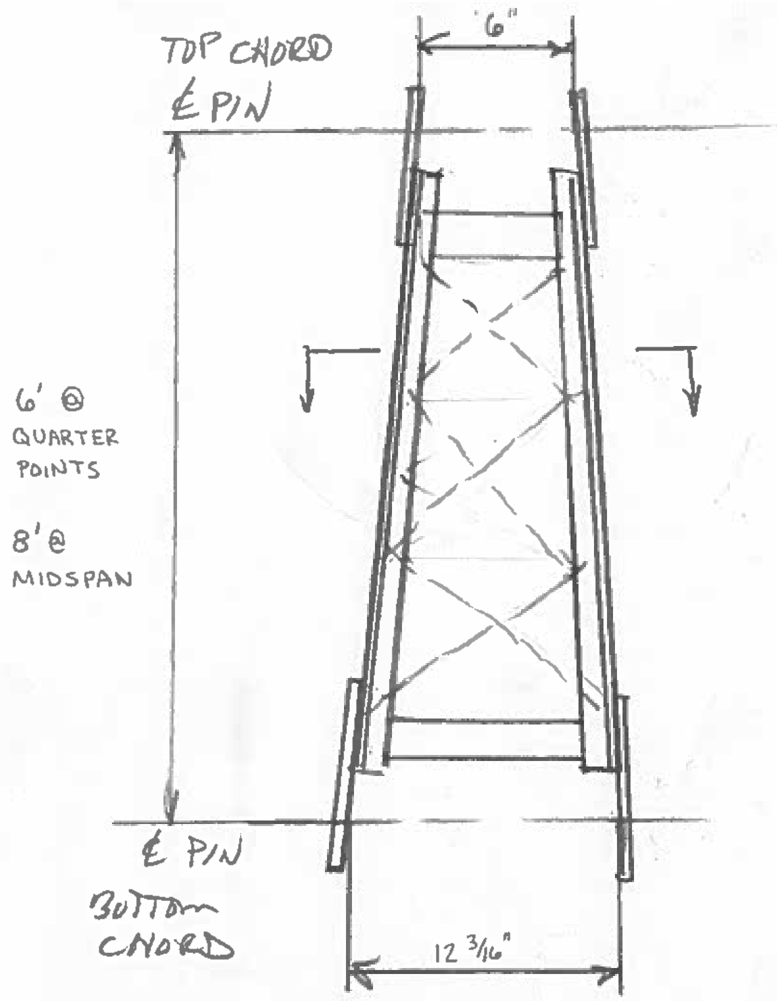
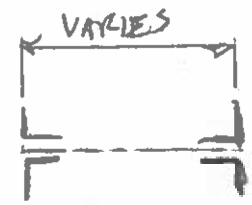
FIELD NOTES	JOB NO. 50075033	BRIDGE NO:
	DATE: 10/28/2016	SHEET 4 OF
	CREW: DAL, DAF	



ANGLE SIZE = 1 3/4" x 1 3/4" x 3/16"



SECTION A-A

AS-BUILT VERTICAL

REVISION 1	DATE	CREW	COMPANY	REVISION 3	DATE	CREW	COMPANY
REVISION 2	DATE	CREW	COMPANY	REVISION 4	DATE	CREW	COMPANY

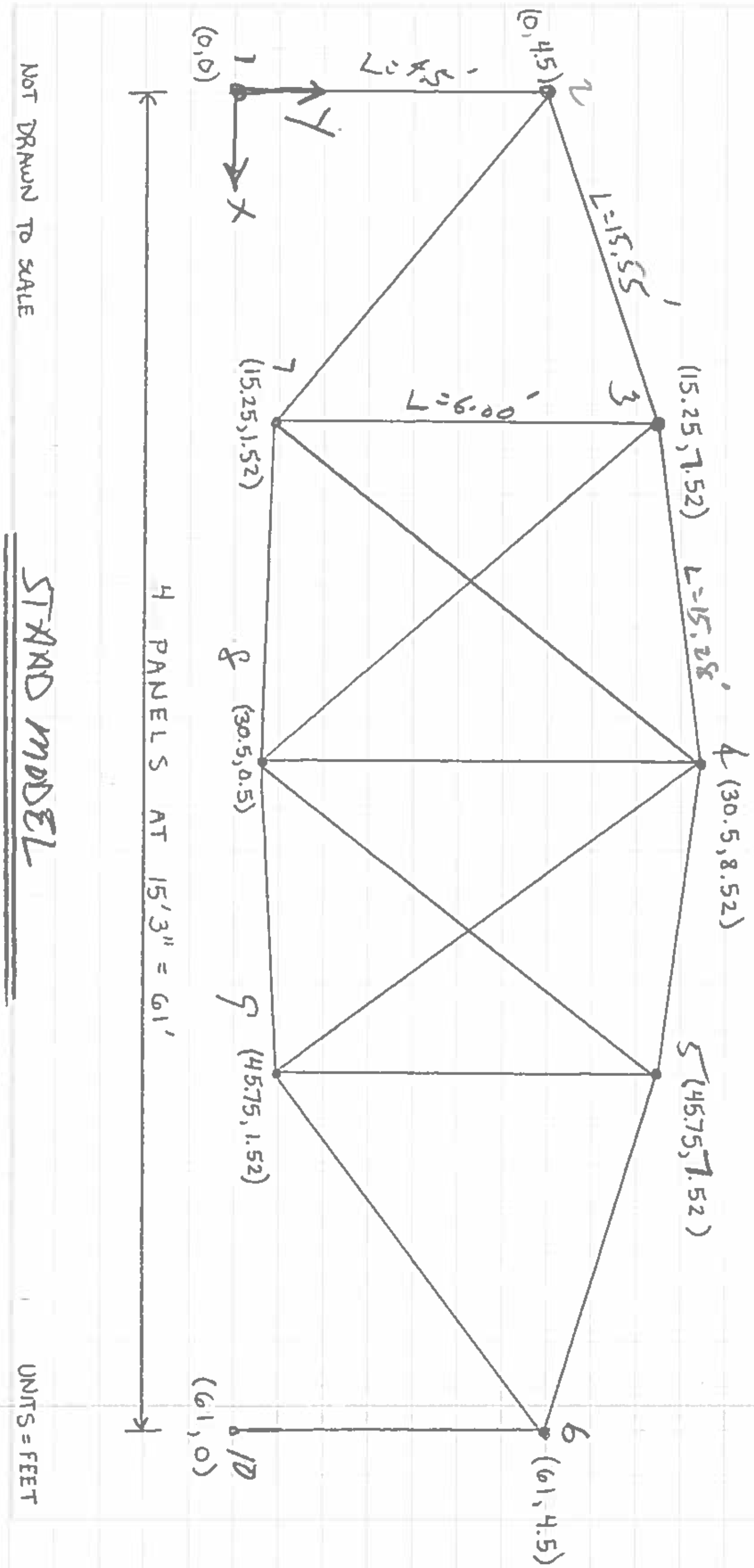
Dewberry

Calculation Shee

Designer DAF　Date 11/4/2016　Checker TJS　Date 11/16

Title TRUSS - PIN X-Y COORDINATES　Job No.

Subject B04575　Sheet No. 5 of



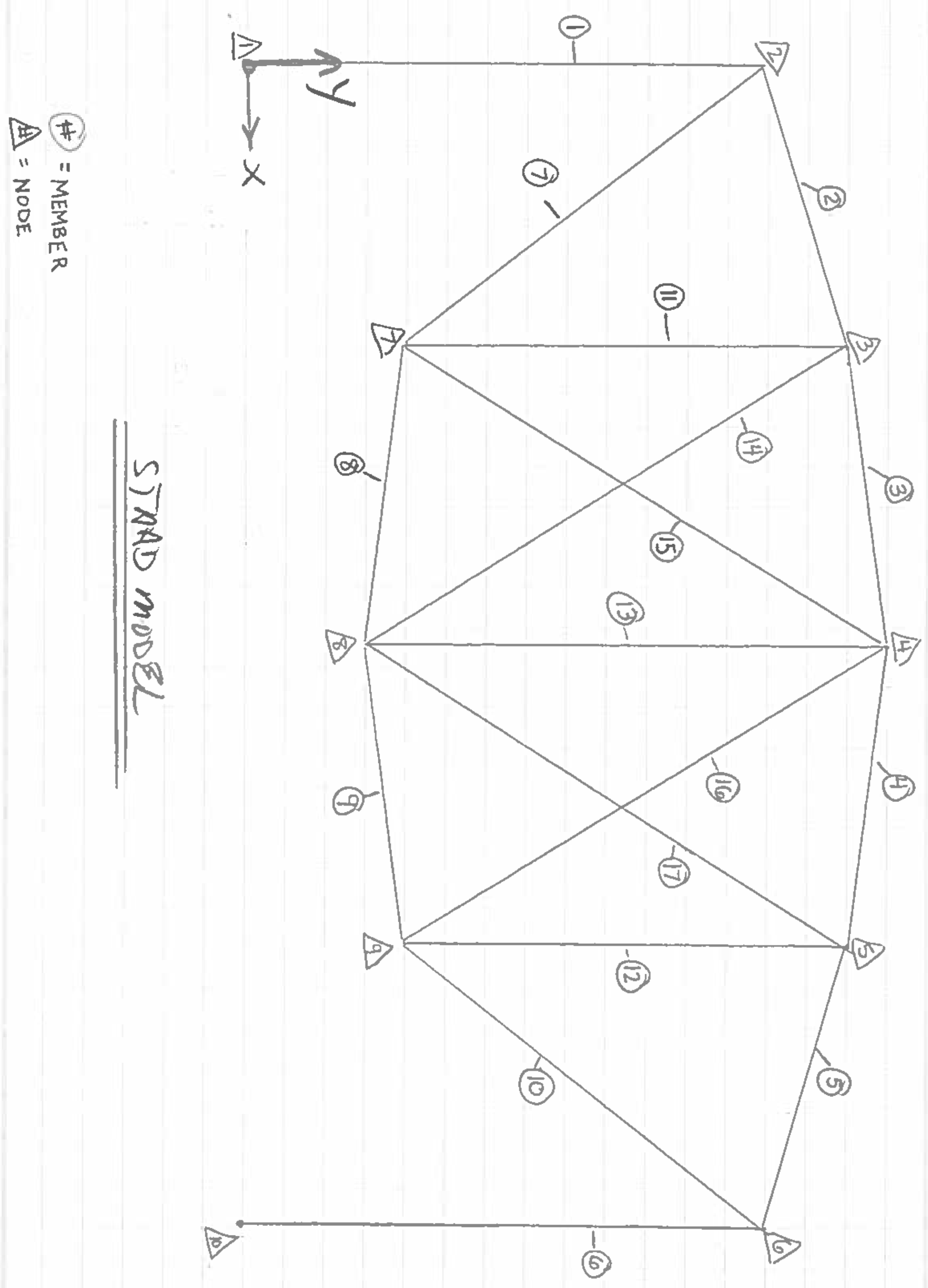
Dewberry

Calculation Shee

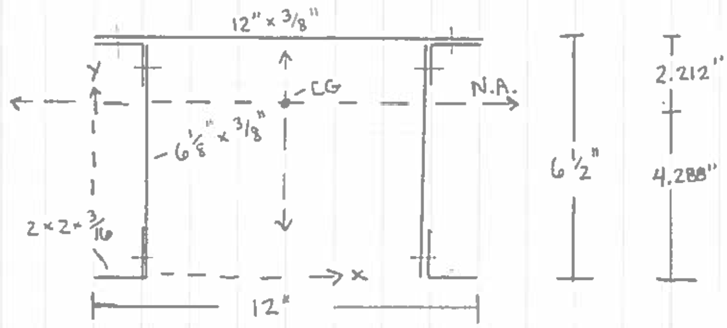
Designer DAF Date 11/4/2016 Checker TJS Date 11/10

Title LABEL CONVENTION Job No.

