Preliminary Structure Report
Bridge No. 05222
November 2014
State Project No. 023-0127

Town Bridge Road over Farmington River
Canton, CT

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1. Executive Summary

Existing Bridge

Town Bridge over the Farmington River (ConnDOT Bridge No. 05222) was constructed by the Town of Canton in 1895 as the replacement for a wooden covered bridge at the same location. The single lane through truss, was fabricated and assembled by the Berlin Iron Bridge Company of Berlin, Connecticut. Town Bridge has entered its second century of service to the Town. It is quickly becoming one of a limited number of through truss bridges constructed in the late 1800s that is still in active vehicular use.

Scope of Rehabilitation Work

Based on the 2013 inspection and evaluation of Bridge No. 05222, the bridge is both structurally deficient and structurally obsolete. Key issues to be addressed in the rehabilitation include repair of the deterioration, improve load carrying capacity, provide internal redundancy, stabilize stone abutments, improve approach profile and sightlines, and maintain original construction methods and materials. Rehabilitation and replacement alternatives are provided to determine the most prudent and cost effective method of advancement for this bridge. The alternatives studies are listed below.

N. No Build (Null Alternative)

1. Bridge Rehabilitation in accordance with the Secretary of the Interior's Standards
   - 1A. Bridge Rehabilitation at Existing Roadway Width (HS7)
   - 1B. Bridge Rehabilitation at Existing Roadway Width (HS20)
   - 1C. Bridge Rehabilitation Widened to 20' Roadway Width (HS20)
2. New Bridge on Upstream Alignment to 26' (HL93); Truss Bridge restored/preserved as a Pedestrian Facility

Maintenance and Protection of Traffic

Town Bridge Road over the Farmington River will be closed throughout the construction period. Traffic will be detoured approximately 2 miles. Temporary access to driveways within the Town Bridge Road closure limits will be maintained throughout the project.

2. Location Map

Figure 1 – Location Map

3. Detour Map

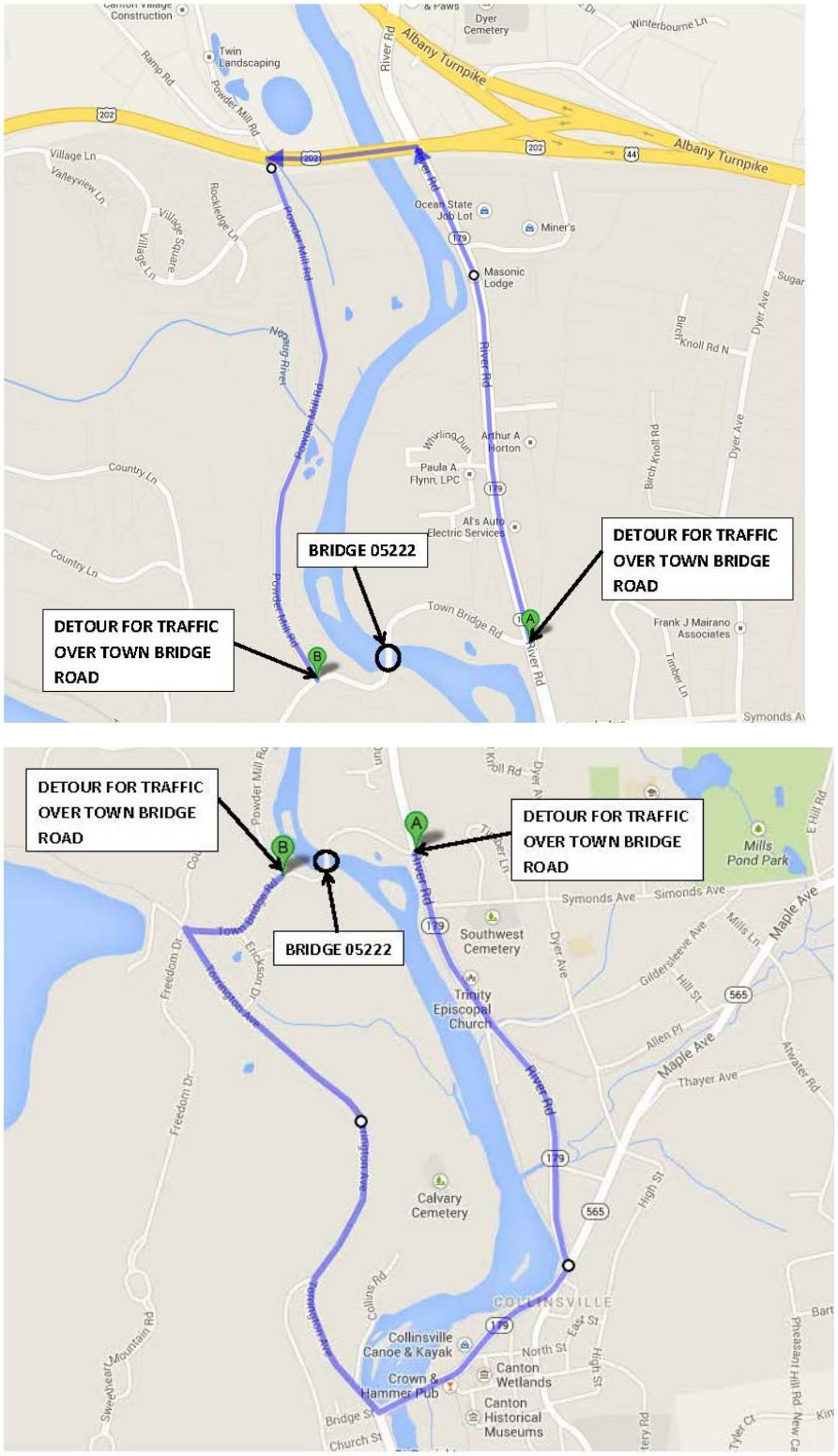


Figure 2 – Detour Map

4. Introduction

The Town of Canton has identified the need to study engineering alternatives to improve the structural condition and roadway width/alignment of the Town Bridge Road Bridge (Bridge No. 05222) over the Farmington River. The bridge is located in Hartford County, Connecticut. The project study focuses on the approximate 0.6 mile segment of Town Bridge Road bounded by Powder Mill Road to the south and River Road (Route 179) to the northeast.

Town Bridge Road is a narrow two-lane rural local road that typically runs through the steep wooded terrain of the scenic Farmington River. The area is characterized by very low-density residential development, farming and recreation. Town Bridge was constructed by the Town of Canton in 1895 as the replacement for a wooden covered bridge at the same location. The single lane through truss, was fabricated and assembled by the Berlin Iron Bridge Company of Berlin, Connecticut. The Bridge has entered its second century of service to the Town. It is quickly becoming one of a limited number of through truss bridges constructed in the late 1800s still in active vehicular use.

The Bridge was listed in the National Register of Historic Places in 1999 and is listed with the Historic American Engineering Record, but has not been documented for inclusion in the collection of the Library of Congress. In consideration of the Town of Canton's desire to make improvements at this crossing of the Farmington River, this report has been prepared in accordance with the requirements of Section 106 of the National Historic Preservation Act of 1966, as amended 916 U.S.C. 470 et seq. The requirements under Section 106 mandate that a determination be made of the effects that an undertaking has on a historic property. Concurrent with the Section 106 requirements, this report is also in compliance with Section 4(f) of the USDOT Act which requires documentation that there are no "prudent and feasible" alternatives to the taking or use of a historic property.

The intent of this preliminary engineering study is to evaluate appropriate methods to restore and rehabilitate the bridge in order to increase its load-carrying capacity and to improve the safety of the crossing while complying with appropriate conservation standards and treatments for historic properties. The ultimate goal of this project will be to develop the required elements of the structural rehabilitation in such a manner that will not have an adverse effect on the historic nature of the bridge while increasing the structural capacity in accordance with minimum standards required by AASHTO/FHWA. This report summarizes the rehabilitation and or replacement options and recommends a preliminary preferred alternative.

5. Project Purpose

The purpose of this project is to study methods to address the structural deficiency and functional obsolescence of the existing bridge. The rehabilitation of the bridge will allow for

an increase in load capacity of the bridge and possible improvement of some of the geometric and safety deficiencies of Town Bridge Road. This report is based on the findings of the latest bridge inspection performed in October 2013, material testing findings, rehabilitation plans and other records on file.

6. Project Need

In recent times, the Bridge has undergone major repairs in 1983-84 and in 1989-1990. The 1989-90 repairs rehabilitated the Bridge to a 12 ton load posting. The load rating of the Bridge has been reduced several times over the years to reflect continued deterioration of the structure. The current load restriction is 7 tons for a dual-axle vehicle and 10 tons for a tri-axle truck. Due to the configuration of the portal bracing, the Bridge has a vertical clearance restriction of 12'- 4". The current Sufficiency Rating of the Bridge is 14.73 and the Priority Rating is 11.03 as listed on page 107 of the Local Bridge Program Manual Fiscal Year 2010. The Bridge is listed as eligible for Federal funding.

The paint film applied during the 1989-90 work has reached the end of its service life and is allowing moisture to directly attack the metal work of the Bridge. This has resulted in a significant change in the rate of deterioration of the Bridge. Without intervention to arrest material deterioration and rehabilitation to strengthen structural connections and select member replacements that do not have adequate capacity, the Bridge will soon reach the end of its service life; no longer providing continued service to the community and ultimately resulting in the loss of this valuable historic resource.

7. Project Area Description

Bridge Description. Bridge No. 05222 is a 160-foot long single span Parker[1] through truss bridge having a stringer-floorbeam framing system and corrugated metal pan deck with bituminous concrete infill. The truss is supported on full height stone masonry abutments with concrete backwalls; the bridge wingwalls are of stone masonry construction. The existing bridge has an overall length of 172-feet and provides a 14'-4" clear roadway width between railings. The vertical clearance is 12'-4". The truss incorporates a mix of riveted and pinned member connections. It is complete with ornate lattice-work railings and decorative finials.

The bridge was built in 1895 by the Berlin Iron Bridge Company and underwent a major rehabilitation in 1989. Town Bridge carries one lane of alternating direction traffic over the Farmington River in the Town of Canton, CT. The span is located approximately 0.2 miles west of River Road (Route 179) and 0.7 miles south of the Litchfield Turnpike (Route 202).

[1] The Parker through truss bridge is a Pratt-type truss having a polygonal upper chord that increases the depth of the truss toward the center where the greatest strength to support loads is needed.

Roadway Description. The total roadway width varies at the approaches to Town Bridge; no lane line striping is present. The typical roadway width at the southern approach is 26'±; the northern approach roadway width varies between 21' and 29' within 300 feet of the bridge. The approach roadway narrows to a 16' wide paved roadway before the bridge and narrows further to a limiting 14'-4" width between W-beam rail elements on the span.

The horizontal alignment of Town Bridge Road consists of a series of curvilinear segments (S-Curves). The roadway generally runs parallel to the Farmington River. At the bridge approaches, the alignment at each approach is a sharp hairpin curve that brings the crossing near perpendicular to the stream alignment.

The vertical alignment on the southern approach consists of a steep near 11.0% (approx.) downgrade on a sag vertical curve from the intersection of Powder Mill Road and crosses the river on a slight crest vertical curve. The northern approach consists of a series of crests and sags and a steep climb (approximately 14.1%) to reach the north abutment of the bridge.

Town Bridge has alternating one-way traffic controlled by a stop sign on the south approach where motorists must yield the right of way to southbound traffic. There is a yield sign on the north approach. Due to the sharp vertical curve on the north approach, combined with a sharp horizontal curve, sight distance is limited to approximately 100' with the horizontal sight distance controlling (limited by the truss).

Traffic. The estimated Average Daily Traffic (ADT) for Town Bridge Road at the project location is 593 vehicles (bi-directional) based on data collected during a 7-Day Automatic Traffic Recorder Count in 2013 (Refer to Appendix D).

8. Historical and technological Significance

Town Bridge Road Bridge is one of two surviving pin-connected Parker through truss bridges in the state, but its historic and technological significance far exceeds it being a rare example of its truss type. It has been recognized as one of the most interesting records of metal truss bridges in the state for the historic context and the development and eventual design standardization. With its combination of idiosyncratic details and standardized components typical of the period, the bridge chronicles the technological advances in a host of areas from metallurgy to the transition from pinned to rigid field connections and the very development of the profession of structural engineering. The Bridge is listed on the National Register of Historic Places and included in the Connecticut Historic Bridge Inventory.

Town Bridge was built for the Town of Canton in 1895 by the Berlin Iron Bridge Company, the most prominent in-state bridge fabricating company of its day. The bridge has characteristic details developed by consulting engineer J.E. Buddington (1853–1931), an 1877 graduate of Yale's Sheffield Scientific School, who had a long career in bridge design. As one of three Parker through truss bridges built in the area between between1892 and

1895 and designed or attributed to the long-time railroad engineer J. E. Buddington, Town Bridge and two Simsbury bridges provide a rare record of the mid-1890s advances in design and understandings about building strong and cost-effective bridges. Each of the three has differences in how members are constructed and connected with Town Bridge, illustrating how standardized details proved more effective than the idiosyncratic concepts Buddington used on the two bridges in Simsbury.

Town Bridge owes its basic design to Buddington, but since it was fabricated and erected by a well-established company, it is more traditional of mid-1890s highway bridge construction except for the lower chords and use of riveted (rigid) field connections for verticals and floorbeams; details that can be attributed to Buddington and are reflective of emerging design theory and technology. Portable pneumatic riveting equipment was being perfected during the 1890s, making it possible to drive rivets in the field, thus facilitating the transition from pinned to riveted panel point connections. Metal truss bridges provided the cost effective, permanent and strong crossings vital to improving the highways and byways that contributed so significantly to economic development and changes to the urban and rural landscape prior to World War I and represent one of the most important technological advances of the second half of the nineteenth century.

When the Berlin Iron Bridge Company fabricated Town Bridge, it replaced Buddington's "old-fashioned" details with "standardized" ones typical of the period, like verticals and diagonals composed of toe-out channels with lacing and floorbeams connected at the lower panel points. The company retained the rigid-design of the lower chords instead of using eyebars; and framed the floorbeams into the bottom portion of the verticals using rivets to achieve the same stiff design.

Another significant feature of Town Bridge is the preservation of its superb aesthetic detailing – a hallmark of the Berlin Iron Bridge Company. With its Eastlake-style cresting and lattice railings with cast iron bosses, robust finials atop each hip panel, radiating pattern strap work fills at the portal knee braces, and one remaining cast iron railing end post, the bridge presents as complete an array of period decoration as any pin connected through truss bridge in the nation. The portal detailing, which is particularly choice, is also remarkably complete. The railing and finial design are trademarks of the Berlin Iron Bridge Company and are found on other middle 1890s bridges.

Distinguishing Characteristics of Town Bridge. To assist with developing rehabilitation options and assessing the effects on the historic truss bridge, the following features are considered to be distinguishing characteristics that are important to preserve in order to maintain historic significance.

- The overall proportions associated with a Parker design through truss span, including the placement and shape of the members, like the slope of the upper chord and the alignment of the portal brace on the inclined end posts.

- All aesthetic detailing, like the finials, cresting, knee braces, railings, and the remaining

railing endpost.

- Type of connections; pins or rivets. A high strength buttonhead bolt is an acceptable replacement for a rivet.

- Idiosyncratic details like the design of the lower chord. Such details should not be altered nor should the method of connection for in-kind replacement material or members.

- How the truss members are composed and how loads are transferred back to the ground (load path).

- The rehabilitated stone abutments with flared wingwalls have associative significance. They are the appropriate period detail.

There are many members that are not distinguishing characteristics. They include the deck, stringers, and floorbeams and the strength of material. It is acceptable to replace wrought iron with steel, but all wrought iron should be salvaged and securely stored to support other restorations/rehabilitations of historic structures. The welded repairs are not distinguished.

9. Existing Condition (Bridge Inspection and Field Observations)

TranSystems personnel performed an in-depth inspection of Bridge No. 05222 on October 21-22, 2013. The bridge was found to be in Serious Condition (National Bridge Inspection Standards- NBIS condition rating of "3"). The inspection objective was to provide a detailed field evaluation of the overall condition of the structure. Findings were compared to previous inspections and general bridge dimensions were verified. The inspection also included verification of member sizes, observation of critical connection details and evaluation of rehabilitation concepts.

Deck. The deck is in good condition (rated "7"). The deck consists of a bituminous-concrete filled galvanized corrugated metal deck. The deck exhibits areas of heavy rust at end dams and there are areas of light rust in the fascia overhang areas at scupper pipes. The bituminous overlay exhibits longitudinal, transverse and map cracks that are up to 3/4" wide, areas of uneven bituminous patches and moderate raveling throughout. There are isolated potholes up to 3' long x 1' wide x 1" deep. The compression seal deck joint at the south abutment has tears up to 21" long, plow damage to the steel extrusion, and there is a 1/2” vertical misalignment between the concrete header and the approach pavement. The backer bar at the eastern side of the south deck joint has fallen down due to deteriorated/broken anchor screws on the underside. The paved over north abutment deck joint has areas of raveling, deteriorated patches and extensive cracking. There is evidence of leakage at the underside of both deck joints. There are galvanized steel curbs/splash guards at the edge of the deck. The ornamental bridge railing along both fascias exhibits minor impact damage with scrapes and bent/broken lattice bars with areas of heavy rust

and up to 100% section loss. There are 4" diameter PVC scupper pipes along both curb lines. The pipe supports that connect the pipes to the truss bottom chords are severely deteriorated at most locations.

Superstructure. The superstructure is in serious condition (rated "3"). The trusses with wrought iron eyebars have areas of active corrosion, pack rust, painted over pitting and isolated perforations. The vertical truss members have up to 20% section loss in the gross cross sectional area; concentrated at the lower nodes primarily at the clip angle connection to the floorbeams (East Truss U6L6 at L6). The bottom chords have section loss up to 26.5% in the gross cross sectional area; concentrated at the nodes, scupper locations, and metal beam rail post connections (West Truss at node L5). The top chord exhibits material section loss but this is less severe in comparison to the bottom chord condition.