Subject BR #04575 - TRUSS Sheet No. 6 of



→ MEMBERS 1 & 6 (END POSTS) AREA = $11.97 in^2$



∠ - AREA = 0.722
$\bar{X}$ = 0.561"

TOP PL TOP ∠s BOT. ∠s

$\bar{Y} = [4.50 in^2 (6\,5/16") + 2(0.722 in^2)(6.5" - 0.561" - 0.375") + 2(0.722 in^2)(0.561 in)$
$+ 2(2.30 in^2)(3.06")] / 12.06 in^2$ (WEB PL)

$\bar{Y} = (28.406 in^3 + 8.034 in^3 + 0.81 in^3 + 14.076 in^3)/11.97 in^2$

$\bar{Y} = 4.288 in$

$I_{\bar{x}} = \frac{12"(3/8")^3}{12} + 4.50 in^2 (2.21" - 3/16")^2 + [0.271 in^4 + 0.722 in^2 (4.29" - 0.561")^2]2 +$
$2[0.271 in^2 + 0.722 in^2 (2.21" - 3/8" - 0.561")^2] + 2\left[\frac{(3/8")(6\,1/8")^3}{12} + 2.30 in^2 \left(4.29" - \frac{6.125"}{2}\right)^2\right]$

$I_{\bar{x}} = 0.141 in^4 + 18.407 in^4 + 20.622 in^4 + 2.886 in^4 + 2(7.181 in^4 + 3.466 in^4)$

$I_{\bar{x}} = 63.35 in^4$

$r_x = \sqrt{I/A} = \sqrt{63.35 in^4 / 11.97 in^2} = 2.30 in$

$\bar{X} = 6"$

$I_{\bar{y}} = \frac{(3/8")(12")^3}{12} + 2\left(\frac{6.125"(3/8")^3}{12} + 2.30 in^2 (6.0" - 2" - 3/16")^2\right)$
$+ 4(0.271 in^4 + 0.722 in^2 (6.0" - (2 - 0.561))^2)$

$I_{\bar{y}} = 54 in^4 + 2(0.027 in^4 + 33.431 in^4) + 4(15.291 in^4)$

$I_{\bar{y}} = 182.08 in^4$

$r = \sqrt{182.08 in^4 / 11.97 in^2} = 3.90 in$

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Calculation Shee

Designer DAF Date 11/7/2016 Checker TJB Date 11/16

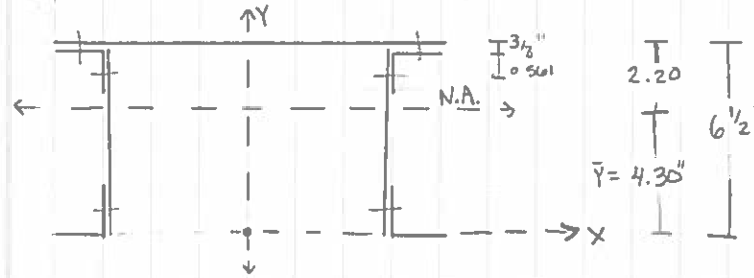
Title MOMENT OF INERTIA Job No.

Subject BR 04575 TRUSS Sheet No. 8 of

$$\bar{Y} = \Sigma(Ay)/A$$

$$I_{\bar{y}} = I_1 + A_1 d_1^2 + I_2 + A_2 d_2^2 + \ldots$$

→ MEMBERS 2-5 (TOP CHORD) AREA: $12.06\,in^2$



$\angle\ 2\times2\times 3/16$

$A = 0.72\,in^2$

$\bar{x} = 0.56\,in^2$

$I = 0.272\,in^4$

$$\bar{Y} = [4.59in^2(6\tfrac{5}{16}") + 2(0.722in^2)(6.5in - 0.56in - 0.375in) + 2(0.722in^2)(0.56in) + 2(2.30in^2)(3.06in)] / 12.06in^2$$

$$\bar{Y} = (28.97in^3 + 8.03in^3 + 0.81in^3 + 14.08in^3)/12.06in^3$$

$$\bar{Y} = 51.89in^3/12.06in^3 = 4.30\ in$$

$$I_x = \frac{12.25"(3/8")^3}{12} + 4.59in^2(2.20" - 3/16")^2 + [0.271in^4 + 0.722in^2(4.30" - 0.561")^2]2 + 2[0.271in^4 + 0.722in^2(2.20" - 3/8" - 0.561")^2] + \left[\frac{(3/8")(6\tfrac{1}{8}")^3}{12} + 2.30in^2\left(4.30" - \frac{6.125"}{2}\right)^2\right]2$$

$$I_{\bar{x}} = 0.054in^4 + 18.590in^4 + 20.729in^4 + 2.849in^4 + (7.181in^4 + 3.522in^4)2$$

$$I_{\bar{x}} = 63.628in^4$$

$$r_x = \sqrt{I/A} = \sqrt{63.628in^4/12.06in^2} = \underline{2.297\ in}$$

$$\bar{Y} = 6.125in$$

$$I_{\bar{y}} = \frac{(3/8")(12.25")^3}{12} + 2\left(\frac{6.125"(3/8")^3}{12} + 2.30in^2(6.125" - 2" - 3/16")^2\right) + 4(0.271in^4 + 0.722in^2(6.125" - (2" - 0.561"))^2)$$

$$I_{\bar{y}} = 57.446in^4 + 2(0.027\ in^4 + 35.659in^4) + 4(16.125\ in^4)$$

$$I_y = 193.318\ in^4$$

$$r_y = \sqrt{193.318in^4/12.06in} = \underline{4.00\ in}$$

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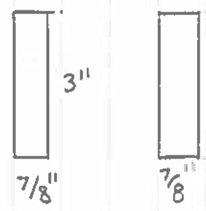
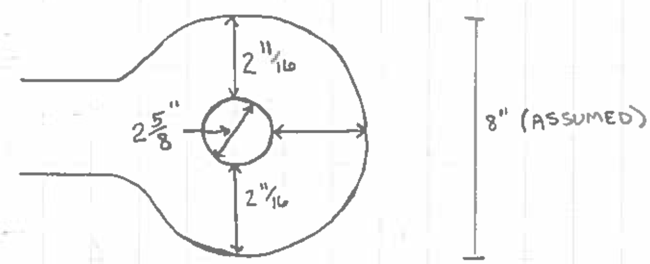
Calculation Sheet

Designer: DAF Date: 11/7/2016 Checker: TJS Date: 11/16
Title: MOMENT OF INERTIA Job No.
Subject: Br 04575 TRUSS Sheet No. 9 of

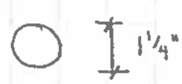
→ MEMBERS 7-10 (EYEBARS) AREA = $(2.625 in^2)2 = 5.25 in^2$
AT MIDSPAN



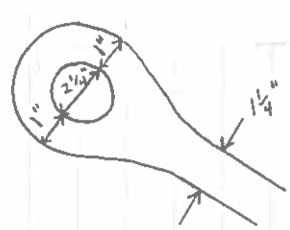


NET SECTION AREA AT PIN = $2(2\frac{11}{16}")(\frac{7}{8}") = 4.70 in^2$ SAY $4.00 in^2$ × 2 Eye bars $= 8.00 IN^2$

→ MEMBERS 14-17 (TENSION RODS) AREA = $1.23 in^2$



AT TOP CHORD CONNECTION



NET SECTION AREA AT PIN = $[(1")^2 \pi / 4] \times 2 = 1.57 in^2$ ⇒ SAY $1.00 in^2$

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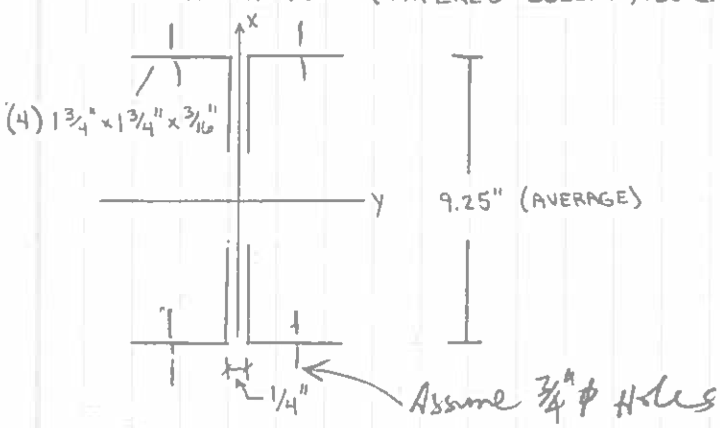
Calculation Shee

Designer DAF Date 11/7/2016 Checker TJS Date 11/16
Title MOMENT OF INERTIA Job No.
Subject Br 04575 TRUSS Sheet No. 10 of

MEMBERS 11-13 (TAPERED COLUMN/TOWERS)

AREA = (0.62 × 4) = 2.48 in²

WIDTH OF TOWER
6.5' AT TOP
12" AT BOTTOM



AREA = 0.62 in²
I = 0.18 in⁴
$\bar{x} = \bar{y} = 0.51$ in

$\bar{X} = 1\frac{7}{8}"$
$\bar{Y} = 4\frac{5}{8}"$

$I_x = 4\left(0.18\,in^4 + 0.62\,in^2\left(\frac{1}{8}" + 0.51"\right)^2\right) = 1.72\,in^4$

$r_x = \sqrt{1.72\,in^4 / 2.48\,in^2} = 0.83\,in$

$I_y = 4\left(0.18\,in^4 + 0.62\,in^2\left(4.625" - 0.51"\right)^2\right) = 42.71\,in^4$

$r_y = \sqrt{42.71\,in^4 / 2.48\,in^2} = 4.15\,in$

NET SECTION AREA = GROSS AREA − 4(BOLT HOLE DIAMETER × THICKNESS)
= 2.48" − 4($\frac{3}{4}"$ × $\frac{3}{16}"$)
= 1.92 IN²

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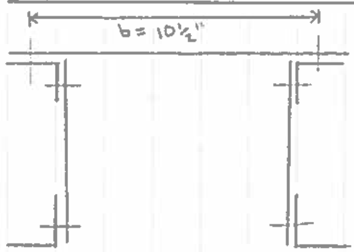
Calculation Shee

Designer DAF Date 11/8/2016 Checker TJS Date 11/16

Title SLENDERNESS CHECK Job No.