The Stringer 4 web at Floorbeam 7 is buckled out-of-plane 1/4" over the full height. The stringer end portions at both abutments exhibit areas of painted over pitting and areas of heavy rust with material section loss up to 28% on the flanges (Stringer 7 @ 1/3 of panel span). The floorbeams typically have deterioration at the ends surrounding the clip angle connection to the vertical truss member. Floorbeams typically have areas of material section loss that is painted over; the paint system is failing and active corrosion is common. The maximum floorbeam section loss is 19% in the web (Floorbeam 8 near East Truss) and 5% in the flanges near midspan.

The truss bearings have up to ¾" thick impacted rust between shoe plates and truss chord channels. The expansion bearings (south abutment) show evidence of normal movement. The sliding expansion stringer bearings at the south abutment have peeling paint and isolated laminated rust; some bearings are missing keeper plates and show no evidence of movement. The fixed stringer bearings at the north abutment have random rusted off anchor bolts and several anchor bolts with section loss up to 50%.

Substructure. The substructure is in satisfactory condition (rated "6"). The stone masonry abutment stems and wingwalls exhibit up to 25% cracked, loose and missing mortar with up to 8" deep penetration between stones. The south abutment stem along the waterline and ends of the northeast and northwest wingwalls has minor voids up to 1' deep between the stones. The southwest reinforced concrete wingwall exhibits moderate scaling; the wall is tipped outward up to 2" over the full height at the south abutment interface. The north abutment concrete backwall has severe scaling with deteriorated concrete along the top edge in Bays 3-6.

Channel. The channel is in good condition (rated "7"). Channel flow is directed toward the south abutment. The stone rip-rap protection placed along the south abutment appears to be stable. Based on drop-line measurements, there are minor changes in the channel depth at the bridge compared to a previous inspection dated 2008.

Approaches. The approach roadway is in satisfactory condition (rated "6"). Metal beam

approach rails at all four corners of the bridge have minor impact damage with small dents and scrapes throughout. There are areas of light pavement raveling and random longitudinal and transverse cracks open to 1" wide. There are cracked and uneven patches in localized areas. The pavement along the north abutment deck joint is slightly heaved and has plow scrapes.

Vertical Clearance. The minimum vertical clearance over the bridge roadway occurs at the south end of the bridge. The minimum clearance measured at the time of this inspection was 12'-8" to the portal knee brace at the southwest curb line. The clearance to the south portal at the center of the roadway is 14'-2" and 13'-11" to the bottom on the posting sign.

10. Material Testing

a. Lead/PCB Testing

On October 10, 2013 lead paint and PCB testing was completed by Thielsch Engineering. The samples contained total lead results of 14,200 and 17,100 milligrams per kilogram wet or parts per million (ppm). Based on the Environmental Protection Agency's Resource Conservation and Recovery Act TCLP Standard, total lead over 100 ppm is considered hazardous waste. The results of the PCB testing were 0.112 ppm, which is considered non-detectable (see Appendix F).

b. Bridge Pin UT Testing

On October 30, 2013, all the truss pins on the bridge were inspected by Team Industrial Inc. using a straight beam ultrasonic testing method. All pins were found to be free of measurable indications (see Appendix F).

c. Steel Coupon Testing

On November 20, 2013 steel coupons were collected by Thielsch Engineering. There were two (2) steel coupons extracted from the bridge structure. Chemical analysis and tensile tests were performed on both samples; the samples meet the tensile requirements and chemical composition of ASTM A36, ASTM A572 Gr 42 and ASTM A709 Gr 36 except for phosphorus content (see Appendix F).

d. Steel Replication Testing

On November 15, 2013 eyebar replication testing was completed by Thielsch Engineering to determine the composition of the truss eyebars (steel or wrought iron). Two areas were ground, polished, etched with 2% nital then examined with an optical microscope to determine the microstructure. The sample microstructure consisted of a ferritic matrix with numerous longitudinal inclusions, typically found with wrought iron material as shown in the photomicrograph in Appendix F.

e. Abutment Vertical Borings

On May 22, 2014 vertical borings of the abutments were taken to determine the abutment foundation conditions and soil characteristics in the vicinity of the existing

bridge. Four borings were taken at the existing abutment locations, including two vertical coring's through the abutment stem to determine interior rock quality and identify the bottom elevation of the foundation. In order to establish the slope of the existing abutment backwall, two vertical probes were also taken (see Appendix F).

11. Load Capacity Analysis

The bridge is currently posted for 7 tons (single unit trucks) and 10 tons (semi-trailer trucks). The Connecticut Department of Transportation's (ConnDOT) latest bridge inventory rating is 10 Tons for an HS20 Vehicle. As part of this evaluation, all members of the bridge were analyzed to determine their load carrying capacity for the current (as-inspected) condition. Member capacity was also calculated for each proposed rehabilitated/replaced condition developed for the various alternatives analysis. Based on the 1895 year of construction and 2013 material testing, the properties used in the load capacity analysis are as follows:

Wrought Iron Eyebars: Fy= 26 ksi

Original Structural Steel: Fy = 36 ksi (Trusses, verticals, diagonals, floorbeams)

Rehabilitated Steel: Fy = 50 ksi (Stringers and floorbeam coverplates)

Member capacities were determined using HS7 truck loading for Alternate 1A, HS20 truck loading for Alternate 1B & 1C and HL93 truck loading for Alternate 2. Truck loadings were chosen based on the minimum loading requirements for historic structures, AASHTO Standard Specifications and AASHTO LRFD Specifications. See Appendix I for calculations.

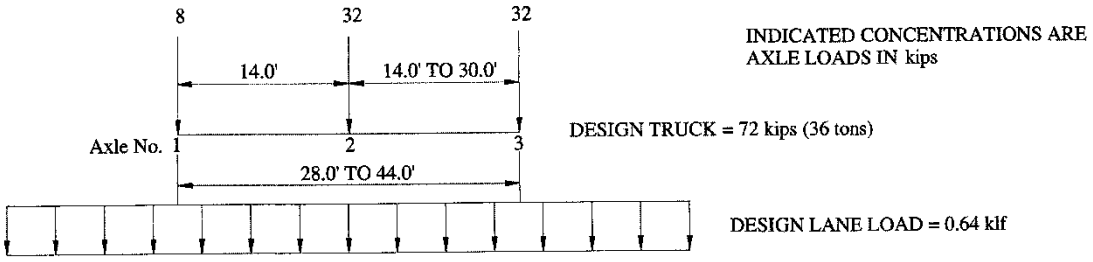


Figure 1 – AASHTO HL93 Truck Design Load

12. Design Criteria

Roadway Design Criteria. In order to provide comparison between various rehabilitation and replacement alternatives for the Town Bridge study, design criteria were first established based on the characteristics and usage of the roadway. Functional classification is the grouping of highways by the character of service provided and is central to the development of design standards. Town Bridge Road is classified as a "Rural Local Road (Open Density)". Local roads are intended to provide access to residences, farms,

businesses, and are not typically intended to serve through traffic. Design criteria will utilize ConnDOT Highway Design Manual (HDM-2003) guidelines as well as AASHTO standards for Geometric Design.

The HDM-2003 recommends a travel lane width of 10' for Rural Local Roads having AADT between 400-1500. Further, shoulder widths of 2' to 4' are recommended. Based on the adjacent roadway segment of Town Bridge Road, south of Powder Mill Road, a 25 mph[2] design speed is selected as the proposed design speed for the evaluation of alternatives.

The design parameters recommended for this project are listed below. A comparison of the proposed alternate roadway design elements for new construction, with the current Design Standards specified in the HDM-2003, is included in Appendix E:

- 2013 Traffic Volume: 593 vehicles per day
- Design Classification: Rural Local Road
- Design Speed: 25 mph
- Posted Speed: NA
- Travel Lane Width: 10 feet
- Shoulder Lane Width: 2 - 4 feet
- Travel Lane Cross Slope: 1.5 - 2%
- Shoulder Cross Slope: Same as adjacent travel lane
- Minimum Radius: 190 feet
- Minimum and Maximum Grade: 0.5% and 11%
- Stopping Sight Distance: 155 feet
- Minimum Vertical Clearance: 14'-3"

Bridge Design Loading. The proposed bridge will be designed in accordance with the AASHTO LRFD Bridge Design Specifications, 5th Edition, 2010 with 2013 Interim Revisions for HL-93 loading, as supplemented by the Connecticut Department of Transportation Bridge Design Manual, 2003 with latest revisions.

13. Alternative Analysis

The alternatives analysis section documents the development of alternate schemes to address the project need based on a set of proposed design criteria. A comparative evaluation is made assessing the merits of each alternative relative to compatibility with project need, environmental impacts, permitting requirements, right-of-way takings, cost effectiveness and public acceptability. The "No Build" or "Null" alternative is used as a baseline for the evaluation. The comparison of the alternatives is presented in a Summary Matrix. The report concludes with a recommendation of a preliminary preferred alternative.

[2] ConnDOT, 10/01/2010, Canton Approved Town Road Speed Limits, Retrieved: 12/16/2013, http://www.ct.gov/dot/lib/dot/documents/dstc/townspeeds/canton.pdf

The alternatives studied in this section, as listed below, consider various courses of action for the Town Bridge Road Bridge. It is noted, that a goal of this project has been to develop the required elements of structural rehabilitation and safety in a manner that will not have an adverse effect on the historic bridge. To this end, Alternatives 1A, 1B, 1C and 2 were developed to avoid the loss of the Section 4(f) property (Town Bridge).

N. No Build (Null Alternative)

1. Bridge Rehabilitation in accordance with the Secretary of the Interior's Standards

   1A. Bridge Rehabilitation at Existing Roadway Width (HS7)

   1B. Bridge Rehabilitation at Existing Roadway Width (HS20)

   1C. Bridge Rehabilitation Widen to 20' Roadway Width (HS20)

2. New Bridge on Upstream Alignment with 26' Roadway Width (HL93); Truss Bridge restored/preserved as a Pedestrian Facility

Constraints that influence the viability of alternative solutions for improvements of the Town Bridge Road crossing include the Section 4(f) property that is currently identified as Bridge No. 05222, itself. Other potential Section 4(f) properties may include the surrounding scenic areas of the Farmington River. Impacts to sensitive environs associated with freshwater wetlands, aquatic resources, threatened & endangered species, open-space, et al. will also influence the comparison of alternatives. Right-of-way availability, cost efficiency as well as temporary impacts of construction/detour are also considerations in the evaluation of alternatives.

Evaluation Criteria. A summary decision matrix comprised of several diverse evaluation criteria is utilized in the assessment of each alternative. Employing this comparison technique, the feasibility and effectiveness of each alternative is revealed. The Alternatives Analysis Summary Matrix of the studied alternatives is located immediately following the discussion of alternatives. The assessment for each alternative includes consideration of the following evaluation criteria:

a. **Compatibility with Project Needs.** This criterion considers whether the alternative addresses the project needs either partially or entirely. This criterion applies to both bridge structural upgrades (Structural Deficiencies) and improvement to Town Bridge Road and Bridge geometric deficiencies (Functionally Obsolete).

b. **Impacts to Historic Resources.** This criterion examines the degree of impact of an alternative on the existing bridge listed on the National Register of Historic Places.

c. **Impacts to the Surrounding Environment.** This criterion considers the level of impact of an alternative on the natural surroundings i.e. wetlands, rare and endangered species, parklands, etc. A listing of anticipated permits is included.

d. **Right-of-Way Impacts.** This criterion discusses the right-of-way takings and easements that will be necessary to construct the alternative under consideration.

e. **Maintenance of Traffic Impacts.** This criterion examines the impact of maintenance of traffic and or detour, including the estimate of construction duration, needed to complete construction for each alternative.

f. **Opinion of Probable Total Construction Cost.** This criterion considers the costs of initial construction and right-of-way acquisition for each alternative. The estimate includes the expenditure for a qualified contractor to build the proposed improvements including estimated right of way costs. Estimated right-of-way acquisition is provided in terms of number of parcels impacted.

g. **Opinion of Probable Life Cycle Cost.** This criterion discusses the life cycle cost, the expenditures associated with maintaining a structure over a period of time. For this study, the life cycle cost for each alternative will be established for a useful life of seventy-five (75) years based upon year 2014 dollars. The life cycle cost is determined by assuming the frequency of maintenance repairs and major rehabilitation actions. A less expensive initial construction cost does not necessarily equate to a less costly alternative when the life cycle of the bridge is considered.

14. Discussion of Alternatives

Alternate N: No Build or Null Alternative.

The No Build alternative, or "doing nothing", presumes that the existing bridge will remain in service with routine maintenance work and priority/flag condition–prompted repairs until it is rehabilitated or replaced in the future. As such, this alternative establishes a baseline for comparison with other rehabilitation or replacement options. In its present physical condition, left unattended with only routine maintenance and priority/flag condition repairs, the bridge is presumably capable of providing continued uninterrupted service for another five (5) years without a significant undertaking. This time frame was established considering the past frequency of major rehabilitation projects, the present physical condition of the bridge, and the other project needs.

a. Project Needs Compatibility. Alternative N does not meet the project needs given that the physical condition of structural components will not be improved. Bridge members with insufficient structural capacity will not be strengthened or replaced and the vehicle weight limit restrictions will remain. Existing and future transportation demands will not be met as the bridge roadway width and the adjacent approach roadways will not be improved and existing geometric deficiencies will remain. Adequate safety features including bridge and approach railings will not be provided. This alternative is not feasible and prudent since it does not address the project needs.

b. Historic Resources Impacts. Several of the existing bridge elements have already been impacted by physical deterioration. Without repair, the structure will be prone to damage due to continued material deterioration and hopes of a meaningful rehabilitation will be greatly diminished.

c. Environmental Impacts. There will be no environmental impacts or permits associated with this alternative.

d. Right-of-Way Impacts. There will be no right-of-way takings.

e. Maintenance of Traffic Impacts. Not applicable.

f. Opinion of Probable Total Construction Cost. $0. There are no construction costs or right-of-way acquisition costs associated with this alternative.

g. Opinion of Probable Life Cycle Cost. The cost of maintaining the bridge over the next five (5) years in 2014 dollars is estimated to be $50,000. This cost presumes that the bridge will be replaced in 2018.

Alternate 1: Bridge Rehabilitation in Accordance with the Secretary of the Interior's Standards for Rehabilitation

This alternative considers the rehabilitation of the bridge in accordance with the Secretary of the Interior's Standards that is defined as follows:

"Rehabilitation" is defined as "the process of returning a property to a state of utility, through repair or alteration, which makes possible an efficient contemporary use while preserving those portions and features of the property which are significant to its historic, architectural, and cultural values."

As stated in the definition, rehabilitation assumes that at least some repair or alteration of the potentially historic bridge will be needed in order to provide for an efficient contemporary use; however, these repairs and alterations must not damage or destroy materials, features, or finishes that are important in defining the structure's historic character. The intent of this alternative is to retain integrity and avoid adverse effects to the existing bridge under Section 106 and use of the structure under Section 4(f).

Alternate 1A: Bridge Rehabilitation at Existing Roadway Width (HS7)

Alternate 1B: Bridge Rehabilitation at Existing Roadway Width (HS20)

This alternative is the sensitive rehabilitation of Town Bridge in the existing configuration and alignment that will provide a minimum increase of HS7 Loading (12.6 tons) (Alternate 1A) to provide functional adequacy. An evaluation of the existing structure was preformed to identify the work required to attain a minimum capacity of HS7 Loading, as well as the

work necessary to provide an increase to HS20 Loading (36 tons) (Alternate 1B) capacity. The improvement in load carrying capacity would be dependent upon the maximum extent of repairs that is prudent and feasible without adversely affecting the historic nature of the bridge. The current 14'-3" clear bridge width and 12'-4" vertical clearance will be maintained. Elements of the rehabilitation include full replacement of the bridge deck, floorbeams, vehicular railing system, and bridge truss and stringer bearings. The existing stringers will be replaced and the stone and concrete abutments and wingwalls repaired, as needed. The existing steel trusses with wrought iron eyebars will be carefully dismantled, appropriately marked and cataloged prior to delivery to a qualified fabrication shop. The truss components will be cleaned, including lead paint removal, rehabilitated and duplex coated with paint over galvanizing off site, before being reassembled at the bridge site.

a. **Compatibility with Project Need.** This alternative partially meets the project need as deteriorated, low capacity members will be strengthened, replaced and/or repaired as needed, to increase the load carrying capacity of the span to provide functional adequacy. This alternative maintains the existing bridge and roadway configurations. There will be no improvement to the geometric elements that are substandard; the bridge will remain as a one-lane structure with alternating two-way traffic. Vertical clearance at the bridge remains substandard. There will be no improvement to approach roadway alignment.

b. **Impact on Historic Properties.** This rehabilitation alternative was developed to avoid adversely affecting the 1895 Town Bridge Road Bridge. Distinguishing characteristics of the truss, lattice railing and aesthetic details will be appropriately restored; connection details for replacement members will be made in a compatible manner. There will be no visible changes to the truss lines. All proposed work will be in conformance with *The Secretary of the Interior's Treatment for Historic Properties*. The historical and technological significance of the bridge and the aspects of integrity that qualify it for the National Register of Historic Places will not be changed.

c. **Environmental Impacts.** There will be no environmental impacts associated with this alternative as the work will be completed within the footprint of existing bridge. In addition to normal environmental best management practices, any work by the contractor on the structural steel would require proper measures to prevent lead paint from entering the river or upland areas. Work adjacent to the stream to repair and repoint stone masonry walls is minimal and there will be no impact to the existing floodplain of the Farmington River. The DEP Natural Diversity Data Base indicates that a state species concern for the Wood Turtle occurs in the vicinity of this project. The anticipated permits are listed in Section 15a of this report.

d. **Right-of-Way Impacts.** There will be no permanent right-of-way impacts with this alternative. Temporary easements will likely be required during construction.

e. **Maintenance of Traffic Impacts.** The bridge and roadway will be closed and traffic detoured for the duration of construction. The estimated duration is 10 Mos.

f. Opinion of Probable Total Construction Cost.

- $2,560,000 (HS7 Loading) (Alternate 1A)
- $2,860,000 (HS20 Loading) (Alternate 1B)

g. **Opinion of Probable Life Cycle Cost.** The cost of maintaining the bridge over the next seventy-five (75) years in 2014 dollars is estimated to be $175,000.

Alternate 1C: Bridge Rehabilitation Widened to 20' Roadway Width (HS20)

This alternative is the rehabilitation of Town Bridge in a widened configuration on the existing alignment or footprint that will provide an increase to HS20 (36 ton) load capacity. This alternative consists of restoring or replacing all deteriorated steel members, as needed. The trusses will be spread apart by 5'-9"± (22'-9" c/c Truss Lines) and two new stringer lines added to provide a minimum 20-foot clear bridge width. Replacement of the deck and floorbeams will be included (similar to Alt. 1A). All upper and lower truss bracings will be replaced due to the widening; replacement connections will be compatible with the original design. There will be a new vehicular bridge railing system and bridge bearings. The aesthetic details and lattice railings will be preserved to the fullest extent possible. The existing stone and concrete abutments and wingwalls will be modified to accommodate the widening of the bridge roadway and new truss bearing seats. The existing steel trusses with wrought iron eyebars will be carefully dismantled, appropriately marked and cataloged prior to delivery to a qualified fabrication shop. The truss components will be cleaned including lead paint removal, rehabilitated and duplex coated with paint over galvanizing off site, before being reassembled at the bridge site.

a. Compatibility with Project Need. This alternative meets the project need as deteriorated, low capacity members will be strengthened, replaced and/or repaired as needed, to increase the load carrying capacity of the span to HS20. This alternate provides improvement to the narrow existing bridge width to accommodate two-way traffic. Vertical clearance at the bridge will be increased. Minor approach roadway and profile improvement will be made for consistency with the bridge widening.

b. Impact on Historic Properties. This rehabilitation alternative was developed to maintain the distinguishing characteristics and the overall proportions associated with a Parker design such as the slope of the upper chord and the alignment of the portal brace on the inclined end posts. The lattice railing and aesthetic details will be appropriately restored to the fullest extent possible; connection details for replacement members will be made in a compatible manner. There will be moderate visible change to the truss lines that will be spread apart by less than 6-feet. This widening will increase the loads in the truss top chord and vertical members by up to 60%. In order to increase the load carrying capacity of the bridge to the required strength, more than half

of the members will require complete replacement or extensive repairs. All proposed work will be in conformance with *The Secretary of the Interior's Treatment for Historic Properties*. The historical and technological significance of the bridge and the aspects of integrity that qualify it for the National Register of Historic Places will be maintained to the fullest extent.

c. Environmental Impacts. There will be minor environmental impacts associated with this alternative as the work will be completed along the same footprint of existing with minor widening. In addition to normal environmental best management practices, any work by the contractor on the structural steel would require proper measures to prevent lead paint from entering the river or upland areas. Work adjacent to the stream is necessary for reconstruction of the wingwalls to facilitate the widening of each abutment. There will be an impact to the existing floodplain of the Farmington River based on the placement of fill within the floodplain. The DEP Natural Diversity Data Base indicates that a state species concern for the Wood Turtle occurs in the vicinity of this project. The anticipated permits are listed in Section 15a of this report.

d. Right-of-Way Impacts. There will be no permanent right-of-way impacts with this alternative. Temporary easements will like be required during construction.

e. Maintenance of Traffic Impacts. The bridge and roadway will be closed and traffic detoured for the duration of construction. The estimated duration is 15 Mos.

f. Opinion of Probable Total Construction Cost. $3,700,000.

g. Opinion of Probable Life Cycle Cost. The cost of maintaining the bridge over the next seventy-five (75) years in 2014 dollars is estimated to be $225,000.

Alternate 2: New Bridge on Upstream Alignment with 26' Roadway Width (HL93); Truss Bridge restored/preserved as a Pedestrian Facility

This alternative involves the construction of a new bridge upstream on an improved roadway alignment. The existing historic truss will be rehabilitated as per Alternate 1A, and remain in place as a pedestrian facility.

The new alignment will improve the geometry by connecting at the intersection of Powder Mill Road and Town Bridge Road, then proceeding directly across the Farmington River on a skew and touch down at a location near the current north abutment. The new alignment will require a significantly longer bridge, approximately 400 feet in total length. The most feasible and cost effective option for the new bridge is a multi-span girder type bridge. The new bridge will provide a 26-foot minimum roadway width and full legal load capacity (HL93).

Alternative 2 will have approximately 925 feet of new approach roadway. The proposed horizontal alignment will seek to eliminate the existing sharp hairpin curvature at approaches to the bridge and provide a long tangent section from Powder Mill Road across the proposed bridge connecting to the exiting alignment with a 395' radius curve. The proposed horizontal and vertical alignment will be designed to current design criteria for a 25 mph design speed. This alternative will result in fill material being placed below the 100 year flood elevation, warranting further evaluation of the potential impacts to the floodway. The existing driveway serving the Munroe property on the south side of the river would be extended along the existing Town Bridge Road alignment to meet the proposed roadway near the intersection with Powder Mill Road. The proposed location shown on the Roadway Plan has been evaluated and selected to meet intersection sight distance criteria for 25 mph. The work requires the closure of the bridge for the duration of the project.

a. Compatibility with Project Need. This alternative meets the project need as the new multi-span/multi-girder bridge will be designed in accordance with all AASHTO LRFD design standards providing HL93 capacity and meeting all geometric and safety standards. Further, this alternative includes preservation of the existing historic truss, in-place as a pedestrian facility.

b. Impact on Historic Properties. This rehabilitation alternative will result in no adverse effect to the 1895 Town Bridge Road Bridge as preservation of the existing bridge is included. The overall proportions associated with a Parker design as well as the distinguishing characteristics will be maintained and properly restored in accordance with *The Secretary of the Interior's Treatment for Historic Properties.*

c. Environmental Impacts. There will be significant environmental impacts associated with this alternative for the work to construct a new alternate roadway alignment and bridge. Work adjacent to the stream is necessary for the new construction upstream. This alternative will require the greatest degree of new fill in the floodplain and regulatory permitting is expected to be extensive. The DEP Natural Diversity Data Base indicates that a state species concern for the Wood Turtle occurs in the vicinity of this project. The anticipated permits are listed in Section 15a of this report.

d. Right-of-Way Impacts. There will be significant right-of-way impacts (greatest of all alternatives) associated with this alternative. It is estimated that 3 properties are impacted, totaling approximately 42,830 ft^2 or .98 Acres. Temporary easements are likely to be required for construction access.

e. Maintenance of Traffic Impacts. The bridge and roadway will be closed and traffic detoured until the existing historic truss is rehabilitated as per Alternate 1A. Once rehabilitated, the roadway will reopen until the upstream bridge is complete allowing the historic truss to remain as a pedestrian facility. The estimated duration is 24 Mos.

f. Opinion of Probable Total Construction Cost. $10,190,000 (HL93).

g. Opinion of Probable Life Cycle Cost. The cost of maintaining the bridge over the next seventy-five (75) years in 2014 dollars is estimated to be $675,000.

15. Preliminary Preferred Alternative

In summary, Alternate 1B: Bridge Rehabilitation at Existing Roadway Width to HS20 capacity (36 tons), provides the most comprehensive solution, overall value and benefit, and is recommended for the rehabilitation of Bridge No. 05222. The widening alternatives that reuse the existing trusses are not prudent and feasible due to the extensive amount of member replacement required. As a result, this would adversely affect the historic nature of the bridge. The remaining alternatives suggest full replacement of the existing structure and would come at extreme costs.

Alternate 1B will replace all deteriorated steel within the single span truss bridge to provide functional adequacy and repair the substructure as needed. The distinguishing characteristics of the truss, lattice railing and aesthetic details will be appropriately restored to the fullest extent with no visible changes to the truss lines.

There are no permanent right of way impacts as this alternative maintains the existing bridge and roadway configurations. The bridge will be rehabilitated within the existing footprint and all normal environmental best manage practices will be taken to minimize any environmental impacts.

Although the bridge and roadway will be closed and traffic detoured for the duration of construction, this alternative provides the quickest return to service when compared to the other alternatives. Once rehabilitation is complete, this bridge structure will provide an estimated 75-year service life, with minimum future maintenance costs.

Preservation Recommendations:

In light of the historical and technological significance of the bridge, preservation is being studied. Any proposed action that would have an adverse impact, like removing it or significantly modifying the original design, would need to be meticulously documented to support the conclusion that there were no other prudent or feasible alternatives. There are a variety of conventional and cost-effective treatments to address structural deficiencies on metal truss bridges and that conform to The Secretary of the Interior's Standards for Rehabilitation.

a. Permits

- Due to potential impact, the following permits will be required:
- Local Inland Wetlands
- USACOE CAT II General Permit
- CT DEP (may not be needed)
- Flood Management Certification (State MOU Process)
- Coordination with DEP Biodiversity

b. Bridge Removal Sequence

The bridge is required to be taken off site for cleaning, repainting, and galvanizing. Wetlands surrounding the bridge will necessitate all work to be done at the roadway level. The truss will be removed segmentally by jacking the bridge at the abutments, stabilizing the bridge with a crane located at the north approach, and pulling the truss sequentially over at the south approach. The proposed removal sequence is as follows (See Appendix A):

- The wearing surface, deck, MBR and stringers will be removed.
- The north and south approaches will require site preparation. The north approach will be excavated to allow the crane to sit on a level surface and to decrease the earth pressure on the abutment. The south approach will be leveled for the use of the removal skid.
- A temporary diagonal strut will be installed between Panel points L2-L3 and L4-L5 to accommodate for sequential disassembly.
- The bridge will be jacked to the elevation of the rollers with two jacks at each abutment.
- Panel point L8 & L9 at the north end of the bridge will be secured to the crane.
- Panel point L2 & L3 at the south end of the bridge will be secured to the crane.
- The bridge will be lifted a
- nd pulled from the south end onto the removal skid.
- Truss panel point L0 to L2 will be disassembled.
- Panel point L4 & L5 at the south end of the bridge will be secured to the crane.
- The truss will be pulled over the removal skid, and the truss will be disassembled at the next two panel points. This process will be repeated until entire structure is disassembled.

The proposed reinstallation sequence is as follows (See Appendix A):

- Truss panel points L8 to L10 will be assembled.
- Panel point L9 will be secured to the crane and the truss will be pushed over the removal skid.

- The next segment will be assembled (L7 to L8).
- This procedure will be repeated until the entire bridge is constructed.

16. Cost Considerations

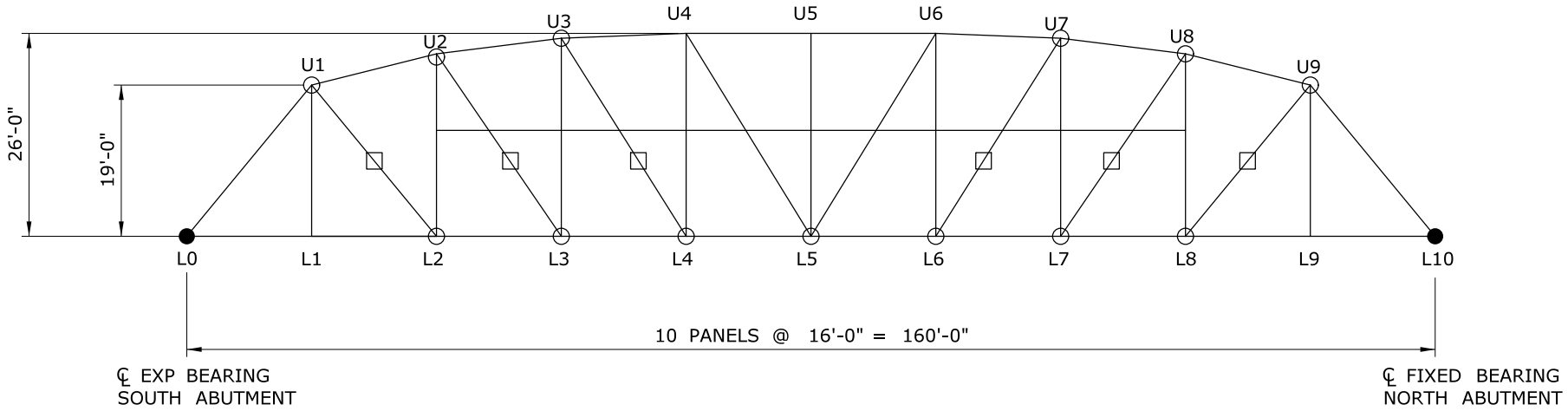
The appendices include the itemized construction cost estimates for each of the studied alternatives. The estimates summarized in the table below consider highway and bridge work items. See Appendix J.

Rehab. Alternative	Estimated Construction Costs
1A. Bridge Rehabilitation at Existing Roadway Width (HS7)	$ 2,560,000
1B. Bridge Rehabilitation at Existing Roadway Width (HS20)	$ 2,860,000
1C. Bridge Rehabilitation Widen to 20' Roadway Width (HS20)	$ 3,700,000
2. New Bridge on Upstream Alignment with 26' Roadway Width (HL93)	$ 10,190,000

Table 1 – Rehab. Alternative Cost Estimation Breakdown

APPENDIX A

SKETCHES



EXISTING ELEVATION-EAST TRUSS

EAST ELEVATION SHOWN, WEST OPPOSITE HAND

LEGEND

- ○ 2"ø PIN
- ● 3"ø PIN AT BRGS
- □ EYEBAR

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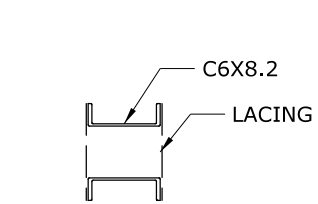
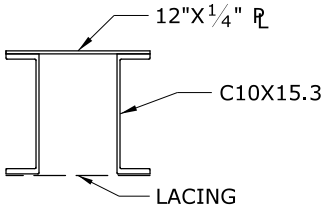
REHABILITATION OF BR. NO. 05222
TOWN BRIDGE ROAD
OVER FARMINGTON RIVER

TOWN OF CANTON

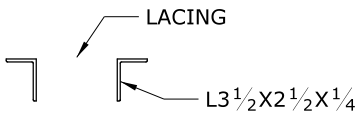
DATE: 7/2014	DRAWN: SAD	DRAWING: 1
DESIGNER: JLS	CHECKER: JBM	



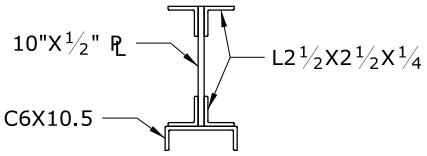
DIAGONAL & VERTICAL



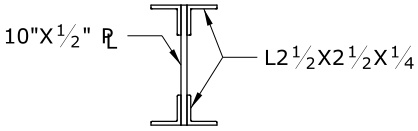
TOP CHORD



LONGITUDINAL BRACING



BOTTOM CHORD
L0-L3 WEST TRUSS



BOTTOM CHORD
EAST TRUSS &
L3-L10 WEST TRUSS

EXISTING TRUSS MEMBERS

LEGEND

○ 2"ø PIN

● 3"ø PIN AT BRGS

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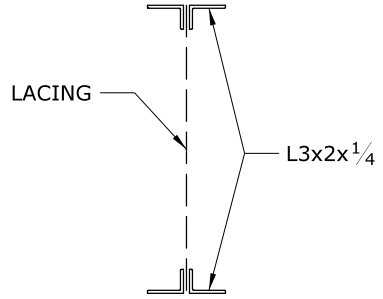
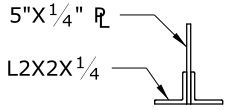
REHABILITATION OF BR. NO. 05222
TOWN BRIDGE ROAD
OVER FARMINGTON RIVER