Subject Br. 04575 Sheet No. 11 of

TOP CHORD COMPRESSION MEMBERS



TOP PLATE - STIFFENED

LENGTH BETWEEN BOLTS = 10½"

THICKNESS = 3/8"

$b/t = 10\frac{1}{2}" / \frac{3}{8}" = 28$

$\lambda_r = 1.40\sqrt{E/F_y} = \left(\sqrt{28{,}000{,}000\,psi / 26000\,psi}\right)1.4 = 45.94$

$28 = b/t < \lambda_r = 45.9$

NOT SLENDER

ANGLES

LENGTH OF SIDE = b = 2"

THICKNESS = t = 3/16"

$b/t = 2" / \frac{3}{16}" = 10.667$

$\lambda_r = 0.45\sqrt{E/F_y} = 0.45\sqrt{28{,}000{,}000\,psi / 26{,}000\,psi} = 14.77$

$10.67 = b/t < \lambda_r = 14.77$

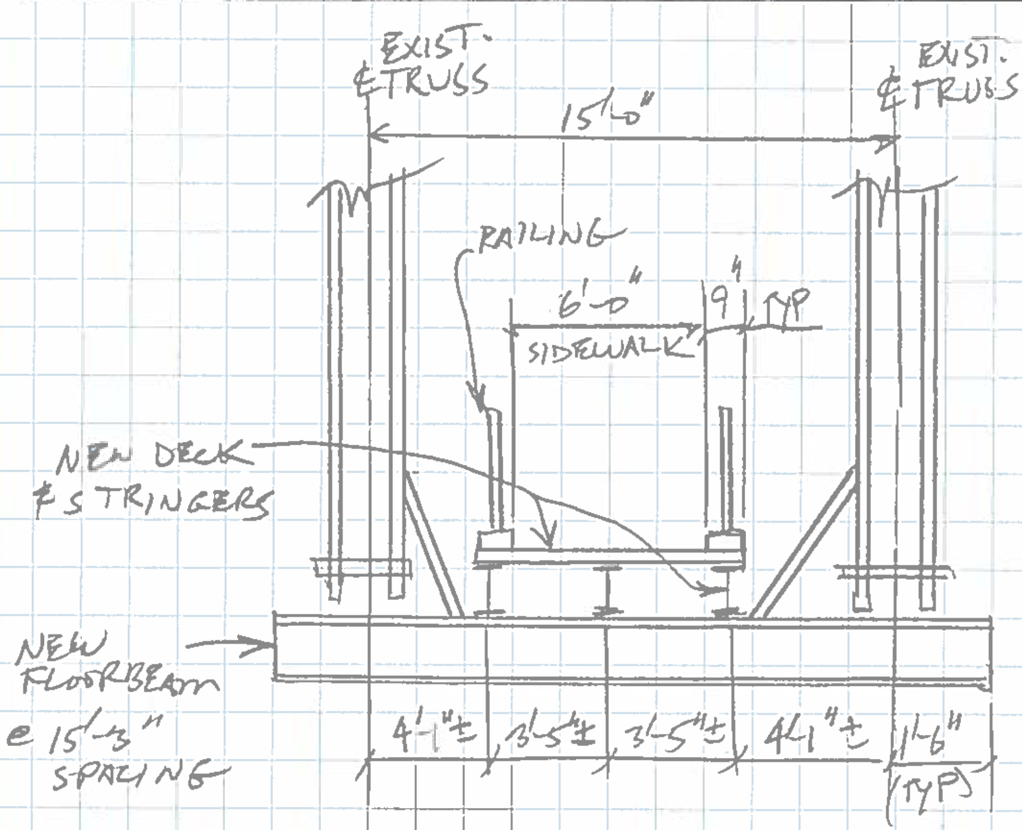
NOT SLENDER

Dewberry

Calculation Sheet

Designer TJS Date 11/16 Checker DAF Date 11/16
Title VERNON Job No.
Subject PEDESTRIAN BRIDGE Sheet No. 12 of

PRELIMINARY
PEDESTRIAN BRIDGE ASSUMED DECK FOR STAAD DL'S



DEAD LOADS

ASSUME TIMBER DECK γ = 50 PCF — WEIGHT @ FLOORBEAM

DECKING = 4/12 × 7.5' × 50 PCF × 15.25' = 1906

CURB (4"×9")/144 × 2 × 50 PCF × 15.25' = 381

FLOORBEAM - ASSUME 50 LB/FT × 18' = 900

STRINGERS - ASSUME 40 LB/FT × 3 × 15.25' = 1830

RAILING ASSUME 50 LB/FT × 2 × 15.25 = 1525

6542

10% MISC = 654

7196 LBS

DL PER TRUSS = 7196/2 = 3598 LBS @ FB NODE SAY 3,600 LBS

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Calculation Sheet

Designer TJS Date 11/16 Checker DAF Date 11/16
Title VERNON Job No.
Subject PEDESTRIAN BRIDGE Sheet No. 13 of

LIVE LOAD

PEDESTRIAN LIVE LOAD = 90 PSF (GUIDE SPEC 3.1)

LIVE LOAD PER TRUSS @ FB = 6' WIDE x 90 PSF x 15.25'/2
= 4118 LBS

SAY 4,200 LBS @ BOTTOM CHORD FB LOCATIONS

APPLY LOADS @ 1, 2 & 3 FLOORBEAMS TO CONSIDER SYMMETRICAL & UNSYMMETRICAL LIVE LOADING ON TRUSS

LOAD COMBINATIONS

FOR PRELIMINARY STUDY, CONSIDER STRENGTH I ONLY

STR I = 1.25 DC + 1.75 PL

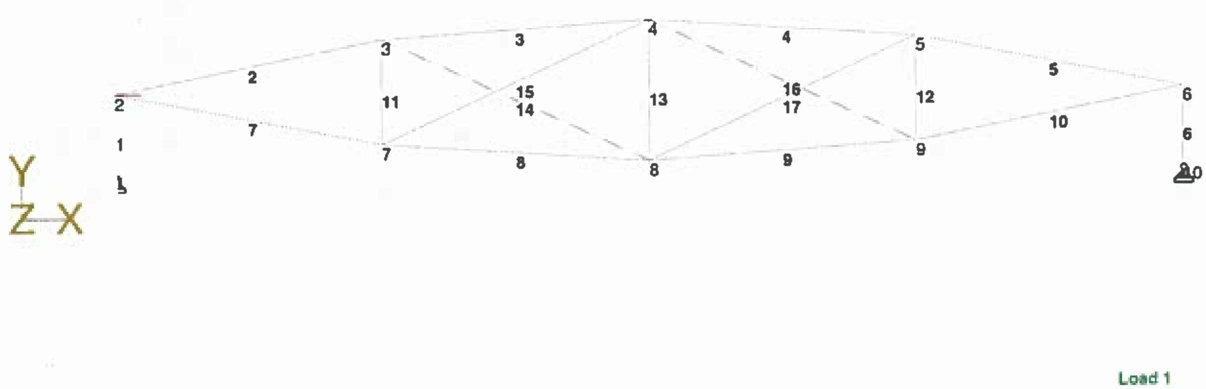
DC = DEAD LOAD OF TRUSS & DECK SYSTEM

PL = PEDESTRIAN LIVE LOAD ONLY
ASSUME NO VEHICLE ACCESS

STAAD LOAD CASES

LC1 - DEAD LOAD DUE TO SELF WEIGHT OF TRUSS ONLY. WEIGHT BASED ON INPUT CROSS SECTION AREA OF MEMBERS. ASSUME 15% ADDITIONAL FOR MISC. PL'S & LACING BARS.
LC2 - DEAD LOAD OF NEW DECK SYSTEM, INCLUDING DECKING, CURBS, RAILING, STRINGERS & FLOOR BEAMS
LC3 - PED. LL @ 3 FBS (NODES 7, 8, 9)
LC4 - " " @ (1) - 1/4 PT FB (NODE 7)
LC5 - " " @ CENTER FB (NODE 8)
LC6 - " " @ (1) - 1/4 PT & CENTER FB (NODES 7, 8)

Software licensed to Dewberry	Job No	Sheet No 1	Rev
	Part		
Job Title VERNON PEDESTRIAN BRIDGE	Ref		
	By DAF	Date 04-Nov-16	Chd
Client	File Vernon Pedestrian Bridge	Date/Time 09-Nov-2016 16:19	



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Calculation Sheet

Designer TJS Date 11/16 Checker DAF Date 11/16
Title VERNON Job No.
Subject PEDESTRIAN BRIDGE Sheet No. 15 of

MATERIAL PROPERTIES

TRUSS BUILT IN 1885 PER BRI-19 (REF 4)

- ASSUME WROUGHT IRON

$F_y = 26$ ksi REF. 2 6A.6.2.3
$F_u = 48$ ksi
$E = 28{,}000$ ksi

- PINS

$F_y = 25.5$ ksi REF. 2 TABLE 6A.6.2.2-1
BUILT BEFORE 1905

MEMBER CAPACITY

TENSION & COMPRESSION CAPACITIES DETERMINED IN ACCORDANCE WITH REF. 1

FOR STRENGTH LIMIT STATE

CAPACITY $= \phi_c \phi_s (\phi P_n)$ (REF 2. 6A.4.2.1)

ϕ_c = CONDITION FACTOR (REF. 2, TABLE 6A.4.2.3-1)

ASSUME $\phi_c = 1.00$ FOR SATISFACTORY CONDITION
NO SIGNIFICANT SECTION LOSS, TRUSSES WILL BE CLEANED & PAINTED

ϕ_s = SYSTEM FACTOR (REF. 2, TABLE 6A.4.2.4-1)

$\phi_s = 0.9$ FOR TRUSS BRIDGES WITH RIVETED OR EYE BAR MEMBERS

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Calculation Sheet

Designer TJS Date 11/16 Checker DAF Date 11/16
Title VERNON Job No.
Subject PEDESTRIAN BRIDGE Sheet No. 16 of

TENSION MEMBERS (REF. 1, 6.8)

TENSION CAPACITY IS LESSER OF YIELDING ON GROSS SECTION OR FRACTURE ON NET SECTION

YIELDING ON GROSS SECTION

$P_r = \phi_y P_{ny} = \phi_y F_y A_g$ $\phi_y = 0.95$ (REF. 1 6.5.4.2)
A_g = GROSS AREA

FRACTURE ON NET SECTION

$P_r = \phi_u P_{nu} = \phi_u A_n F_u R_p U$

$\phi_u = 0.80$ (REF. 1 6.5.4.2)

$R_p = 1.0$ BOLT HOLE REDUCTION FACTOR, NO BOLTS EYEBARS & RODS ONLY

$U = 1.0$ SHEAR LAG REDUCTION FACTOR. FOR EYEBARS & RODS FORCE TRANSMITTED TO ALL ELEMENTS

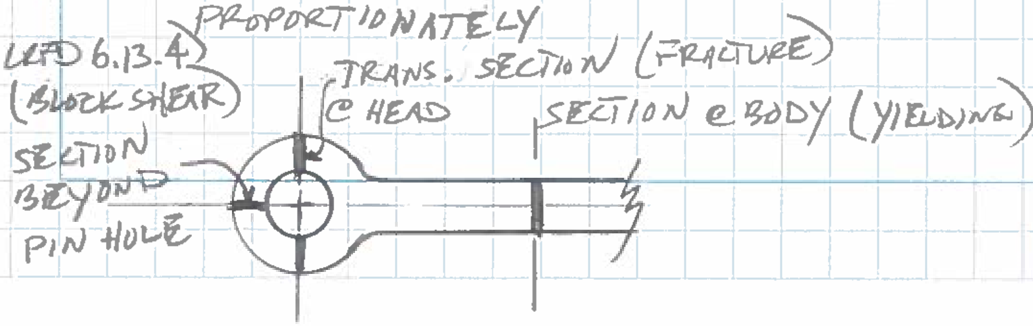
A_n = NET AREA

- EYEBARS FOR EXIST. EYEBARS, USE REF. 2 6A.6.6.2

1. TRANSVERSE NET WIDTH @ HEAD ≥ 1.35 WIDTH OF BODY

2. WIDTH BEYOND PIN HOLE ≥ 0.75 WIDTH OF BODY

3. IF #1 OR #2 NOT SATISFIED REDUCE SECTION OF BODY PROPORTIONATELY



COMPRESSION MEMBERS (REF. 1, 6.9)

$P_r = \phi_c P_n$ $\phi_c = 0.9$ (REF. 1, 6.5.4.2)

FOR NONCOMPOSITE MEMBER (REF. 1, 6.9.4.1)

$P_n = 0.658^{(P_o/P_e)} \times P_o$ FOR $P_e/P_o \geq 0.44$

$P_n = 0.877 P_e$ FOR $P_e/P_o < 0.44$

$P_o = Q F_y A_g$ Q = SLENDERNESS REDUCTION FACTOR (REF. 1, 6.9.4.2.2)

$P_e = \dfrac{\pi^2 E}{(K\ell/r)^2} A_g$

TABLE 6.9.4.2.1-1

- LOCAL BUCKLING - $b/t \leq k\sqrt{E/F_y}$ (REF. 1, 6.9.4.2.1)

A.) UNSTIFFENED ELEMENTS - b = FULL WIDTH OF ANGLE LEG

OUTSTANDING LEGS OF ANGLES $k = 0.45$

B.) STIFFENED ELEMENTS $K = 1.49$ b = C-C BOLTS OF PL

• COLUMN EFFECTIVE LENGTHS

FOR PRIMARY MEMBERS $Kl/r \leq 120$ (REF 1, 6.9.3)

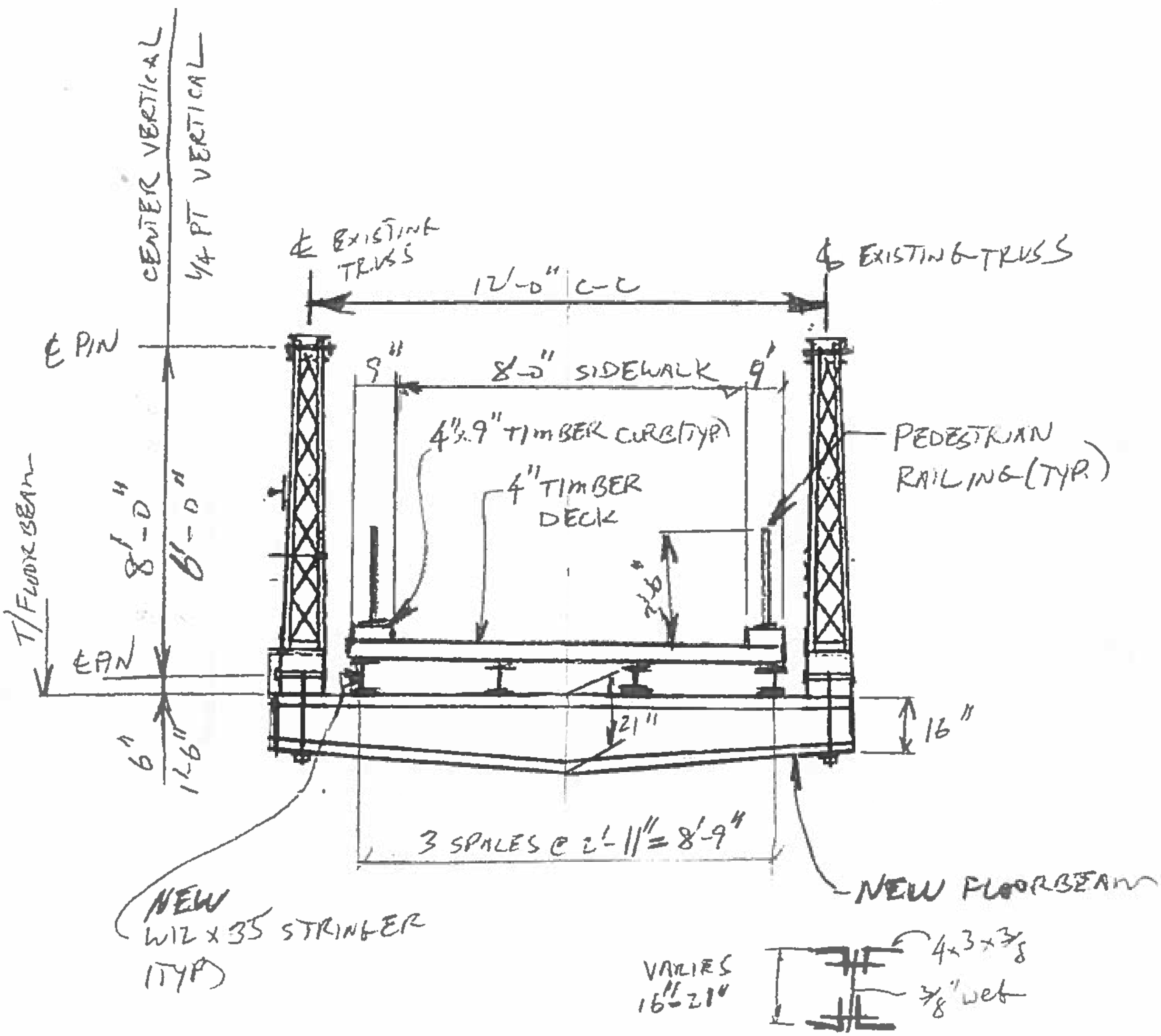
EFFECTIVE LENGTH FACTOR, K (REF 1, 4.6.2.5)

PINNED CONNECTIONS @ BOTH ENDS $K = 0.875$
IN BRACED PLANE

HALF-THROUGH/PONY TRUSS/ TOP CHORD OUT OF PLANE BUCKLING $K > 1.0$

REF 1, 4.6.3.5 & 6.14.2.9
REF. 3, 7.1.2

FOR PRELIMINARY STUDY ASSUME $K = 2$ FOR OUT OF PLANE BUCKLING



PROPOSED PEDESTRIAN BRIDGE

ALTERNATE 3

Dewberry

Job Number:	50075033		
Job Description:	BR 04575, Vernon		
Notes by:	TJS	Date:	11/16/2016
Checked by:	DAF	Date:	11/16/2016

FINAL PEDESTRIAN BRIDGE FLOOR SYSTEM LOADS

Input

C-C Trusses	11.00	ft
Sidewalk Width	8.00	ft
Curb Width	0.75	ft
Floorbeam Spacing	15.25	ft
FB Overhang	1.50	ft

													Weight per Floorbeam
DEAD LOADS													
Timber			Density =	50	pcf (LRFD Table 3.5.1-1)								
Deck	4	in/12	X	9.5	ft	X	15.25 ft	X		50 pcf	=		2415 lbs
Curbs	4	in/12	X	0.75	ft	X	15.25 ft	X 2	X	50 pcf	=		381 lbs
Steel													
Stringers	40	lb/ft	X	3		X	15.25 ft	=					1830 lbs
Floorbeam	50	lb/ft	X	1		X	14.00 ft	=					700 lbs
Railing	50	lb/ft	X	2		X	15.25 ft	=					1525 lbs
											TOTAL =		6851 lbs
											10% Misc		685 lbs
											FLOORBEAM DL PER TRUSS =		3768 lbs
											SAY		**3800 lbs**
LIVE LOADS													
Pedestrian Load =	90	psf (LRFD Guide Spec 3.1)		X			8.00 ft	X		15.25 ft	=		10980 lbs
											FLOORBEAM LL PER TRUSS =		5490 lbs
											SAY		**5500 lbs**

Dewberry

Job Number: 50075033
Job Description: BR 04575, Vernon
Notes by: TJS Date: 11/16/2016
Checked by: DAF Date: 11/16/2016

STAAD MEMBER FORCE OUTPUT

File Name: Vernon Pedestrian Bridge-Truss.anl
Date: 11/09/16 16.19.54

		Load Case 1	Load Case 2	Load Case 3	Load Case 4	Load Case 5	Load Case 6		
	STAAD Member	Truss Self Weight	Deck Dead Load	Pedestrian Live Load at Joints 7, 8, 9	Pedestrian Live Load at Joint 7	Pedestrian Live Load at Joint 8	Pedestrian Live Load at Joints 7, 8	Max LL Compression	Max LL Tension
Top Chord and End Posts	1	-2.68	-5.40	-6.30				-6.30	-
	2	-5.11	-13.99	-16.32				-16.32	-
	3	-5.22	-14.39	-16.78				-16.78	-
	4	-5.17	-14.39	-16.78				-16.78	-
	5	-5.22	-14.39	-16.78				-16.78	-
	6	-2.68	-5.40	-6.30				-6.30	-
Bottom Chord Eyebars	7	5.07	13.98	16.32				-	16.32
	8	4.78	13.09	15.27				-	15.27
	9	4.78	13.09	15.27				-	15.27
	10	5.07	13.98	16.32				-	16.32
Vertical Towers	11	-0.37	1.49	1.73	1.06	-0.69	1.77	-0.69	1.77
	12	-0.37	1.49	1.73	-0.34	-0.69	-1.03	-1.03	1.73
	13	-0.47	1.27	1.49	-1.06	1.05	1.03	-1.06	1.49
Diagonal Rods	14	0.28	0.69	0.81	0.00	2.92	0.00	0.00	2.92
	15	0.21	0.73	0.85	4.42	0.00	1.50	0.00	4.42
	16	0.21	0.73	0.85	0.00	0.00	0.00	0.00	0.85
	17	0.28	0.69	0.81	1.46	2.92	4.27	0.81	4.27

Notes:
Member forces reported in kips
Compression forces = " -"
Tension forces = " + "

21

Dewberry

Job Number:	50075033
Job Description:	BR 04575, Vernon
Notes by:	TJS — Date: 11/16/2016
Checked by:	DAF — Date: 11/16/2016

PEDESTRIAN TRUSS LRFD LOAD RATING (AS BUILT CONDITION)

Material Properties

Fy = 26 ksi
Fu = 48 ksi
E = 28000 ksi

Assume Wrought Iron
(AASHTO MBE, Table 6A.6.2.1-1)
(AASHTO MBE, 6A.6.2.3)

Load Factors (LRFD 3.4.1)

DC 1.25
PL 1.75

Resistance Factors (LRFD 6.5.4.2)

Compression ϕc = 0.9
Tension Yielding ϕy = 0.95
Tension Fracture ϕu = 0.8

K = 0.875 Pinned connection in braced plane (LRFD 4.6.2.5)
Rp = 1.00 Bolt hole reduction factor (LRFD 6.8.2.1)
U = 1.00 Shear lag reduction factor (LRFD 6.8.2.1)

(AASHTO MBE, 6A.4.2.3 & 6A.4.2.4)

Condition Factor, ϕc = 1.00 Good or Satisfactory
System Factor, ϕs = 0.90 Truss with Riveted/Eyebar Members
ϕc ϕs= 0.900