TOWN OF CANTON

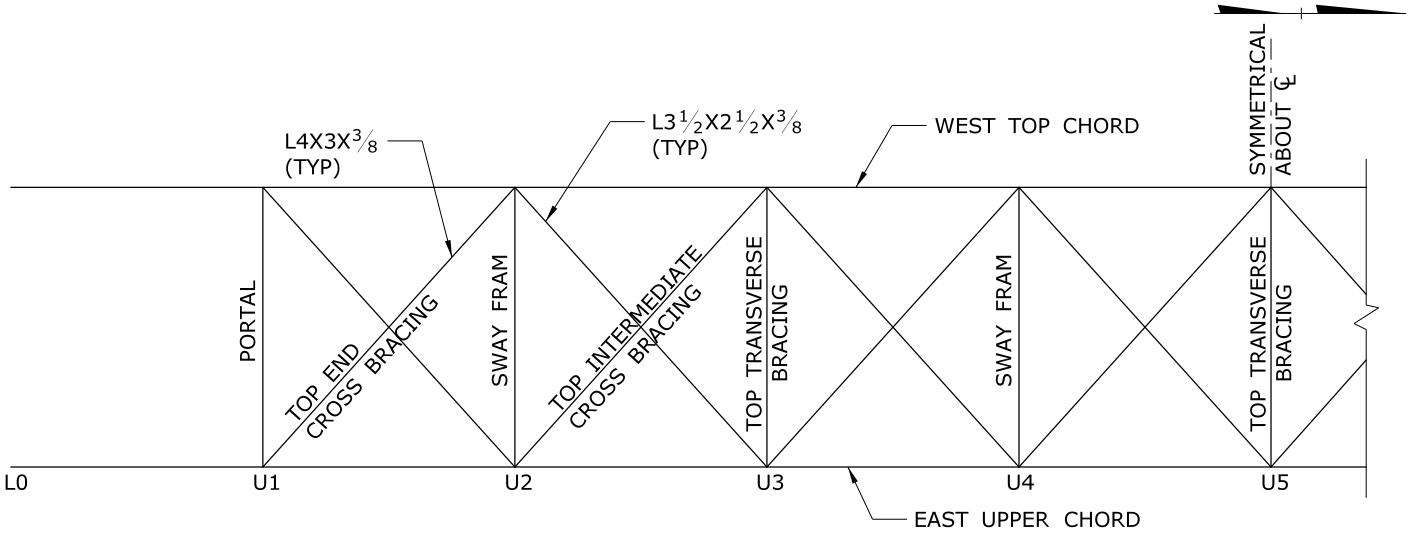
DATE: 7/2014	DRAWN: SAD	DRAWING: 2
DESIGNER: JLS	CHECKER: JBM	



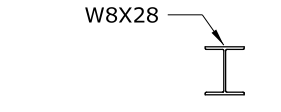
NORTH & SOUTH PORTAL



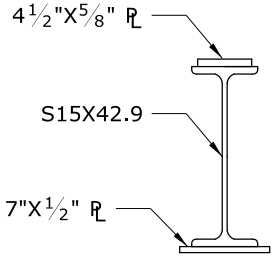
TOP TRANSVERSE BRACING



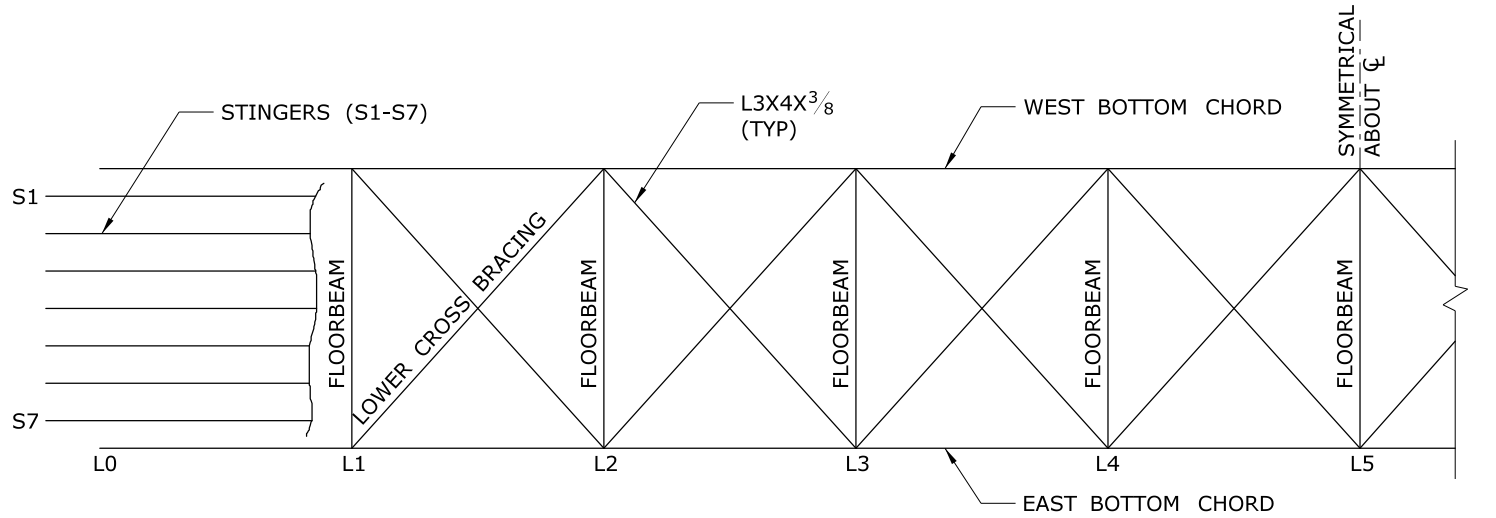
EXISTING FRAMING MEMBERS (UPPER BRACING)



STRINGER



FLOORBEAM



EXISTING FRAMING MEMBERS (LOWER BRACING)

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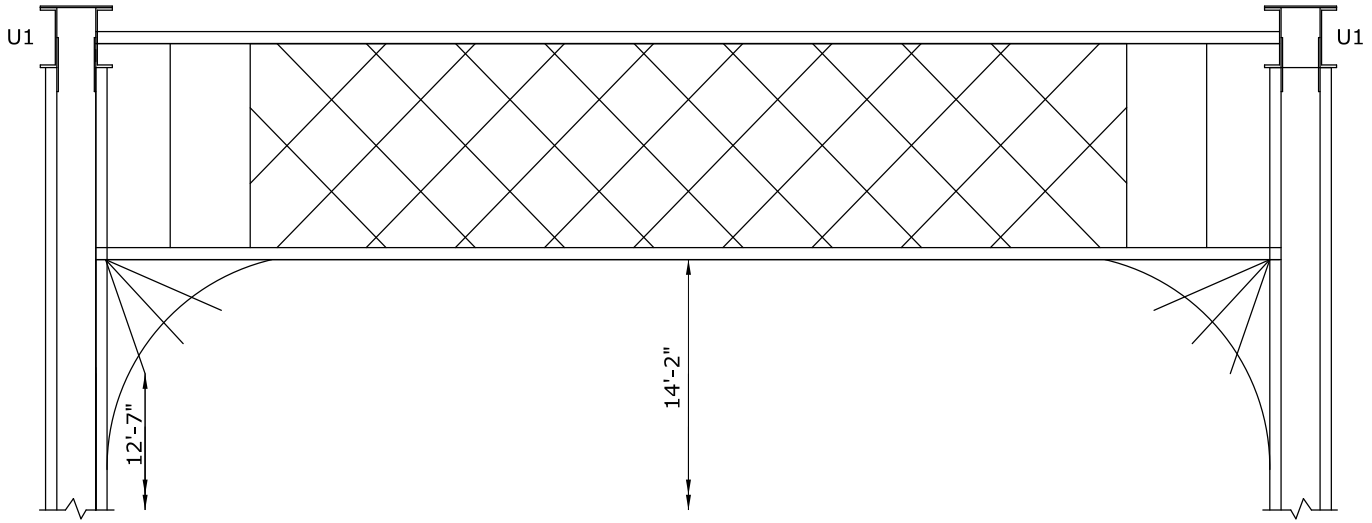
REHABILITATION OF BR. NO. 05222
TOWN BRIDGE ROAD
OVER FARMINGTON RIVER

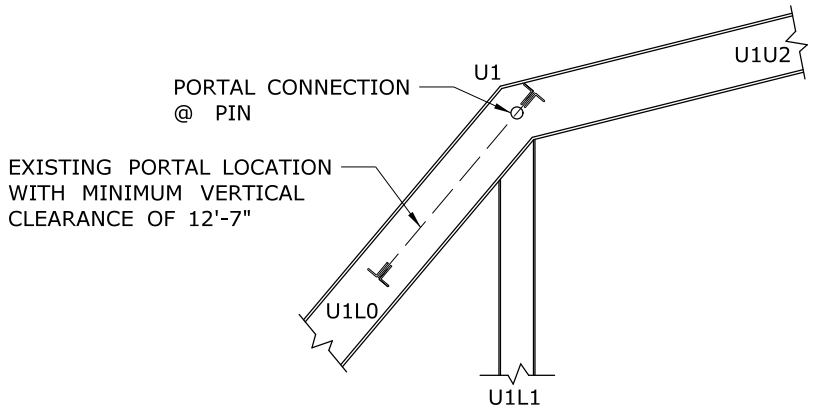
TOWN OF CANTON

DATE: 7/2014	DRAWN: SAD	DRAWING: 3
DESIGNER: JLS	CHECKER: JBM	



EXISTING PORTAL

(ALTERNATIVE 1A SHOWN, 1B & 2 ARE SIMILAR)
SCALE: $^{3}/_{8}$" = 1'-0"



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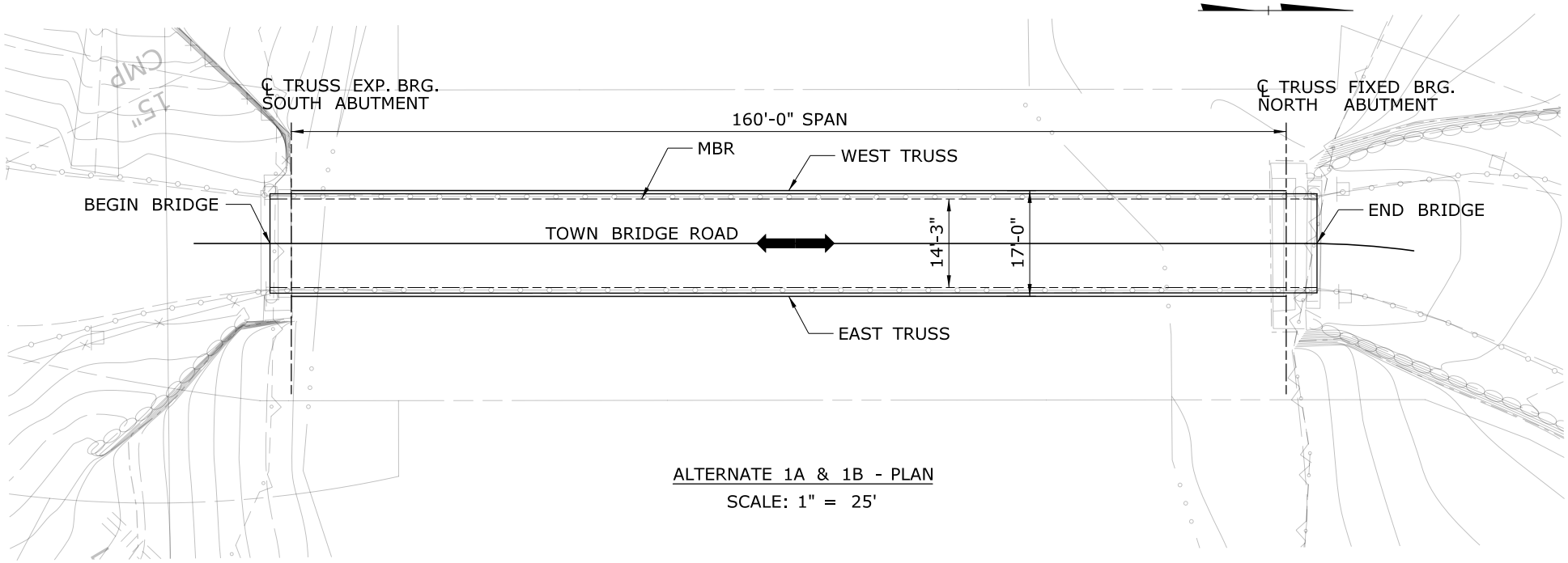
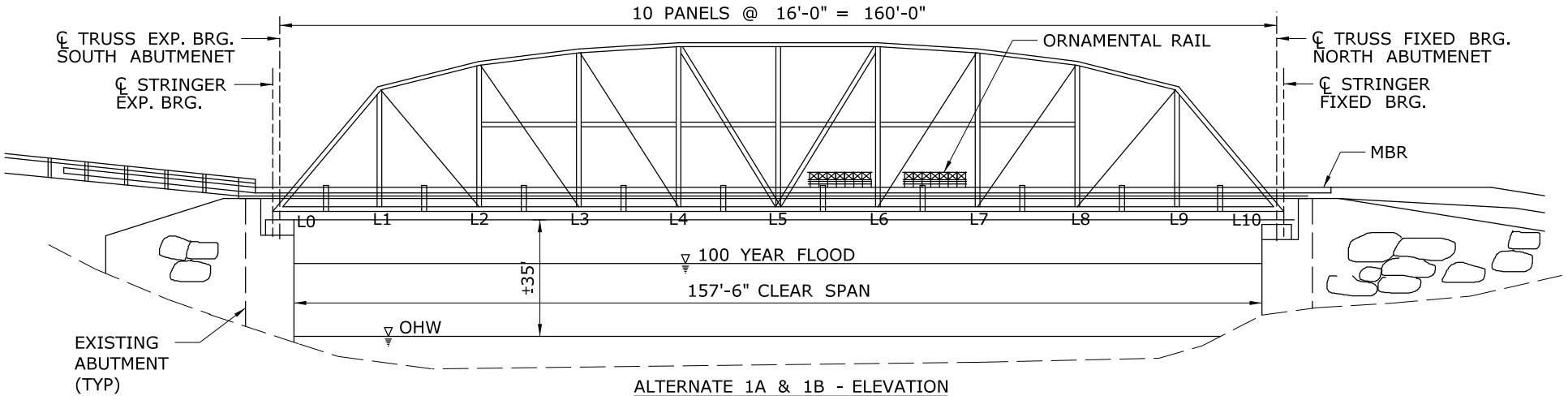
REHABILITATION OF BR. NO. 05222
TOWN BRIDGE ROAD
OVER FARMINGTON RIVER

TOWN OF CANTON

DATE: 7/2014	DRAWN: SAD	DRAWING: 4
DESIGNER: JLS	CHECKER: JBM	



ALTERNATE 1A & 1B - PLAN
SCALE: 1" = 25'



ALTERNATE 1A & 1B - ELEVATION
EAST ELEVATION SHOWN, WEST OPPOSITE HAND
SCALE: 1" = 25'

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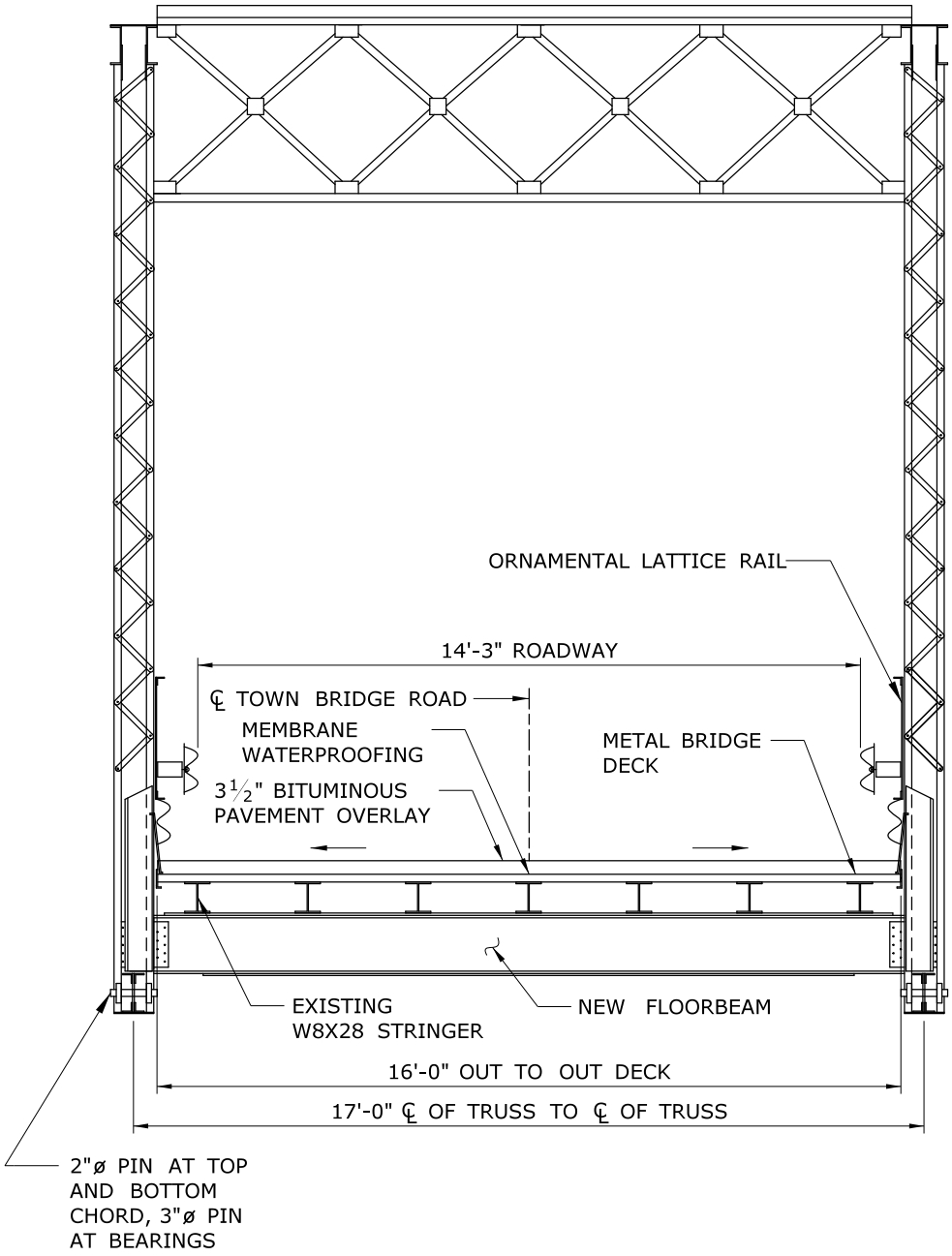
REHABILITATION OF BR. NO. 05222
TOWN BRIDGE ROAD
OVER FARMINGTON RIVER

TOWN OF CANTON

DATE: 7/2014	DRAWN: SAD	DRAWING: 5
DESIGNER: JLS	CHECKER: JBM	



ALTERNATE 1A & 1B - PROPOSED CROSS SECTION

SCALE: ¼" = 1'-0"