STAAD Member Force Load Multiplier

Joint Deck Dead Load STAAD 3600 1.056
Final 3800

Joint Pedestrian Live Load STAAD 4200 1.310
Final 5500

COMPRESSION MEMBERS

Member No.	STAAD Member No.	Unfactored Axial Loads (kips): Dead Load (Truss Self Weight)	Unfactored Axial Loads (kips): Dead Load (FB & Deck Weight)	Unfactored Axial Loads (kips): Pedestrian Live Load	Factored (kips): Strength I Loads	Gross Area (In^2)	Length (ft)	Kx	rx (in)	KxLx/rx	Ky	ry (in)	KyLy/ry	Max KL/r	Po = Fy*A (LRFD 6.9.4.1.1)	Pe (LRFD 6.9.4.1.2)	Pe/Po	Pn (LRFD 6.9.4.1.1)	Compression Capacity Pr =ϕc*ϕs*ϕc*Pn, (MBE 6A.4.2.1)	Capacity/Demand Ratio	Status >1 = OK
U1L1/U5L5	1, 6	-2.68	-5.70	-8.25	-24.91	11.97	4.50	0.875	2.30	20.54	2.000	3.90	27.69	27.69	311.22	4313.5	13.86	302.0	244.6	9.82	OK
U1U2/U4U5	2, 5	-5.11	-14.77	-21.37	-62.25	12.06	15.55	0.875	2.30	70.99	2.000	4.00	93.30	93.30	313.56	382.9	1.22	222.6	180.3	2.90	OK
U2U3/U3U4	3, 4	-5.22	-15.19	-21.97	-63.97	12.06	15.28	0.875	2.30	69.76	2.000	4.00	91.68	91.68	313.56	396.5	1.26	225.2	182.4	2.85	OK
U2L2/U4L4	11, 12	-0.37	1.57	-1.35	-0.86	2.48	6.00	0.875	0.83	75.90	0.875	4.15	15.18	75.90	64.48	119.0	1.84	51.4	41.6	48.58	OK
U3L3	13	-0.47	1.34	-1.39	-1.34	2.48	8.00	0.875	0.83	101.20	0.875	4.15	20.24	101.20	64.48	66.9	1.04	43.1	34.9	26.02	OK

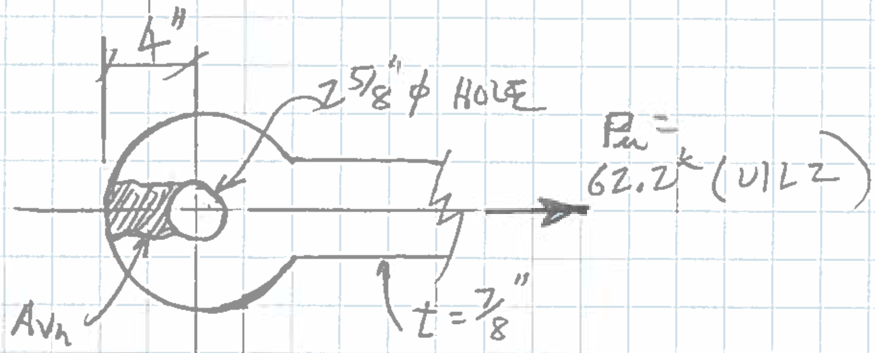
(Gross Area through Pr are grouped under "Compression Member Properties & Capacity (Kips)".)

TENSION MEMBERS

Member No.	STAAD Member No.	Unfactored Axial Loads (kips): Dead Load (Truss Self Weight)	Unfactored Axial Loads (kips): Dead Load (FB & Deck Weight)	Unfactored Axial Loads (kips): Pedestrian Live Load	Factored (kips): Strength I Loads	Gross Area, Ag (In^2)	Net Area, An (In^2)	Tension Yielding Pr = ϕy*Fy*Ag (LRFD 6.8.2.1)	Tension Fracture Pr = ϕu*Fu*An*Rp*U (LRFD 6.8.2.1)	Minimum Tension, Pr	Tension Capacity Pr =ϕc*ϕs*Pr (MBE 6A4.2.1)	Capacity/Demand Ratio	Status >1 = OK
U1L2/U5L4	7, 10	5.07	14.76	21.37	62.18	5.25	8.00	129.68	307.20	129.68	116.7	1.88	OK
L2L3/L3L4	8, 9	4.78	13.82	20.00	58.24	5.25	8.00	129.68	307.20	129.68	116.7	2.00	OK
U2L2/U4L4	11, 12	-0.37	1.57	2.32	5.56	2.48	1.92	61.26	73.73	61.26	55.1	9.92	OK
U3L3	13	-0.47	1.34	1.95	4.50	2.48	1.92	61.26	73.73	61.26	55.1	12.24	OK
Diagonal Rods	14-17	0.28	0.77	5.79	11.44	1.23	1.00	30.38	38.40	30.38	27.3	2.39	OK

(Gross Area through Tension Capacity are grouped under "Tension Member Properties & Capacity (Kips)".)

CHECK EYEBAR BLOCK SHEAR (LRFD 6.13.4)



$A_{tn} = 0$ $R_r = \phi_{bs} R_p (0.58 F_u A_{vn})$ $F_u = 48\ ksi$

$\phi_{bs} = 0.8$ (LRFD 6.5.4.2)

$A_{vn} = 4 - \frac{1}{2}(2.625) \times \frac{7}{8}'' = 2.35\ in^2$ / EYEBAR

$R_p = 1.0$ (ASSUME HOLE DRILL/CUT)

$R_r = (0.8)(1.0)(0.58 \times 48\ ksi \times 2.35\ in^2 \times 2$ shear planes)

$= 104.7^k$ PER EYEBAR $\times 2 = 209.4^k$ / MEMBER

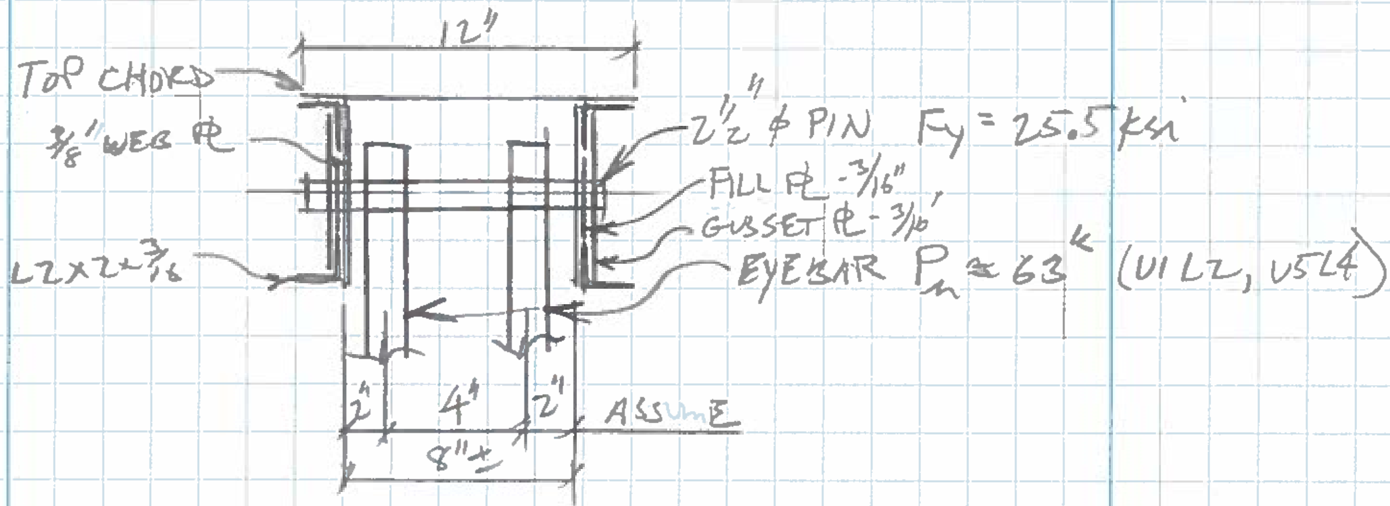
$P_u = 62.2^k < 209.4^k$ OK

Dewberry

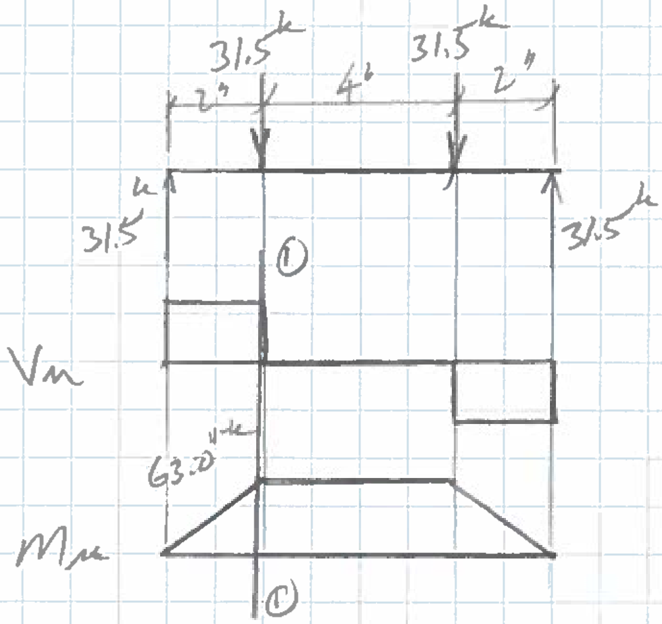
Calculation Sheet

Designer TJS Date 11/16 Checker Date
Title VERNON Job No.
Subject PEDESTRIAN BRIDGE Sheet No. 24 of

CHECK PIN CAPACITY (LRFD 6.7.6.2)



SECTION @ END POST



COMBINED BENDING & SHEAR (LRFD 6.7.6.2.1)

$$\frac{6.0 M_u}{\phi_f D^3 F_y} + \left(\frac{2.2 V_u}{\phi_v D^2 F_y}\right)^3 \leq 0.95 \qquad \phi_v = \phi_f = 1.0$$

$D = 2.5"$

Dewberry

Calculation Sheet

Designer TJJ Date 11/16 Checker Date
Title VERNON Job No.
Subject PEDESTRIAN BRIDGE Sheet No. 23 of

$$\frac{(6.0)(63.0^{k\text{-in}})}{(1.0)(2.5)^3(25.5)} + \left[\frac{2.2(31.5^k)}{(1.0)(2.5)^2(25.5)}\right]^3$$

$0.95 + 0.08 = 1.03 > 0.95$

8.4% OVER

BEARING CAPACITY (LRFD 6.7.6.2.2)

$(R_{PB})_n = 1.5 t D F_y$ $t = (\frac{3}{8}" + \frac{3}{16}" + \frac{3}{16}") = 0.75"$

(3/8": WEB; 3/16": GUSSET PL; 3/16": FILLER)

$(R_{PB})_n = (1.5)(0.75)(2.5)(26\ ksi) = 73.1^k > 31.5^k$ (OK)