TOWN OF CANTON

DRAWING: 6

DATE: 7/2014 | DRAWN: SAD | CHECKER: JBM

DESIGNER: JLS

REHABILITATION OF BR. NO. 05222
TOWN BRIDGE ROAD
OVER FARMINGTON RIVER

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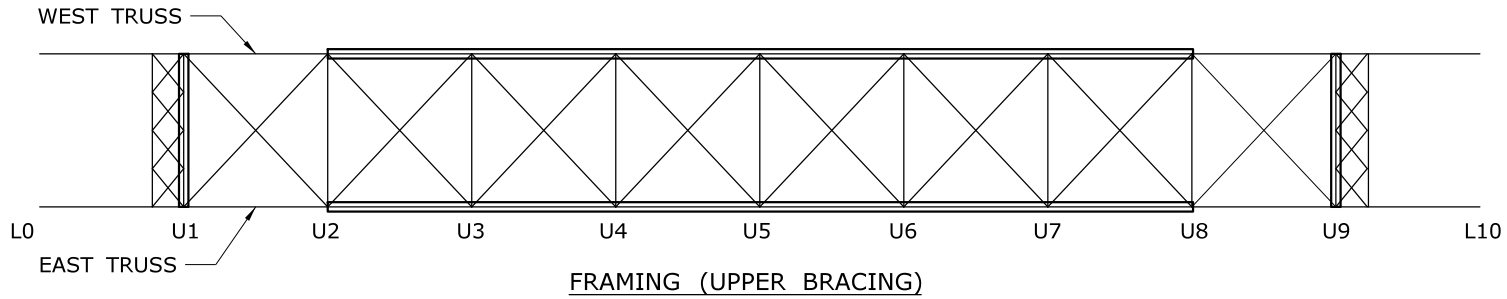
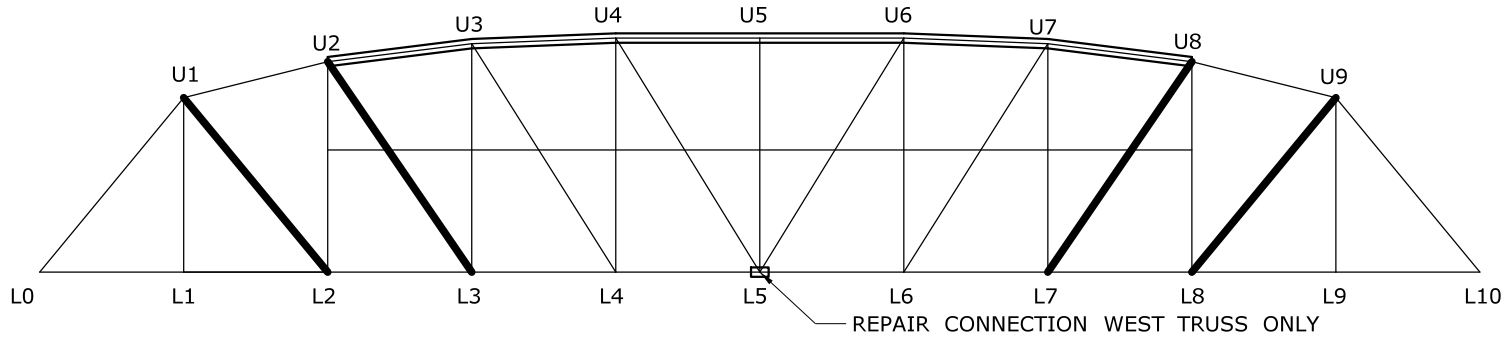
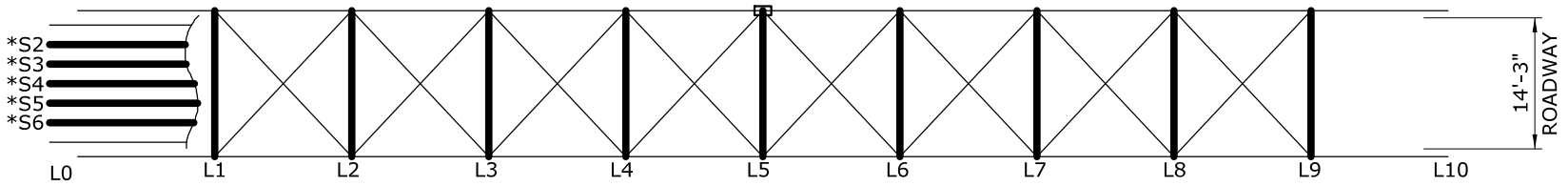


FRAMING (UPPER BRACING)



ELEVATION - EAST TRUSS

EAST ELEVATION SHOWN, WEST OPPOSITE HAND



FRAMING (LOWER BRACING)

NOTE

* STRINGERS 2-6 NEED REPLACEMENT FOR L0L1

LEGEND

MEMBER REPLACEMENT

MEMBER REPAIR

ALTERNATE 1A (HS7) - MEMBER REPLACEMENT

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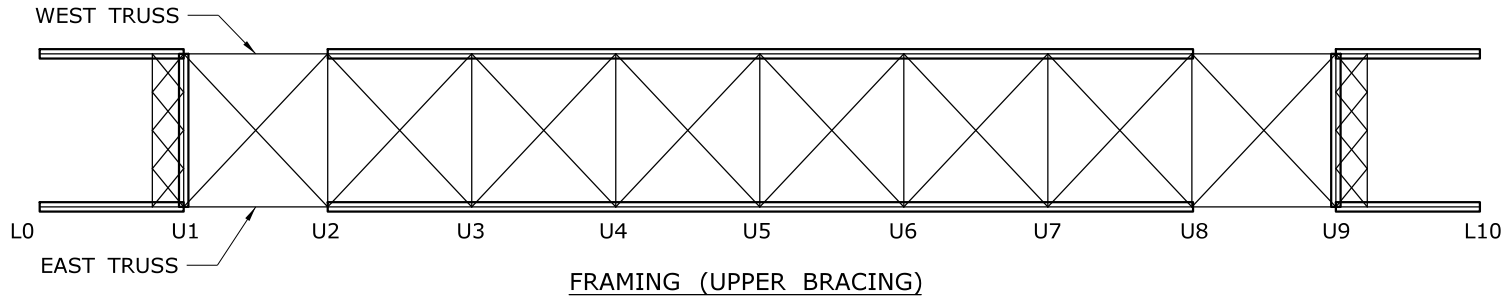
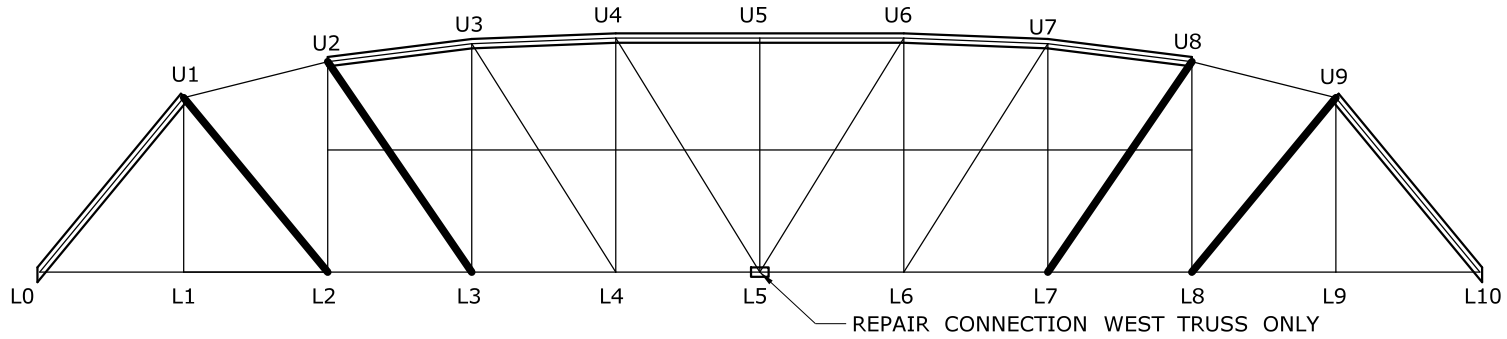
REHABILITATION OF BR. NO. 05222
TOWN BRIDGE ROAD
OVER FARMINGTON RIVER

TOWN OF CANTON

DATE: 7/2014	DRAWN: SAD	DRAWING: 7
DESIGNER: JLS	CHECKER: JBM	

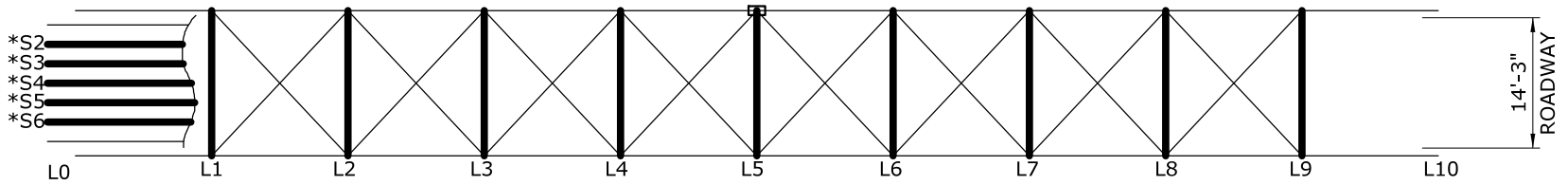


FRAMING (UPPER BRACING)



ELEVATION - EAST TRUSS

EAST ELEVATION SHOWN, WEST OPPOSITE HAND



FRAMING (LOWER BRACING)

NOTE

* STRINGERS 2-6 NEED REPLACEMENT FOR FULL LENGTH OF BRIDGE

LEGEND

MEMBER REPLACEMENT

MEMBER REPAIR

ALTERNATE 1B (HS20) - MEMBER REPLACEMENT

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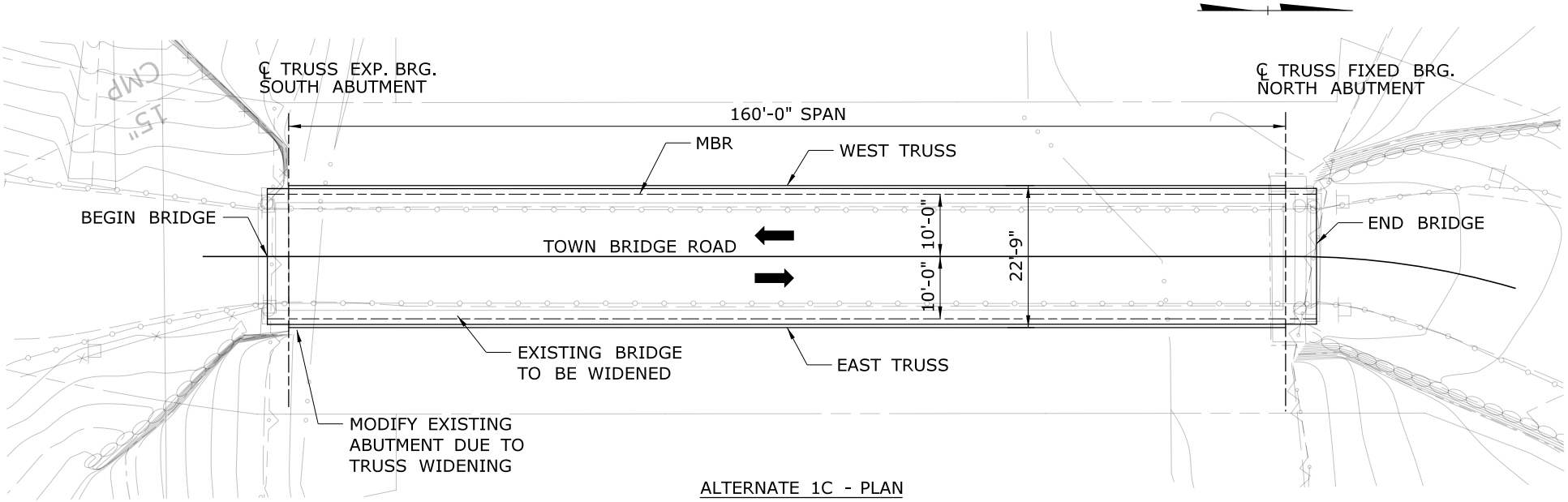
REHABILITATION OF BR. NO. 05222
TOWN BRIDGE ROAD
OVER FARMINGTON RIVER

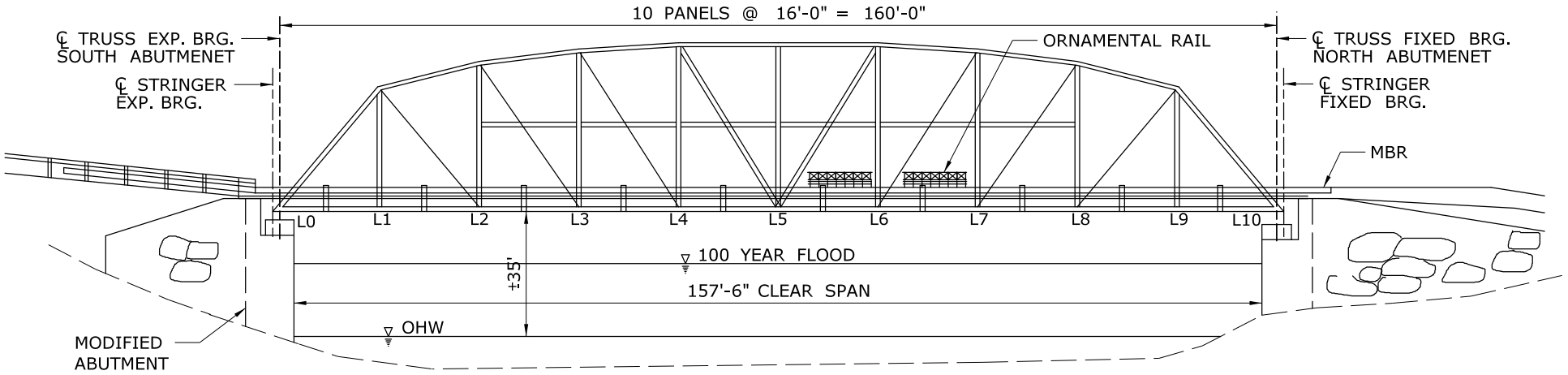
TOWN OF CANTON

DATE: 7/2014	DRAWN: SAD	DRAWING: 8
DESIGNER: JLS	CHECKER: JBM	



ALTERNATE 1C - PLAN

SCALE: 1" = 25'



ALTERNATE 1C - ELEVATION

EAST ELEVATION SHOWN, WEST OPPOSITE HAND

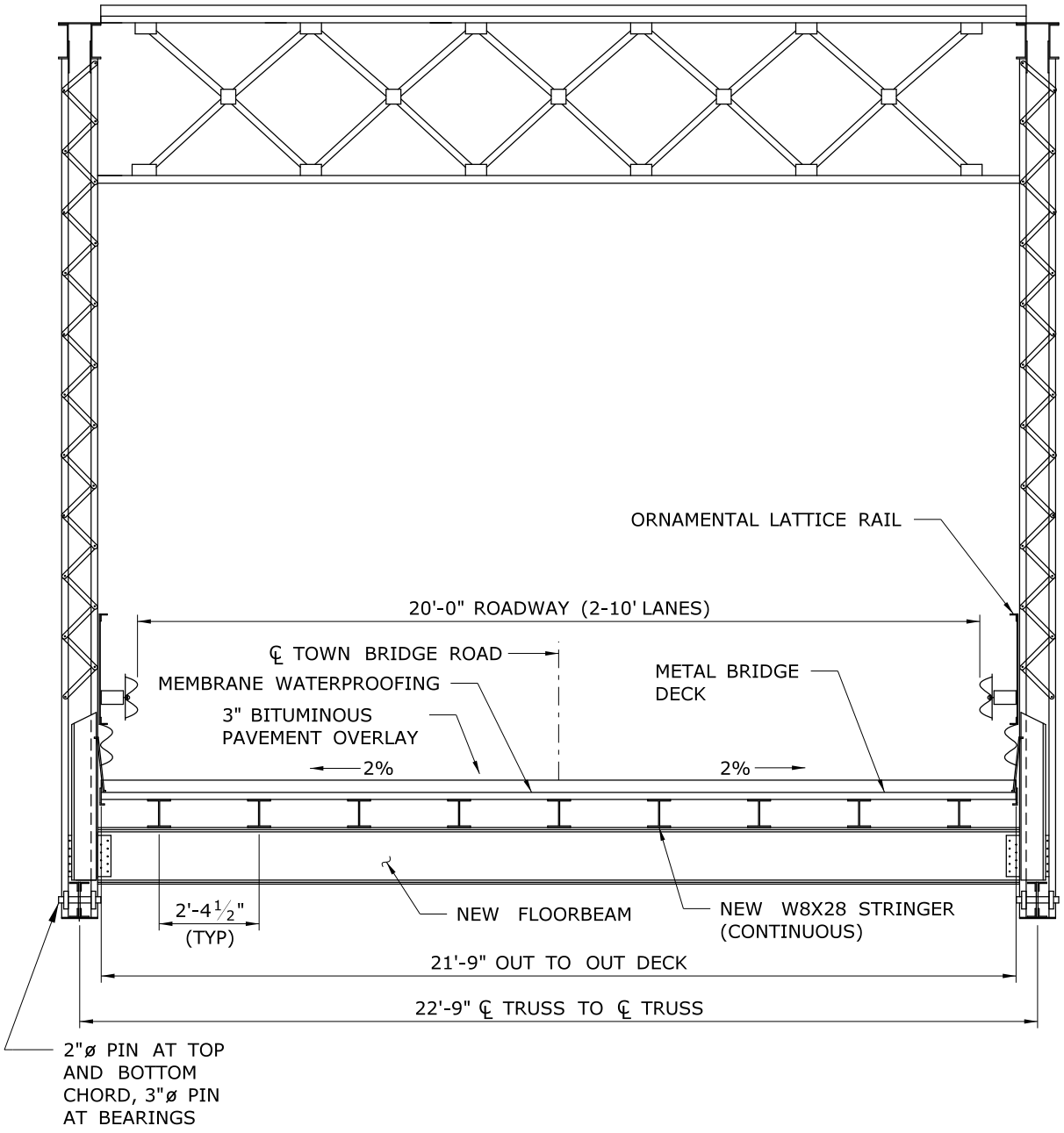
SCALE: 1" = 25'

TranSystems

REHABILITATION OF BR. NO. 05222
TOWN BRIDGE ROAD
OVER FARMINGTON RIVER

TOWN OF CANTON

DATE: 7/2014	DRAWN: SAD	DRAWING: 9
DESIGNER: JLS	CHECKER: JBM	



ALTERNATE 1C - PROPOSED CROSS SECTION

SCALE: ¼" = 1'-0"

TOWN OF CANTON

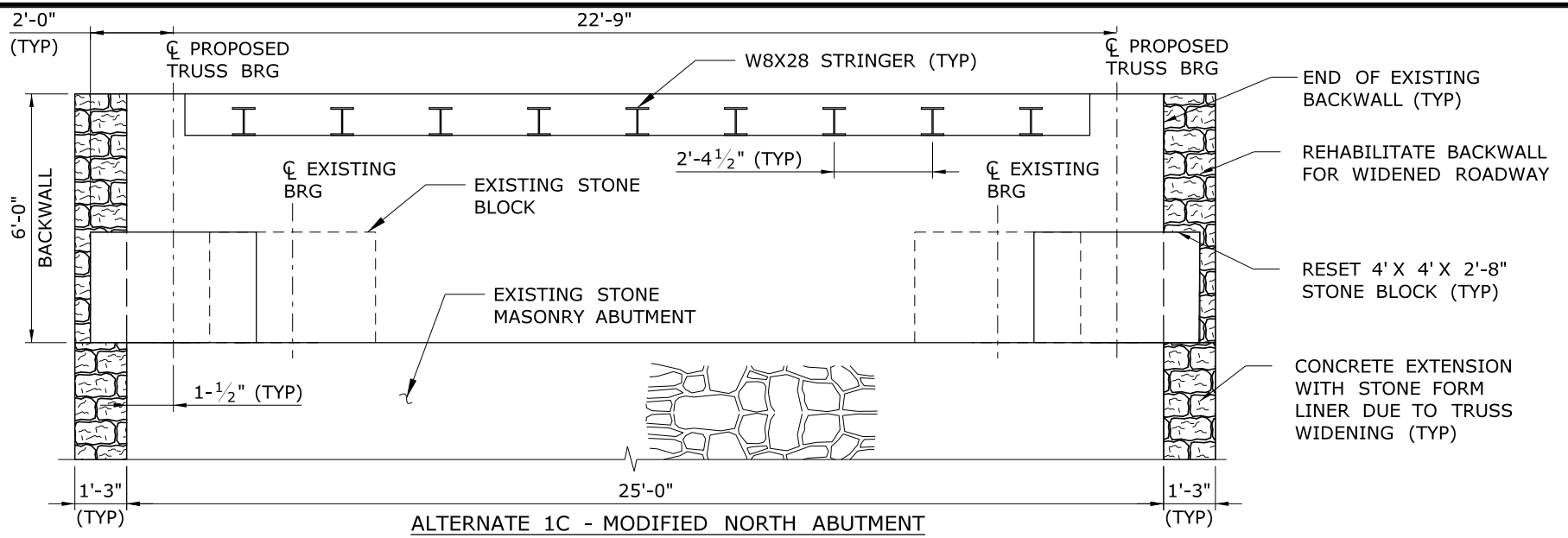
DRAWING: 10

DATE: 7/2014 | DRAWN: SAD | CHECKER: JBM

DESIGNER: JLS

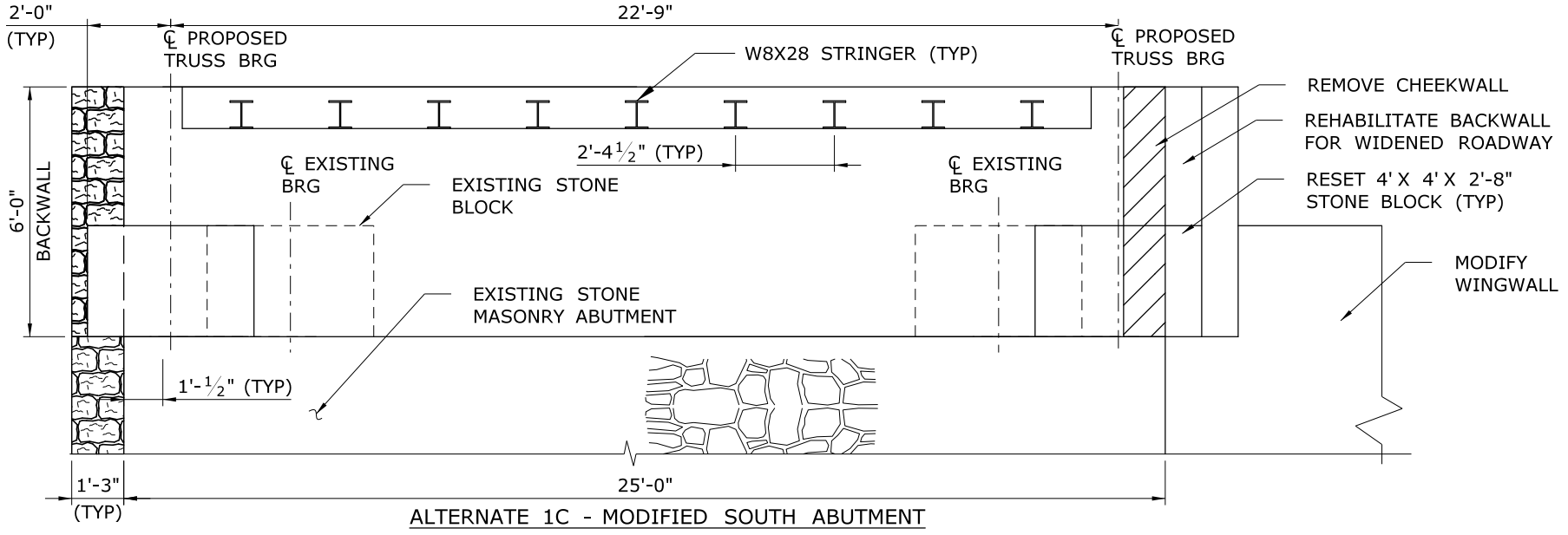
REHABILITATION OF BR. NO. 05222
TOWN BRIDGE ROAD
OVER FARMINGTON RIVER

TranSystems®



ALTERNATE 1C - MODIFIED NORTH ABUTMENT

SCALE: ¼" = 1'-0"



ALTERNATE 1C - MODIFIED SOUTH ABUTMENT

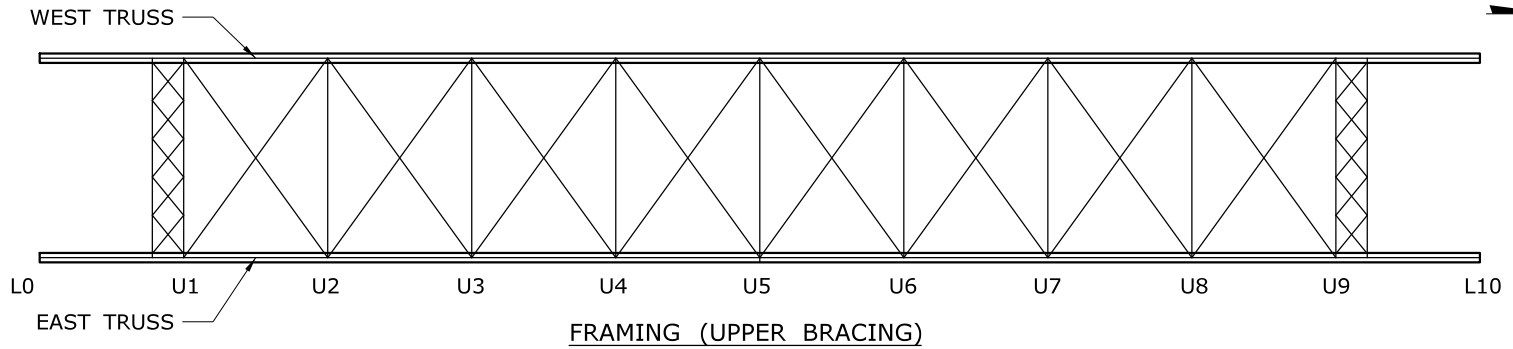
SCALE: ¼" = 1'-0"

TranSystems

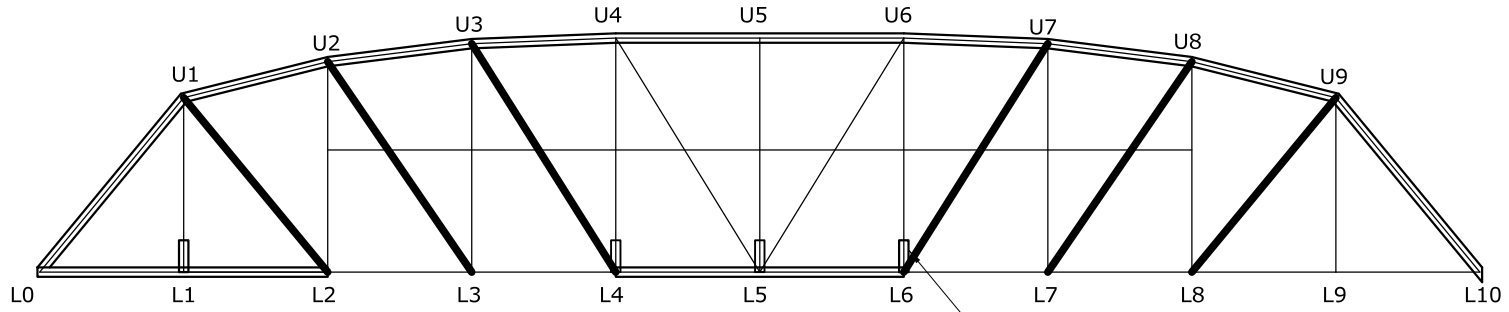
REHABILITATION OF BR. NO. 05222
TOWN BRIDGE ROAD
OVER FARMINGTON RIVER

TOWN OF CANTON

DATE: 7/2014	DRAWN: SAD	DRAWING: 11
DESIGNER: JLS	CHECKER: JBM	

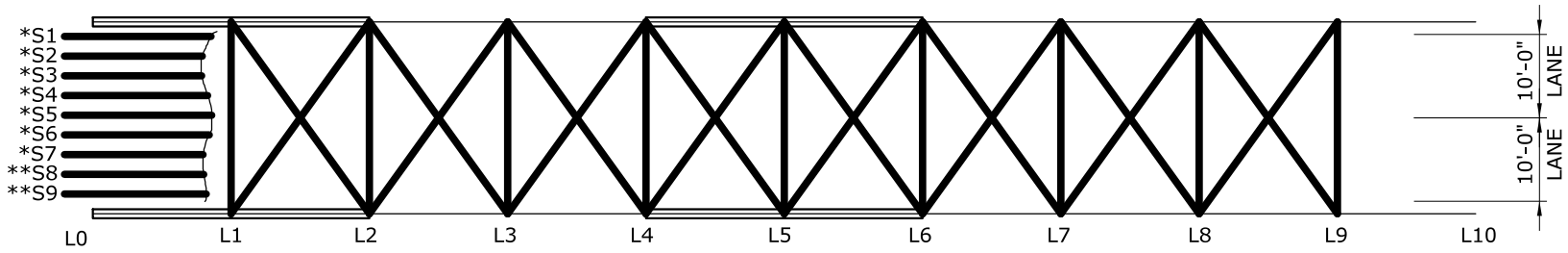


FRAMING (UPPER BRACING)



ELEVATION - EAST TRUSS

EAST ELEVATION SHOWN, WEST OPPOSITE HAND



FRAMING (LOWER BRACING)

NOTE

* STRINGERS 1-7 NEED REPLACEMENT FOR FULL LENGTH OF BRIDGE

** STRINGER 8-9 ARE NEW DUE TO ROAD WIDENING

LEGEND

MEMBER REPLACEMENT

MEMBER REPAIR

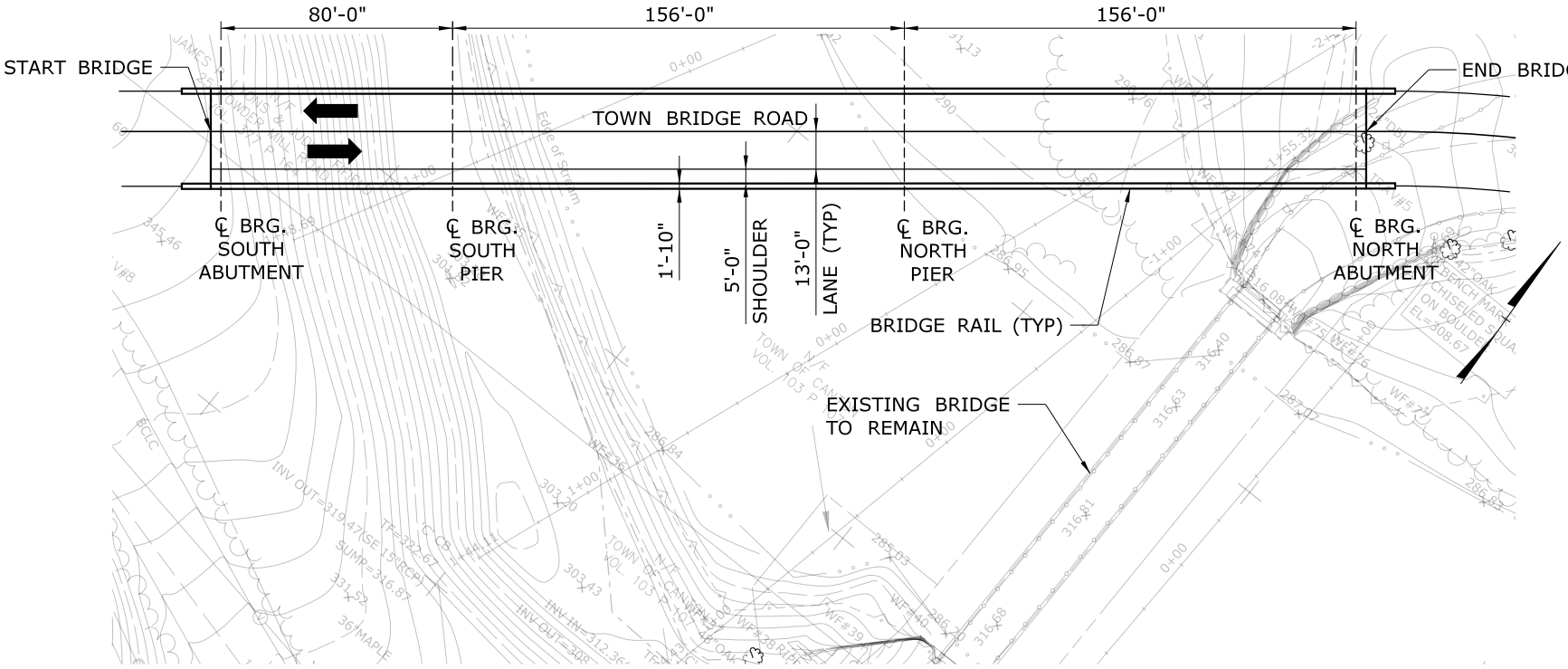
ALTERNATE 1C (HS20) - MEMBER REPLACEMENT

TranSystems

REHABILITATION OF BR. NO. 05222
TOWN BRIDGE ROAD
OVER FARMINGTON RIVER

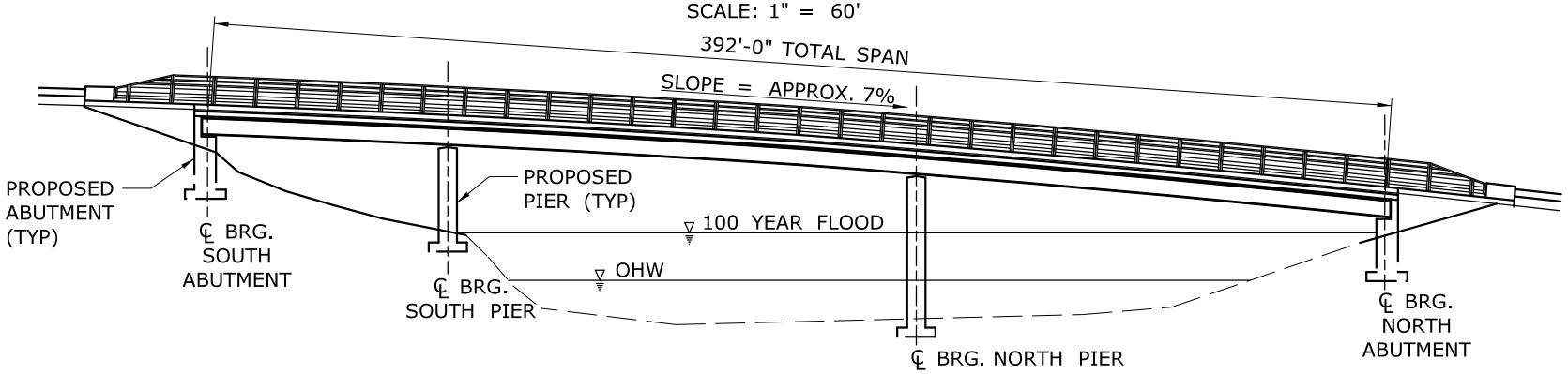
TOWN OF CANTON

DATE: 7/2014	DRAWN: SAD	DRAWING: 12
DESIGNER: JLS	CHECKER: JBM	



ALTERNATE 2 - PLAN

SCALE: 1" = 60'