BY: DAF 11/16
CHECKED TJS 11/16

```
*****************************************************
*                                                   *
*           STAAD.Pro                               *
*           Version  2007    Build 05               *
*           Proprietary Program of                  *
*           Bentley Systems, Inc.                   *
*           Date=    NOV  9, 2016                   *
*           Time=    16:19:54                       *
*                                                   *
*      USER ID: Dewberry                            *
*****************************************************
```

```
     1. STAAD TRUSS
INPUT FILE: Vernon Pedestrian Bridge - Truss.STD
     2. START JOB INFORMATION
     3. ENGINEER DATE 04-NOV-16
     4. JOB NAME VERNON PEDESTRIAN BRIDGE
     5. ENGINEER NAME DAF
     6. END JOB INFORMATION
     7. INPUT WIDTH 79
     8. UNIT FEET KIP
     9. JOINT COORDINATES
    10. 1 0 0 0; 2 0 4.5 0; 3 15.25 7.52 0; 4 30.5 8.52 0; 5 45.75 7.52 0; 6 61 4.5 0
    11. 7 15.25 1.52 0; 8 30.5 0.5 0; 9 45.75 1.52 0; 10 61 0 0
    12. MEMBER INCIDENCES
    13. 1 1 2; 2 2 3; 3 3 4; 4 4 5; 5 5 6; 6 6 10; 7 2 7; 8 7 8; 9 8 9; 10 9 6; 11 3 7
    14. 12 5 9; 13 4 8; 14 3 8; 15 4 7; 16 4 9; 17 5 8
    15. DEFINE MATERIAL START
    16. ISOTROPIC STEEL
    17. E 4.032E+006
    18. POISSON 0.3
    19. DENSITY 0.489024
    20. ALPHA 6E-006
    21. DAMP 0.03
    22. END DEFINE MATERIAL
    23. UNIT INCHES KIP
    24. MEMBER PROPERTY AMERICAN
    25. 2 TO 5 PRIS AX 12.06
    26. 14 TO 17 PRIS YD 1.25
    27. 7 TO 10 PRIS AX 5.25
    28. 11 TO 13 PRIS AX 5.76
    29. 1 6 PRIS AX 11.97
    30. CONSTANTS
    31. MATERIAL STEEL ALL
    32. SUPPORTS
    33. 1 10 PINNED
    34. 2 FIXED BUT FY FZ MX MY MZ
    35. MEMBER TENSION
    36. 14 TO 17
    37. LOAD 1 LOADTYPE DEAD  TITLE LOAD CASE 1
    38. SELFWEIGHT Y -1.15
    39. LOAD 2 LOADTYPE DEAD  TITLE LOAD CASE 2
    40. JOINT LOAD
```

```
41. 7 TO 9 FY -3.6
42. LOAD 3 LOADTYPE LIVE  TITLE LOAD CASE 3
43. JOINT LOAD
44. 7 TO 9 FY -4.2
45. LOAD 4 LOADTYPE LIVE  TITLE LOAD CASE 4
46. JOINT LOAD
47. 7 FY -4.2
48. LOAD 5 LOADTYPE LIVE  TITLE LOAD CASE 5
49. JOINT LOAD
50. 8 FY -4.2
51. LOAD 6 LOADTYPE LIVE  TITLE LOAD CASE 6
52. JOINT LOAD
53. 7 8 FY -4.2
54. PERFORM ANALYSIS PRINT LOAD DATA
```

P R O B L E M   S T A T I S T I C S

NUMBER OF JOINTS/MEMBER+ELEMENTS/SUPPORTS = 10/ 17/ 3

SOLVER USED IS THE OUT-OF-CORE BASIC SOLVER

ORIGINAL/FINAL BAND-WIDTH= 5/ 3/ 8 DOF
TOTAL PRIMARY LOAD CASES = 6, TOTAL DEGREES OF FREEDOM = 15
SIZE OF STIFFNESS MATRIX = 1 DOUBLE KILO-WORDS
REQRD/AVAIL. DISK SPACE = 12.0/ 340926.3 MB

LOADING 1 LOADTYPE DEAD TITLE LOAD CASE 1

SELFWEIGHT Y -1.150

ACTUAL WEIGHT OF THE STRUCTURE = 4.662 KIP

LOADING 2 LOADTYPE DEAD TITLE LOAD CASE 2

JOINT LOAD - UNIT KIP INCH

JOINT	FORCE-X	FORCE-Y	FORCE-Z	MOM-X	MOM-Y	MOM-Z
7	0.00	-3.60	0.00	0.00	0.00	0.00
8	0.00	-3.60	0.00	0.00	0.00	0.00
9	0.00	-3.60	0.00	0.00	0.00	0.00

LOADING 3 LOADTYPE LIVE TITLE LOAD CASE 3

JOINT LOAD - UNIT KIP INCH

JOINT	FORCE-X	FORCE-Y	FORCE-Z	MOM-X	MOM-Y	MOM-Z
7	0.00	-4.20	0.00	0.00	0.00	0.00
8	0.00	-4.20	0.00	0.00	0.00	0.00
9	0.00	-4.20	0.00	0.00	0.00	0.00

LOADING 4 LOADTYPE LIVE TITLE LOAD CASE 4

JOINT LOAD - UNIT KIP INCH

JOINT	FORCE-X	FORCE-Y	FORCE-Z	MOM-X	MOM-Y	MOM-Z
7	0.00	-4.20	0.00	0.00	0.00	0.00

LOADING 5 LOADTYPE LIVE TITLE LOAD CASE 5

JOINT LOAD - UNIT KIP INCH

JOINT	FORCE-X	FORCE-Y	FORCE-Z	MOM-X	MOM-Y	MOM-Z
8	0.00	-4.20	0.00	0.00	0.00	0.00

LOADING 6 LOADTYPE LIVE TITLE LOAD CASE 6

JOINT LOAD - UNIT KIP INCH

JOINT	FORCE-X	FORCE-Y	FORCE-Z	MOM-X	MOM-Y	MOM-Z
7	0.00	-4.20	0.00	0.00	0.00	0.00
8	0.00	-4.20	0.00	0.00	0.00	0.00

**NOTE-Tension/Compression converged after 1 iterations, Case= 1

**NOTE-Tension/Compression converged after 1 iterations, Case= 2

**NOTE-Tension/Compression converged after 1 iterations, Case= 3

**START ITERATION NO. 2

**NOTE-Tension/Compression converged after 2 iterations, Case= 4

**START ITERATION NO. 2

**NOTE-Tension/Compression converged after 2 iterations, Case= 5

**START ITERATION NO. 2

**NOTE-Tension/Compression converged after 2 iterations, Case= 6

************ END OF DATA FROM INTERNAL STORAGE ************

55. PRINT SUPPORT REACTION

SUPPORT REACTIONS -UNIT KIP INCH STRUCTURE TYPE = TRUSS

JOINT	LOAD	FORCE-X	FORCE-Y	FORCE-Z	MOM-X	MOM-Y	MOM Z
1	1	0.00	2.68	0.00	0.00	0.00	0.00
	2	0.00	5.40	0.00	0.00	0.00	0.00
	3	0.00	6.30	0.00	0.00	0.00	0.00
	4	0.00	3.15	0.00	0.00	0.00	0.00
	5	0.00	2.10	0.00	0.00	0.00	0.00
	6	0.00	5.25	0.00	0.00	0.00	0.00
10	1	0.00	2.68	0.00	0.00	0.00	0.00
	2	0.00	5.40	0.00	0.00	0.00	0.00
	3	0.00	6.30	0.00	0.00	0.00	0.00
	4	0.00	1.05	0.00	0.00	0.00	0.00
	5	0.00	2.10	0.00	0.00	0.00	0.00
	6	0.00	3.15	0.00	0.00	0.00	0.00
2	1	0.00	0.00	0.00	0.00	0.00	0.00
	2	0.00	0.00	0.00	0.00	0.00	0.00
	3	0.00	0.00	0.00	0.00	0.00	0.00
	4	0.00	0.00	0.00	0.00	0.00	0.00
	5	0.00	0.00	0.00	0.00	0.00	0.00
	6	0.00	0.00	0.00	0.00	0.00	0.00

************** END OF LATEST ANALYSIS RESULT **************

56. PRINT MAXFORCE ENVELOPE

MEMBER FORCE ENVELOPE

ALL UNITS ARE KIP INCH

MAX AND MIN FORCE VALUES AMONGST ALL SECTION LOCATIONS

MEMB		FY/ FZ	DIST DIST	LD LD	MZ/ MY	DIST DIST	LD LD	FX	DIST	LD
1	MAX	0.00	0.00	1	0.00	0.00	1			
		0.00	0.00	1	0.00	0.00	1	6.30 C	0.00	3
	MIN	0.00	54.00	6	0.00	54.00	6			
		0.00	54.00	6	0.00	54.00	6	2.10 C	54.00	5
2	MAX	0.36	0.00	1	0.00	0.00	1			
		0.00	0.00	1	0.00	0.00	1	16.32 C	0.00	3
	MIN	-0.36	186.55	1	0.00	186.55	6			
		0.00	186.55	6	0.00	186.55	6	4.97 C	186.55	1
3	MAX	0.36	0.00	1	0.00	0.00	1			
		0.00	0.00	1	0.00	0.00	1	16.78 C	0.00	3
	MIN	-0.36	183.39	1	0.00	183.39	6			
		0.00	183.39	6	0.00	183.39	6	5.17 C	183.39	1
4	MAX	0.36	0.00	1	0.00	0.00	1			
		0.00	0.00	1	0.00	0.00	1	16.78 C	0.00	3
	MIN	-0.36	183.39	1	0.00	183.39	6			
		0.00	183.39	6	0.00	183.39	6	4.00 C	183.39	4
5	MAX	0.36	0.00	1	0.00	0.00	1			
		0.00	0.00	1	0.00	0.00	1	16.32 C	0.00	3
	MIN	-0.36	186.55	1	0.00	186.55	6			
		0.00	186.55	6	0.00	186.55	6	2.72 C	186.55	4
6	MAX	0.00	0.00	1	0.00	0.00	1			
		0.00	0.00	1	0.00	0.00	1	6.30 C	0.00	3
	MIN	0.00	54.00	6	0.00	54.00	6			
		0.00	54.00	6	0.00	54.00	6	1.05 C	54.00	4
7	MAX	0.16	0.00	1	0.00	0.00	1			
		0.00	0.00	1	0.00	0.00	1	5.01 T	186.46	1
	MIN	-0.16	186.46	1	0.00	186.46	6			
		0.00	186.46	6	0.00	186.46	6	16.32 T	186.46	3
8	MAX	0.16	0.00	1	0.00	0.00	1			
		0.00	0.00	1	0.00	0.00	1	4.00 T	0.00	4
	MIN	-0.16	183.41	1	0.00	183.41	6			
		0.00	183.41	6	0.00	183.41	6	15.27 T	183.41	3
9	MAX	0.16	0.00	1	0.00	0.00	1			
		0.00	0.00	1	0.00	0.00	1	2.67 T	0.00	4

	MIN	-0.16	183.41	1	0.00	183.41	6			
		0.00	183.41	6	0.00	183.41	6	15.27 T	183.41	3
10	MAX	0.16	0.00	1	0.00	0.00	1			
		0.00	0.00	1	0.00	0.00	1	2.72 T	0.00	4
	MIN	-0.16	186.46	1	0.00	186.46	6			
		0.00	186.46	6	0.00	186.46	6	16.32 T	186.46	3
11	MAX	0.00	0.00	1	0.00	0.00	1			
		0.00	0.00	1	0.00	0.00	1	0.69 C	0.00	5
	MIN	0.00	72.00	6	0.00	72.00	6			
		0.00	72.00	6	0.00	72.00	6	1.77 T	72.00	6
12	MAX	0.00	0.00	1	0.00	0.00	1			
		0.00	0.00	1	0.00	0.00	1	1.03 C	0.00	6
	MIN	0.00	72.00	6	0.00	72.00	6			
		0.00	72.00	6	0.00	72.00	6	1.73 T	72.00	3
13	MAX	0.00	0.00	1	0.00	0.00	1			
		0.00	0.00	1	0.00	0.00	1	1.06 C	0.00	4
	MIN	0.00	96.24	6	0.00	96.24	6			
		0.00	96.24	6	0.00	96.24	6	1.49 T	96.24	3
14	MAX	0.04	0.00	1	0.00	0.00	1			
		0.00	0.00	1	0.00	0.00	1	0.00	0.00	4
	MIN	-0.04	201.46	1	0.00	201.46	6			
		0.00	201.46	6	0.00	201.46	6	2.92 T	201.46	5
15	MAX	0.04	0.00	1	0.00	0.00	1			
		0.00	0.00	1	0.00	0.00	1	0.00	0.00	5
	MIN	-0.04	201.36	1	0.00	201.36	6			
		0.00	201.36	6	0.00	201.36	6	4.42 T	201.36	4
16	MAX	0.04	0.00	1	0.00	0.00	1			
		0.00	0.00	1	0.00	0.00	1	0.00	0.00	4
	MIN	-0.04	201.36	1	0.00	201.36	6			
		0.00	201.36	6	0.00	201.36	6	0.85 T	201.36	3
17	MAX	0.04	0.00	1	0.00	0.00	1			
		0.00	0.00	1	0.00	0.00	1	0.25 T	201.46	1
	MIN	-0.04	201.46	1	0.00	201.46	6			
		0.00	201.46	6	0.00	201.46	6	4.37 T	201.46	6

********** END OF FORCE ENVELOPE FROM INTERNAL STORAGE **********

57. PRINT JOINT DISPLACEMENTS

JOINT DISPLACEMENT (INCH RADIANS) STRUCTURE TYPE = TRUSS

JOINT	LOAD	X-TRANS	Y-TRANS	Z-TRANS	X-ROTAN	Y-ROTAN	Z-ROTAN
1	1	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
	2	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
	3	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
	4	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
	5	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
	6	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
2	1	0.00000	-0.00041	0.00000	0.00000	0.00000	0.00000
	2	0.00000	-0.00087	0.00000	0.00000	0.00000	0.00000
	3	0.00000	-0.00102	0.00000	0.00000	0.00000	0.00000
	4	0.00000	-0.00051	0.00000	0.00000	0.00000	0.00000
	5	0.00000	-0.00034	0.00000	0.00000	0.00000	0.00000
	6	0.00000	-0.00085	0.00000	0.00000	0.00000	0.00000
3	1	0.00572	-0.04364	0.00000	0.00000	0.00000	0.00000
	2	0.01578	-0.12034	0.00000	0.00000	0.00000	0.00000
	3	0.01841	-0.14040	0.00000	0.00000	0.00000	0.00000
	4	0.01110	-0.07976	0.00000	0.00000	0.00000	0.00000
	5	0.00467	-0.03941	0.00000	0.00000	0.00000	0.00000
	6	0.01527	-0.11666	0.00000	0.00000	0.00000	0.00000
4	1	0.00347	-0.05247	0.00000	0.00000	0.00000	0.00000
	2	0.00944	-0.14307	0.00000	0.00000	0.00000	0.00000
	3	0.01101	-0.16692	0.00000	0.00000	0.00000	0.00000
	4	0.00398	-0.03785	0.00000	0.00000	0.00000	0.00000
	5	0.00317	-0.08293	0.00000	0.00000	0.00000	0.00000
	6	0.00864	-0.12655	0.00000	0.00000	0.00000	0.00000
5	1	0.00123	-0.04364	0.00000	0.00000	0.00000	0.00000
	2	0.00310	-0.12034	0.00000	0.00000	0.00000	0.00000
	3	0.00362	-0.14040	0.00000	0.00000	0.00000	0.00000
	4	0.00314	-0.01742	0.00000	0.00000	0.00000	0.00000
	5	0.00167	-0.03941	0.00000	0.00000	0.00000	0.00000
	6	0.00647	-0.06003	0.00000	0.00000	0.00000	0.00000
6	1	0.00695	-0.00041	0.00000	0.00000	0.00000	0.00000
	2	0.01888	-0.00087	0.00000	0.00000	0.00000	0.00000
	3	0.02203	-0.00102	0.00000	0.00000	0.00000	0.00000
	4	0.00503	-0.00017	0.00000	0.00000	0.00000	0.00000
	5	0.00634	-0.00034	0.00000	0.00000	0.00000	0.00000
	6	0.01366	-0.00051	0.00000	0.00000	0.00000	0.00000
7	1	-0.00191	-0.04350	0.00000	0.00000	0.00000	0.00000
	2	-0.00540	-0.12100	0.00000	0.00000	0.00000	0.00000
	3	-0.00630	-0.14117	0.00000	0.00000	0.00000	0.00000
	4	-0.00504	-0.08023	0.00000	0.00000	0.00000	0.00000
	5	-0.00055	-0.03910	0.00000	0.00000	0.00000	0.00000
	6	-0.00521	-0.11745	0.00000	0.00000	0.00000	0.00000
8	1	0.00347	-0.05224	0.00000	0.00000	0.00000	0.00000
	2	0.00944	-0.14383	0.00000	0.00000	0.00000	0.00000
	3	0.01101	-0.16781	0.00000	0.00000	0.00000	0.00000
	4	0.00285	-0.03722	0.00000	0.00000	0.00000	0.00000
	5	0.00317	-0.08355	0.00000	0.00000	0.00000	0.00000
	6	0.00915	-0.12717	0.00000	0.00000	0.00000	0.00000

JOINT DISPLACEMENT (INCH RADIANS) STRUCTURE TYPE = TRUSS

JOINT	LOAD	X-TRANS	Y-TRANS	Z-TRANS	X-ROTAN	Y-ROTAN	Z-ROTAN
9	1	0.00886	-0.04350	0.00000	0.00000	0.00000	0.00000
	2	0.02428	-0.12100	0.00000	0.00000	0.00000	0.00000
	3	0.02833	-0.14117	0.00000	0.00000	0.00000	0.00000
	4	0.00486	-0.01727	0.00000	0.00000	0.00000	0.00000
	5	0.00689	-0.03910	0.00000	0.00000	0.00000	0.00000
	6	0.01466	-0.05957	0.00000	0.00000	0.00000	0.00000
10	1	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
	2	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
	3	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
	4	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
	5	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
	6	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000

************** END OF LATEST ANALYSIS RESULT **************

58. PRINT MEMBER FORCES

MEMBER END FORCES STRUCTURE TYPE = TRUSS

ALL UNITS ARE -- KIP INCH (LOCAL)

MEMBER	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
1	1	1	2.68	0.00	0.00	0.00	0.00	0.00
		2	-2.47	0.00	0.00	0.00	0.00	0.00
	2	1	5.40	0.00	0.00	0.00	0.00	0.00
		2	-5.40	0.00	0.00	0.00	0.00	0.00
	3	1	6.30	0.00	0.00	0.00	0.00	0.00
		2	-6.30	0.00	0.00	0.00	0.00	0.00
	4	1	3.15	0.00	0.00	0.00	0.00	0.00
		2	-3.15	0.00	0.00	0.00	0.00	0.00
	5	1	2.10	0.00	0.00	0.00	0.00	0.00
		2	-2.10	0.00	0.00	0.00	0.00	0.00
	6	1	5.25	0.00	0.00	0.00	0.00	0.00
		2	-5.25	0.00	0.00	0.00	0.00	0.00
2	1	2	5.11	0.36	0.00	0.00	0.00	0.00
		3	-4.97	0.36	0.00	0.00	0.00	0.00
	2	2	13.99	0.00	0.00	0.00	0.00	0.00
		3	-13.99	0.00	0.00	0.00	0.00	0.00
	3	2	16.32	0.00	0.00	0.00	0.00	0.00
		3	-16.32	0.00	0.00	0.00	0.00	0.00
	4	2	8.16	0.00	0.00	0.00	0.00	0.00
		3	-8.16	0.00	0.00	0.00	0.00	0.00
	5	2	5.44	0.00	0.00	0.00	0.00	0.00
		3	-5.44	0.00	0.00	0.00	0.00	0.00
	6	2	13.60	0.00	0.00	0.00	0.00	0.00
		3	-13.60	0.00	0.00	0.00	0.00	0.00
3	1	3	5.22	0.36	0.00	0.00	0.00	0.00
		4	-5.17	0.36	0.00	0.00	0.00	0.00
	2	3	14.39	0.00	0.00	0.00	0.00	0.00
		4	-14.39	0.00	0.00	0.00	0.00	0.00
	3	3	16.78	0.00	0.00	0.00	0.00	0.00
		4	-16.78	0.00	0.00	0.00	0.00	0.00
	4	3	8.02	0.00	0.00	0.00	0.00	0.00
		4	-8.02	0.00	0.00	0.00	0.00	0.00
	5	3	8.00	0.00	0.00	0.00	0.00	0.00
		4	-8.00	0.00	0.00	0.00	0.00	0.00
	6	3	13.37	0.00	0.00	0.00	0.00	0.00
		4	-13.37	0.00	0.00	0.00	0.00	0.00
4	1	4	5.17	0.36	0.00	0.00	0.00	0.00
		5	-5.22	0.36	0.00	0.00	0.00	0.00
	2	4	14.39	0.00	0.00	0.00	0.00	0.00
		5	-14.39	0.00	0.00	0.00	0.00	0.00
	3	4	16.78	0.00	0.00	0.00	0.00	0.00
		5	-16.78	0.00	0.00	0.00	0.00	0.00

MEMBER END FORCES STRUCTURE TYPE = TRUSS

ALL UNITS ARE -- KIP INCH (LOCAL)

MEMBER	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
	4	4	4.00	0.00	0.00	0.00	0.00	0.00
		5	-4.00	0.00	0.00	0.00	0.00	0.00
	5	4	8.00	0.00	0.00	0.00	0.00	0.00
		5	-8.00	0.00	0.00	0.00	0.00	0.00
	6	4	12.01	0.00	0.00	0.00	0.00	0.00
		5	-12.01	0.00	0.00	0.00	0.00	0.00
5	1	5	4.97	0.36	0.00	0.00	0.00	0.00
		6	-5.11	0.36	0.00	0.00	0.00	0.00
	2	5	13.99	0.00	0.00	0.00	0.00	0.00
		6	-13.99	0.00	0.00	0.00	0.00	0.00
	3	5	16.32	0.00	0.00	0.00	0.00	0.00
		6	-16.32	0.00	0.00	0.00	0.00	0.00
	4	5	2.72	0.00	0.00	0.00	0.00	0.00
		6	-2.72	0.00	0.00	0.00	0.00	0.00
	5	5	5.44	0.00	0.00	0.00	0.00	0.00
		6	-5.44	0.00	0.00	0.00	0.00	0.00
	6	5	8.16	0.00	0.00	0.00	0.00	0.00
		6	-8.16	0.00	0.00	0.00	0.00	0.00
6	1	6	2.47	0.00	0.00	0.00	0.00	0.00
		10	-2.68	0.00	0.00	0.00	0.00	0.00
	2	6	5.40	0.00	0.00	0.00	0.00	0.00
		10	-5.40	0.00	0.00	0.00	0.00	0.00
	3	6	6.30	0.00	0.00	0.00	0.00	0.00
		10	-6.30	0.00	0.00	0.00	0.00	0.00
	4	6	1.05	0.00	0.00	0.00	0.00	0.00
		10	-1.05	0.00	0.00	0.00	0.00	0.00
	5	6	2.10	0.00	0.00	0.00	0.00	0.00
		10	-2.10	0.00	0.00	0.00	0.00	0.00
	6	6	3.15	0.00	0.00	0.00	0.00	0.00
		10	-3.15	0.00	0.00	0.00	0.00	0.00
7	1	2	-5.07	0.16	0.00	0.00	0.00	0.00
		7	5.01	0.16	0.00	0.00	0.00	0.00
	2	2	-13.98	0.00	0.00	0.00	0.00	0.00
		7	13.98	0.00	0.00	0.00	0.00	0.00
	3	2	-16.32	0.00	0.00	0.00	0.00	0.00
		7	16.32	0.00	0.00	0.00	0.00	0.00
	4	2	-8.16	0.00	0.00	0.00	0.00	0.00
		7	8.16	0.00	0.00	0.00	0.00	0.00
	5	2	-5.44	0.00	0.00	0.00	0.00	0.00
		7	5.44	0.00	0.00	0.00	0.00	0.00
	6	2	-13.60	0.00	0.00	0.00	0.00	0.00
		7	13.60	0.00	0.00	0.00	0.00	0.00
8	1	7	-4.78	0.16	0.00	0.00	0.00	0.00
		8	4.76	0.16	0.00	0.00	0.00	0.00