ALTERNATE 2 - ELEVATION

EAST ELEVATION SHOWN, WEST SIMILAR

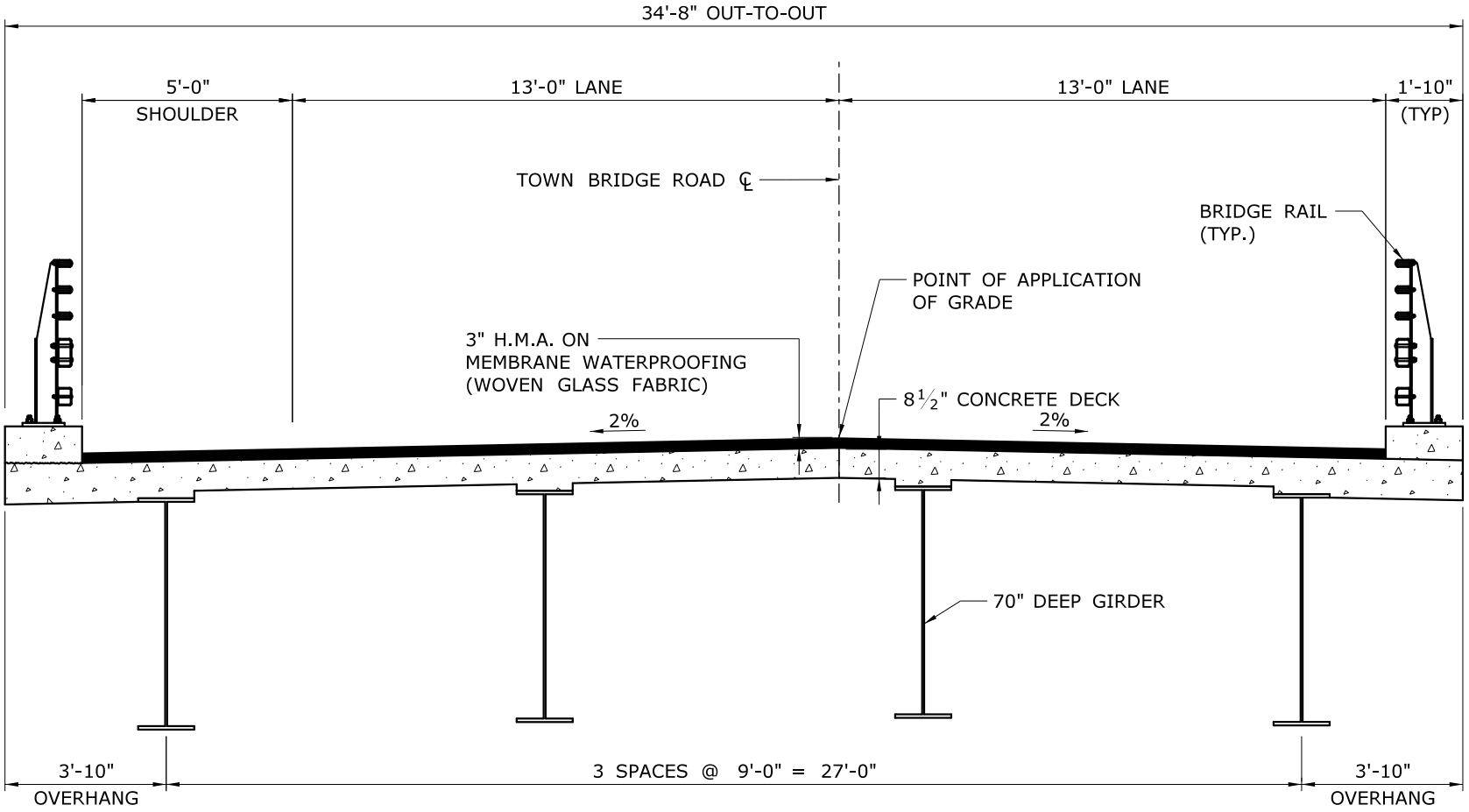
SCALE: 1" = 60'

TranSystems

REHABILITATION OF BR. NO. 05222 TOWN BRIDGE ROAD OVER FARMINGTON RIVER

TOWN OF CANTON

DATE: 7/2014	DRAWN: SAD	DRAWING: 13
DESIGNER: JLS	CHECKER: JBM	



ALTERNATE 2 - PROPOSED CROSS SECTION

SCALE: ¼" = 1'-0"

TranSystems

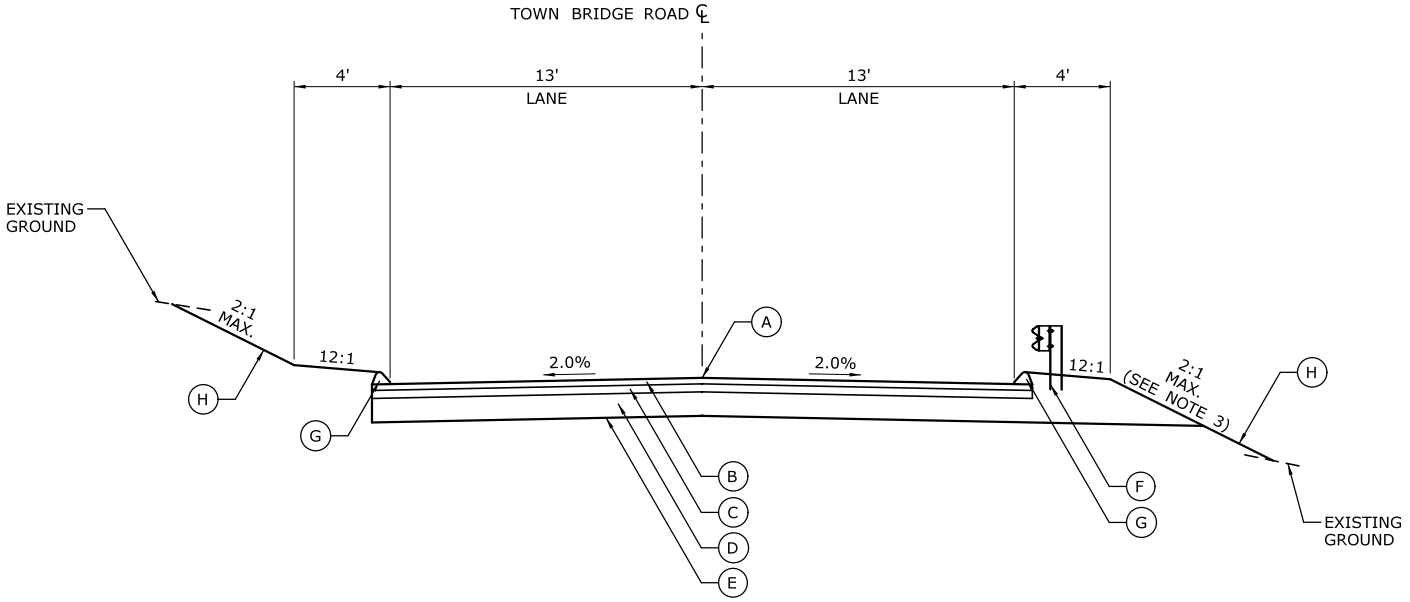
REHABILITATION OF BR. NO. 05222
TOWN BRIDGE ROAD
OVER FARMINGTON RIVER

TOWN OF CANTON

DATE: 7/2014	DRAWN: SAD	DRAWING: 14
DESIGNER: JLS	CHECKER: JBM	

NOTES:

1. TYPICAL SECTION FOR ALTERNATIVE 4 IS SHOWN. TYPICAL SECTION FOR ALTERNATIVE 3 IS IDENTICAL.
2. MATERIAL AND LIFT THICKNESSES SHOWN ON THIS SHEET ARE FOR QUANTITY DEVELOPMENT/COST ESTIMATION PURPOSES ONLY. THE PROPOSED PAVEMENT STRUCTURE WILL BE DESIGNED DURING FINAL DESIGN.
3. ALTERNATIVE 3 PROPOSES SIDE SLOPES STEEPER THAN 2:1 IN THE VICINITY OF THE PROPOSED BRIDGE AND TO LIMIT FILL INTO THE FEMA FLOODPLAIN. SLOPES STEEPER THAN 2:1 SHALL BE PROTECTED BY RIPRAP.



ROADWAY TYPICAL SECTION
TOWN BRIDGE ROAD
SCALE: 1" = 8'

LEGEND

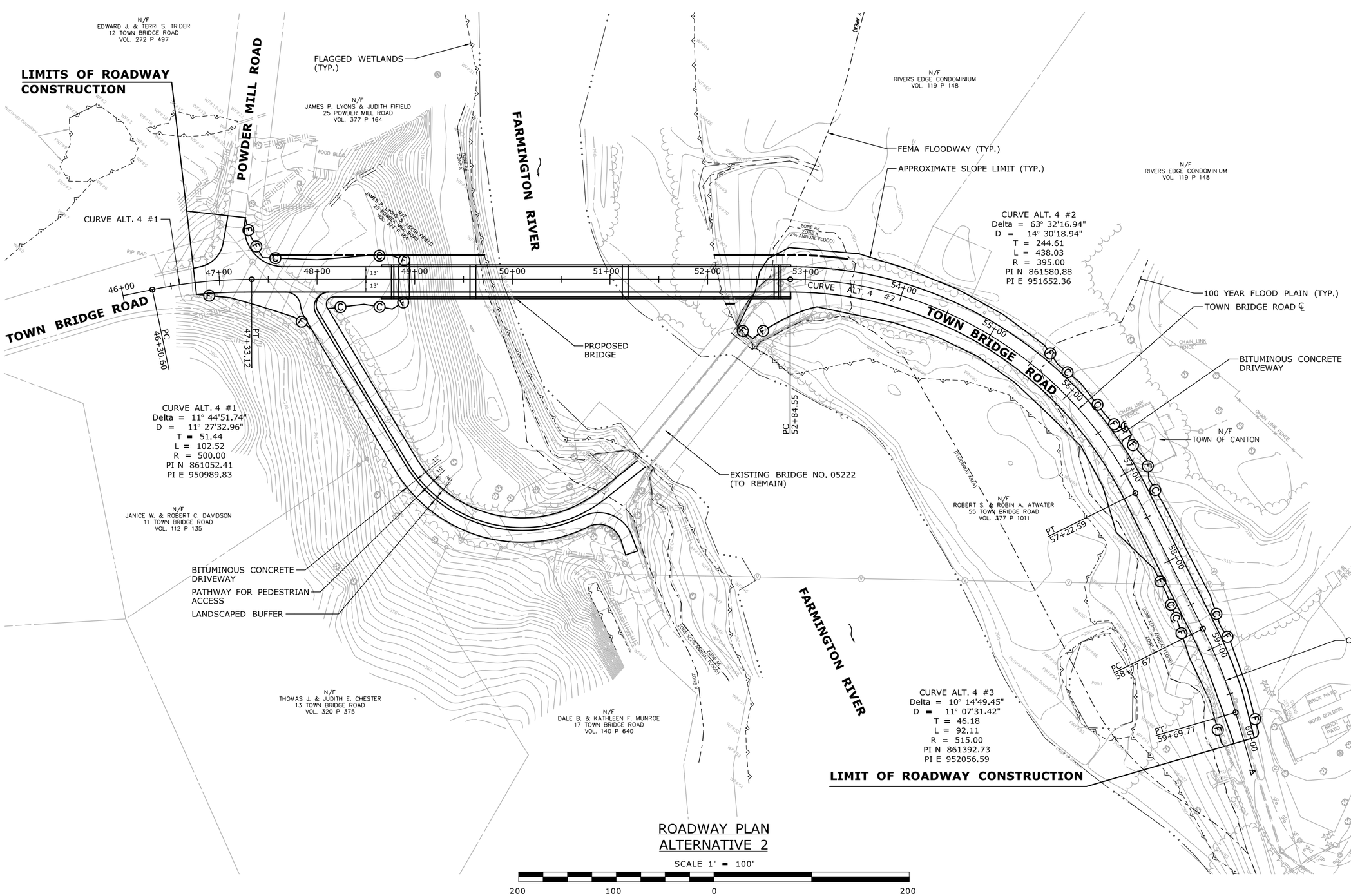
- (A) POINT OF APPLIED GRADE
- (B) 3" HMA
- (C) 4" PROCESSED AGGREGATE BASE
- (D) 12" SUBBASE
- (E) FORMATION OF SUBGRADE
- (F) METAL BEAM RAIL (TYPE R-B 350)
- (G) BITUMINOUS CONCRETE LIP CURBING
- (H) TURF ESTABLISHMENT

TranSystems

REHABILITATION OF BR. NO. 05222
TOWN BRIDGE ROAD
OVER FARMINGTON RIVER

TOWN OF CANTON

DATE: 12/2013	DRAWN: CRH	DRAWING: 15
DESIGNER: CRH	CHECKER: TPR	



ROADWAY PLAN
ALTERNATIVE 2

SCALE 1" = 100'

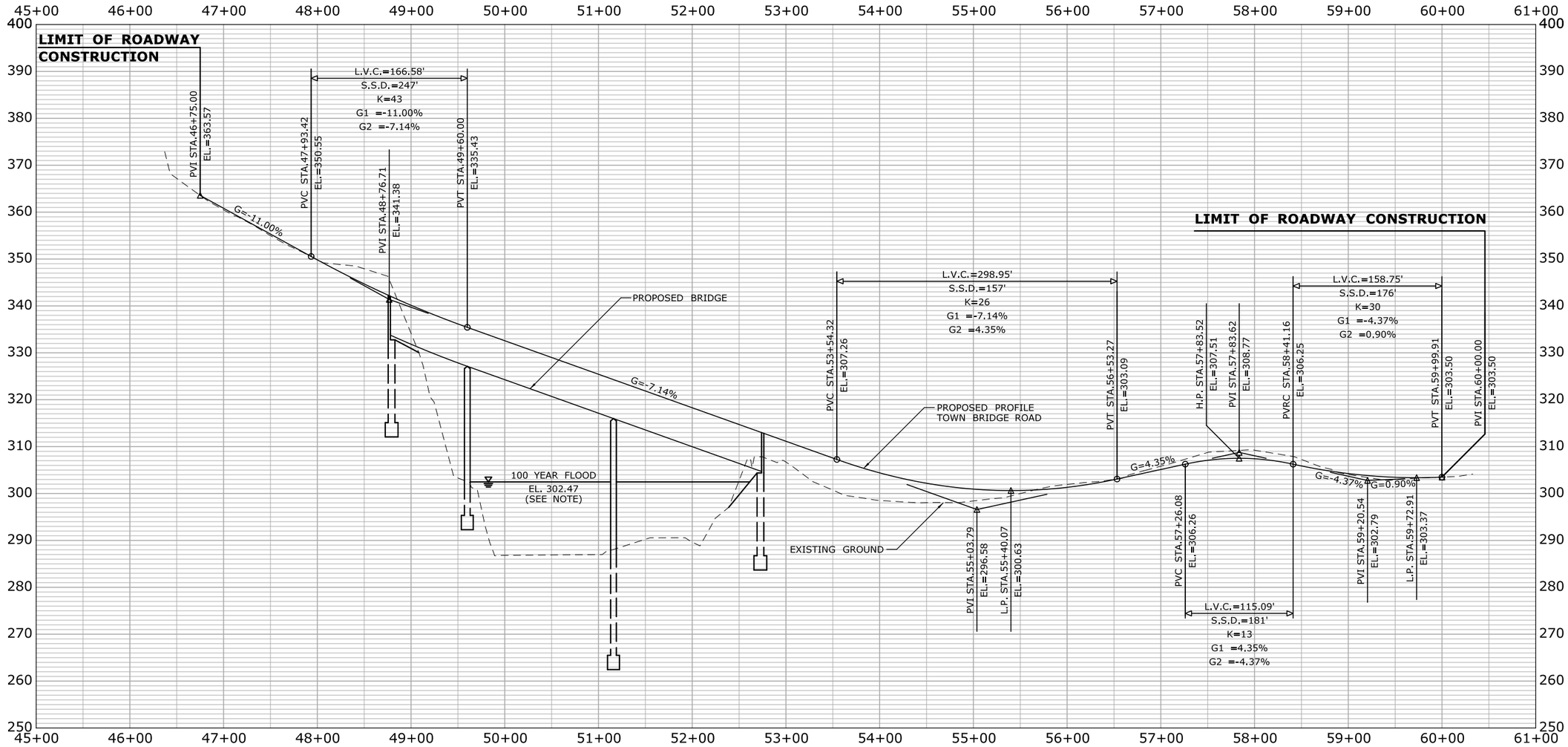
200 100 0 200

TranSystems

REHABILITATION OF BR. NO. 05222
TOWN BRIDGE ROAD
OVER FARMINGTON RIVER

TOWN OF CANTON

DATE: 12/2013	DRAWN: CRH	DRAWING: 16
DESIGNER: CRH	CHECKER: TPR	



NOTE:

100 YEAR FLOOD ELEVATION DISPLAYED ON THIS SHEET IS THE RESULT OF PRELIMINARY HYDRAULIC ANALYSIS. THE EXACT ELEVATION MAY CHANGE AS A RESULT OF FURTHER DETAILED DESIGN AND ANALYSIS.