MEMBER END FORCES STRUCTURE TYPE = TRUSS

ALL UNITS ARE -- KIP INCH (LOCAL)

MEMBER	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
	2	7	-13.09	0.00	0.00	0.00	0.00	0.00
		8	13.09	0.00	0.00	0.00	0.00	0.00
	3	7	-15.27	0.00	0.00	0.00	0.00	0.00
		8	15.27	0.00	0.00	0.00	0.00	0.00
	4	7	-4.00	0.00	0.00	0.00	0.00	0.00
		8	4.00	0.00	0.00	0.00	0.00	0.00
	5	7	-5.35	0.00	0.00	0.00	0.00	0.00
		8	5.35	0.00	0.00	0.00	0.00	0.00
	6	7	-12.01	0.00	0.00	0.00	0.00	0.00
		8	12.01	0.00	0.00	0.00	0.00	0.00
9	1	8	-4.76	0.16	0.00	0.00	0.00	0.00
		9	4.78	0.16	0.00	0.00	0.00	0.00
	2	8	-13.09	0.00	0.00	0.00	0.00	0.00
		9	13.09	0.00	0.00	0.00	0.00	0.00
	3	8	-15.27	0.00	0.00	0.00	0.00	0.00
		9	15.27	0.00	0.00	0.00	0.00	0.00
	4	8	-2.67	0.00	0.00	0.00	0.00	0.00
		9	2.67	0.00	0.00	0.00	0.00	0.00
	5	8	-5.35	0.00	0.00	0.00	0.00	0.00
		9	5.35	0.00	0.00	0.00	0.00	0.00
	6	8	-8.02	0.00	0.00	0.00	0.00	0.00
		9	8.02	0.00	0.00	0.00	0.00	0.00
10	1	9	-5.01	0.16	0.00	0.00	0.00	0.00
		6	5.07	0.16	0.00	0.00	0.00	0.00
	2	9	-13.98	0.00	0.00	0.00	0.00	0.00
		6	13.98	0.00	0.00	0.00	0.00	0.00
	3	9	-16.32	0.00	0.00	0.00	0.00	0.00
		6	16.32	0.00	0.00	0.00	0.00	0.00
	4	9	-2.72	0.00	0.00	0.00	0.00	0.00
		6	2.72	0.00	0.00	0.00	0.00	0.00
	5	9	-5.44	0.00	0.00	0.00	0.00	0.00
		6	5.44	0.00	0.00	0.00	0.00	0.00
	6	9	-8.16	0.00	0.00	0.00	0.00	0.00
		6	8.16	0.00	0.00	0.00	0.00	0.00
11	1	3	0.24	0.00	0.00	0.00	0.00	0.00
		7	-0.37	0.00	0.00	0.00	0.00	0.00
	2	3	-1.49	0.00	0.00	0.00	0.00	0.00
		7	1.49	0.00	0.00	0.00	0.00	0.00
	3	3	-1.73	0.00	0.00	0.00	0.00	0.00
		7	1.73	0.00	0.00	0.00	0.00	0.00
	4	3	-1.06	0.00	0.00	0.00	0.00	0.00
		7	1.06	0.00	0.00	0.00	0.00	0.00
	5	3	0.69	0.00	0.00	0.00	0.00	0.00
		7	-0.69	0.00	0.00	0.00	0.00	0.00

MEMBER END FORCES STRUCTURE TYPE = TRUSS

ALL UNITS ARE -- KIP INCH (LOCAL)

MEMBER	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
	6	3	-1.77	0.00	0.00	0.00	0.00	0.00
		7	1.77	0.00	0.00	0.00	0.00	0.00
12	1	5	0.24	0.00	0.00	0.00	0.00	0.00
		9	-0.37	0.00	0.00	0.00	0.00	0.00
	2	5	-1.49	0.00	0.00	0.00	0.00	0.00
		9	1.49	0.00	0.00	0.00	0.00	0.00
	3	5	-1.73	0.00	0.00	0.00	0.00	0.00
		9	1.73	0.00	0.00	0.00	0.00	0.00
	4	5	0.34	0.00	0.00	0.00	0.00	0.00
		9	-0.34	0.00	0.00	0.00	0.00	0.00
	5	5	0.69	0.00	0.00	0.00	0.00	0.00
		9	-0.69	0.00	0.00	0.00	0.00	0.00
	6	5	1.03	0.00	0.00	0.00	0.00	0.00
		9	-1.03	0.00	0.00	0.00	0.00	0.00
13	1	4	0.28	0.00	0.00	0.00	0.00	0.00
		8	-0.47	0.00	0.00	0.00	0.00	0.00
	2	4	-1.27	0.00	0.00	0.00	0.00	0.00
		8	1.27	0.00	0.00	0.00	0.00	0.00
	3	4	-1.49	0.00	0.00	0.00	0.00	0.00
		8	1.49	0.00	0.00	0.00	0.00	0.00
	4	4	1.06	0.00	0.00	0.00	0.00	0.00
		8	-1.06	0.00	0.00	0.00	0.00	0.00
	5	4	-1.05	0.00	0.00	0.00	0.00	0.00
		8	1.05	0.00	0.00	0.00	0.00	0.00
	6	4	-1.03	0.00	0.00	0.00	0.00	0.00
		8	1.03	0.00	0.00	0.00	0.00	0.00
14	1	3	-0.28	0.04	0.00	0.00	0.00	0.00
		8	0.25	0.04	0.00	0.00	0.00	0.00
	2	3	-0.69	0.00	0.00	0.00	0.00	0.00
		8	0.69	0.00	0.00	0.00	0.00	0.00
	3	3	-0.81	0.00	0.00	0.00	0.00	0.00
		8	0.81	0.00	0.00	0.00	0.00	0.00
	4	3	0.00	0.00	0.00	0.00	0.00	0.00
		8	0.00	0.00	0.00	0.00	0.00	0.00
	5	3	-2.92	0.00	0.00	0.00	0.00	0.00
		8	2.92	0.00	0.00	0.00	0.00	0.00
	6	3	0.00	0.00	0.00	0.00	0.00	0.00
		8	0.00	0.00	0.00	0.00	0.00	0.00
15	1	4	-0.21	0.04	0.00	0.00	0.00	0.00
		7	0.18	0.04	0.00	0.00	0.00	0.00
	2	4	-0.73	0.00	0.00	0.00	0.00	0.00
		7	0.73	0.00	0.00	0.00	0.00	0.00
	3	4	-0.85	0.00	0.00	0.00	0.00	0.00
		7	0.85	0.00	0.00	0.00	0.00	0.00

MEMBER END FORCES   STRUCTURE TYPE = TRUSS

ALL UNITS ARE -- KIP INCH   (LOCAL)

MEMBER	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
	4	4	-4.42	0.00	0.00	0.00	0.00	0.00
		7	4.42	0.00	0.00	0.00	0.00	0.00
	5	4	0.00	0.00	0.00	0.00	0.00	0.00
		7	0.00	0.00	0.00	0.00	0.00	0.00
	6	4	-1.50	0.00	0.00	0.00	0.00	0.00
		7	1.50	0.00	0.00	0.00	0.00	0.00
16	1	4	-0.21	0.04	0.00	0.00	0.00	0.00
		9	0.18	0.04	0.00	0.00	0.00	0.00
	2	4	-0.73	0.00	0.00	0.00	0.00	0.00
		9	0.73	0.00	0.00	0.00	0.00	0.00
	3	4	-0.85	0.00	0.00	0.00	0.00	0.00
		9	0.85	0.00	0.00	0.00	0.00	0.00
	4	4	0.00	0.00	0.00	0.00	0.00	0.00
		9	0.00	0.00	0.00	0.00	0.00	0.00
	5	4	0.00	0.00	0.00	0.00	0.00	0.00
		9	0.00	0.00	0.00	0.00	0.00	0.00
	6	4	0.00	0.00	0.00	0.00	0.00	0.00
		9	0.00	0.00	0.00	0.00	0.00	0.00
17	1	5	-0.28	0.04	0.00	0.00	0.00	0.00
		8	0.25	0.04	0.00	0.00	0.00	0.00
	2	5	-0.69	0.00	0.00	0.00	0.00	0.00
		8	0.69	0.00	0.00	0.00	0.00	0.00
	3	5	-0.81	0.00	0.00	0.00	0.00	0.00
		8	0.81	0.00	0.00	0.00	0.00	0.00
	4	5	-1.46	0.00	0.00	0.00	0.00	0.00
		8	1.46	0.00	0.00	0.00	0.00	0.00
	5	5	-2.92	0.00	0.00	0.00	0.00	0.00
		8	2.92	0.00	0.00	0.00	0.00	0.00
	6	5	-4.37	0.00	0.00	0.00	0.00	0.00
		8	4.37	0.00	0.00	0.00	0.00	0.00

************** END OF LATEST ANALYSIS RESULT **************

59. FINISH

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          *********** END OF THE STAAD.Pro RUN ***********

            **** DATE= NOV  9,2016   TIME= 16:19:54 ****

     ************************************************************
     *          For questions on STAAD.Pro, please contact      *
     *    Bentley Systems Offices at the following locations    *
     *                                                          *
     *              Telephone              Web / Email          *
     *                                                          *
     *  USA:       +1 (714)974-2500                             *
     *  CANADA     +1 (905)632-4771      detech@odandetech.com  *
     *  UK         +44(1454)207-000                             *
     *  SINGAPORE +65 6225-6158                                 *
     *  EUROPE     +31 23 5560560                               *
     *  INDIA      +91(033)4006-2021                            *
     *  JAPAN      +81(03)5952-6500    http://www.ctc-g.co.jp   *
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     *  THAILAND   +66(0)2645-1018/19 partha.p@reisoftwareth.com *
     *                                                          *
     * Worldwide    http://selectservices.bentley.com/en-US/    *
     *                                                          *
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