ROADWAY PROFILE
ALTERNATIVE 2

HORIZ. SCALE IN FEET
0 60 120
VERT. SCALE IN FEET
0 12 24

TranSystems

REHABILITATION OF BR. NO. 05222
TOWN BRIDGE ROAD
OVER FARMINGTON RIVER

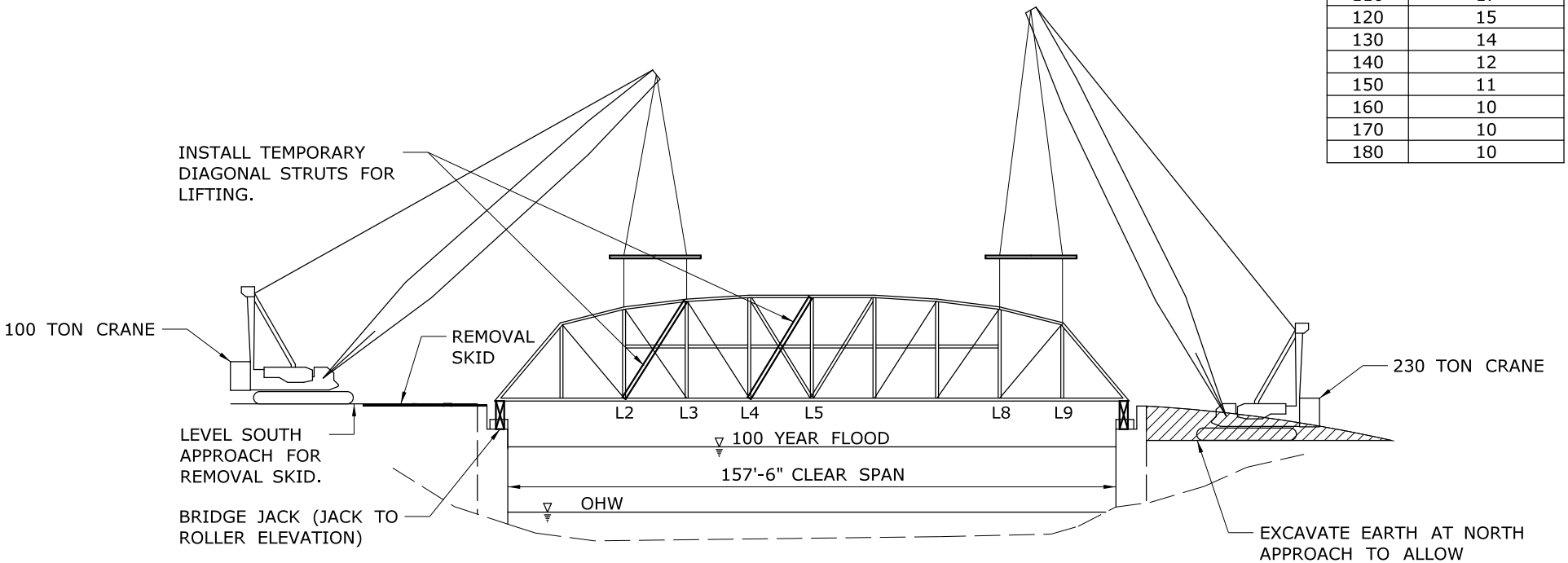
TOWN OF CANTON

DATE: 12/2013	DRAWN: CRH	DRAWING: 17
DESIGNER: CRH	CHECKER: TPR	

REMOVAL SEQUENCE STAGE 1:

1. REMOVE WEARING SURFACE, MBR, DECK, AND STRINGERS.
2. SITE PREPARATION.
3. JACK STRUCTURE AT ABUTMENTS.
4. INSTALL TEMPORARY DIAGONAL STRUT FOR LIFTING
5. SECURE NORTH END OF BRIDGE TO CRANE AT PANEL POINT L8-L9.
6. SECURE SOUTH END OF BRIDGE TO CRANE AT PANEL POINT L2-L3.
7. LIFT AND PULL TRUSSES AT SOUTH END ONTO REMOVAL SKID.

RADIUS (FT)	REACTION AT CRANE PICK POINT (TONS)
40	27
50	26
60	24
70	23
80	21
90	20
100	18
110	17
120	15
130	14
140	12
150	11
160	10
170	10
180	10



REMOVAL SEQUENCE STAGE 1 - ELEVATION

SCALE: 1" = 40'

TranSystems

REHABILITATION OF BR. NO. 05222
TOWN BRIDGE ROAD
OVER FARMINGTON RIVER

TOWN OF CANTON

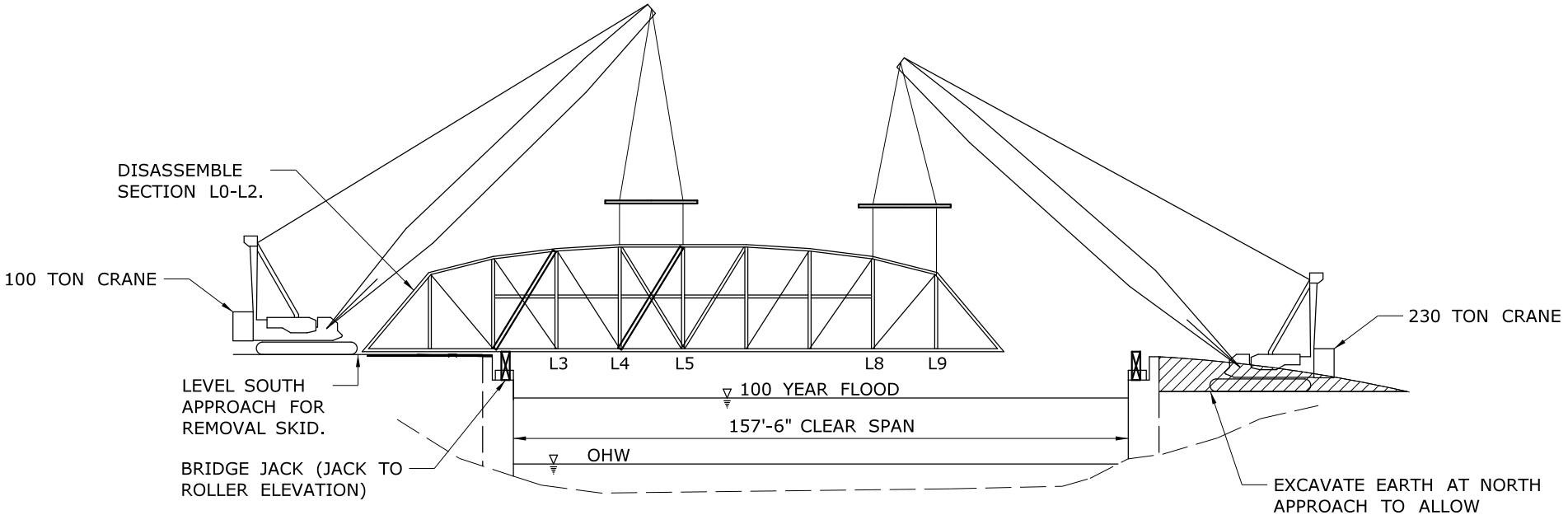
DATE: 7/2014	DRAWN: SAD	DRAWING: 18
DESIGNER: SAD	CHECKER: JBM	

REMOVAL SEQUENCE STAGE 2:

1. DISASSEMBLE TRUSS (PANEL POINT L0 TO L1).
2. CONTINUE PULLING TRUSS OVER REMOVAL SKID.
3. DISASSEMBLE TRUSS (PANEL POINT L1 TO L2).
4. REPEAT PREVIOUS STEPS UNTIL ENTIRE BRIDGE IS DISASSEMBLED.

REINSTALL SEQUENCE:

1. ASSEMBLE TRUSS PANEL POINT L8 TO L10.
2. SECURE TO CRANE.
3. PUSH TRUSS OVER REMOVAL SKID AND ASSEMBLE NEXT SECTION (L7 TO L8).
4. REPEAT UNTIL ENTIRE BRIDGE IS CONSTRUCTED.



REMOVAL SEQUENCE STAGE 1 - ELEVATION

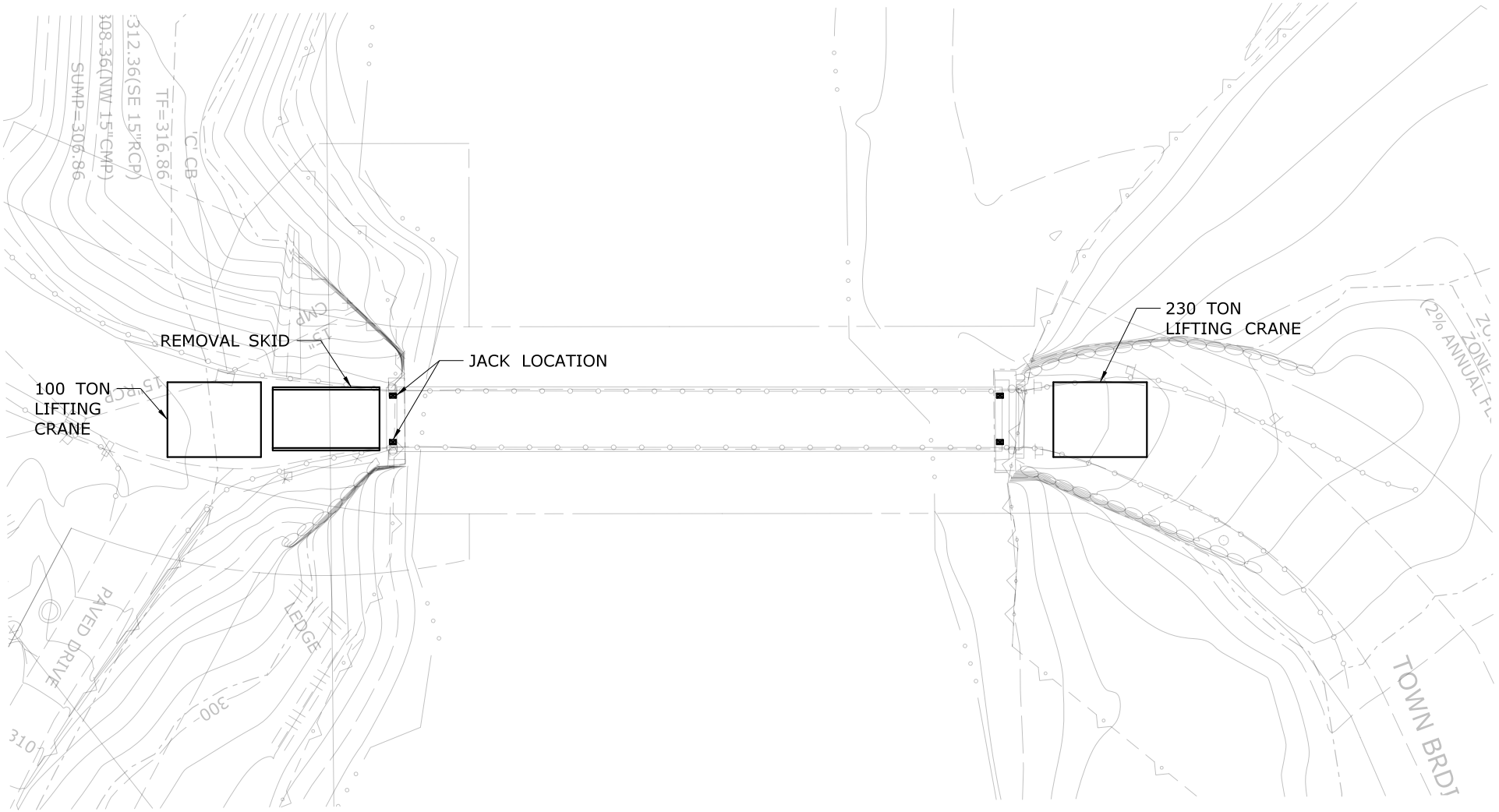
SCALE: 1" = 40'

TranSystems

REHABILITATION OF BR. NO. 05222
TOWN BRIDGE ROAD
OVER FARMINGTON RIVER

TOWN OF CANTON

DATE: 7/2014	DRAWN: SAD	DRAWING: 19
DESIGNER: SAD	CHECKER: JBM	



REMOVAL SEQUENCE PLAN

SCALE: 1" = 40'

TranSystems

REHABILITATION OF BR. NO. 05222
TOWN BRIDGE ROAD
OVER FARMINGTON RIVER

TOWN OF CANTON

DATE: 7/2014	DRAWN: SAD	DRAWING: 20
DESIGNER: SAD	CHECKER: JBM	

APPENDIX B

PHOTOGRAPHS

Bridge No.	05222		
Town:	Canton, CT		
Feature Carried:	Town Bridge Road	**Date:**	July 2014
Feature Crossed:	Farmington River	**Project No.:**	P712110001

Photo 1: **West elevation (looking upstream).**

Photo 2: **Typical truss detail.**

Bridge No.	05222		
Town:	Canton, CT		
Feature Carried:	Town Bridge Road	**Date:**	July 2014
Feature Crossed:	Farmington River	**Project No.:**	P712110001

Photo 3: **Bridge from the south approach.**

Photo 4: **Bridge from the north approach.**

Bridge No.	05222		
Town:	Canton, CT		
Feature Carried:	Town Bridge Road	**Date:**	July 2014
Feature Crossed:	Farmington River	**Project No.:**	P712110001

Photo 5: **South abutment.**

Photo 6: **North abutment.**

Bridge No.	05222		
Town:	Canton, CT		
Feature Carried:	Town Bridge Road	**Date:**	July 2014
Feature Crossed:	Farmington River	**Project No.:**	P712110001

Photo 7: **Typical truss expansion bearing at the south abutment.**

Photo 8: **Typical truss fixed bearing at the north abutment.**

Bridge No.	05222		
Town:	Canton, CT		
Feature Carried:	Town Bridge Road	**Date:**	July 2014
Feature Crossed:	Farmington River	**Project No.:**	P712110001

Photo 9: **Typical floor system.**

Photo 10: **Connection of floorbeam 8 to the west truss. Typical floorbeam and truss connection.**

Bridge No.	05222		
Town:	Canton, CT		
Feature Carried:	Town Bridge Road	**Date:**	July 2014
Feature Crossed:	Farmington River	**Project No.:**	P712110001

Photo 11: **Typical pin connection at bottom chord.**

Photo 12: **Typical deterioration of floorbeam top flanges at the connection to truss.**

Bridge No.	05222		
Town:	Canton, CT		
Feature Carried:	Town Bridge Road	**Date:**	July 2014
Feature Crossed:	Farmington River	**Project No.:**	P712110001

Photo 13: **Section loss at stringer 7 between L0 and L1.**

Photo 14: **Typical pin connection at top chord.**

Bridge No.	05222		
Town:	Canton, CT		
Feature Carried:	Town Bridge Road	**Date:**	July 2014
Feature Crossed:	Farmington River	**Project No.:**	P712110001

Photo 15: **Top of deck looking south. Note cracking in overlay.**

Photo 16: **Typical ornamental railing. Note collision damage.**

APPENDIX E

ROADWAY DESIGN CRITERIA

Design Element		**CTDOT Design Value**	**Existing Geometry**	**Alternative 1A**	**Alternative 1B**	**Alternative 2**	**Alternative 3**	**Alternative 4**
Project Classification		New Construction/Major Reconstruction	-	Spot Improvement	Spot Improvement	Spot Improvement	New Construction/Major Reconstruction	New Construction/Major Reconstruction
Functional Classification		Rural Local Road (Open)	Rural Local Road (Open)	Rural Local Road (Open)	Rural Local Road (Open)	Rural Local Road (Open)	Rural Local Road (Open)	Rural Local Road (Open)
Design Speed		20 mph - 30 mph[1]	15 mph[2]	25 mph	25 mph	25 mph	25 mph	25 mph
Travel Lane Width		10 ft	12.5 ft[3]	14 ft 3 in[4]	10 ft	10 ft	13 ft	13 ft
Shoulder Width		2 ft - 4 ft	0 ft	0 ft	0 ft	0 ft	0 ft	0 ft
Cross Slope (travel lane)		1.5 % - 2 %	1 % - 3%	Maintain Existing Roadway/Bridge Geometry	Maintain Existing Roadway Geometry	Maintain Existing Roadway Geometry	2%	2%
Cross Slope (shoulder)		Same as adjacent travel lane	N/A				2%	2%
Minimum Radii		190 ft (e_{max} = 6.0%)	105 ft				Same as Existing Geometry	395 ft
Horizontal Sight Distance		155 ft	100 ft[5]		100 ft[6]	80 ft[7]	120 ft[7]	300 ft
Minimum Grade		0.5 %	0.35 %		Maintain Existing Roadway Geometry	Maintain Existing Roadway Geometry	1.00 %	0.90 %
Maximum Grade		11 %	14.1 %				9.08 %	11.00 %
Vertical Curvature (K-Value)	Crest	12	3				14	13
	Sag	26/14[8]	9				20	26
Stopping Sight Distance (Crest)		155 ft	79 ft				199 ft	157 ft
Minimum Roadway Vertical Clearance		14 ft 3 in	12 ft 4 in	14 ft	14 ft	14 ft	N/A	N/A
Minimum Vertical Clearance Above 100 Year Flood[9]		2 ft	12 ft	12 ft	12 ft	12 ft	TBD	3 ft
Bridge Width Match Approach Roadway (Yes/No)		Yes	No	No	No	No	Yes	Yes

Notes:

1. Values are given for 25 mph, the proposed design speed.
2. Posted speed limit per the State Traffic Commission's Approved Town Road Speed Limits table.
3. Existing roadway width varies throughout the project area, value represents an average roadway width.
4. The bridge will maintain one 14 ft 3 in lane operating under alternating one-way traffic.
5. Existing horizontal sight distance is limited by the existing truss encroaching on sightlines to the inside of the curve near the north abutment.
6. The proposed horizontal sight distance will be limited by the truss encroaching upon sightlines to the inside of the curve near the north abutment. Should this alternative be selected, further design refinement may enable greater horizontal sight distance.
7. The proposed horizontal sight distance will be limited by the end cap. Should this alternative be selected, further design refinement may enable greater horizontal sight distance.
8. The required K-value to provide the required Headlight Sight Distance for the 25 mph design speed is 26. The required K-value to meet the Comfort Criteria for the 25 mph design speed is 14
9. Vertical clearance heights are based upon preliminary hydraulic analysis which provided 100 year flood water surface elevations through the project site.

APPENDIX J

COST ESTIMATE

Town of Canton
Rehabilitation of Bridge No. 05222
Town Bridge Road over Farmington River

Alternative 1A (HS7)
Preliminary Construction Cost Estimate

FOR STRUCTURE

	Item #	Item	Qty	Unit	Unit Price	Total
1	0219001	Sedimentation Control Systems	250	LF	$4	$1,000.00
2	0406173	H.M.A S0.25	60	TON	$125	$7,500.00
3	0503000	Removal of Floorbeams and Deck	2,800	SF	$50	$140,000.00
4	0503001	Removal of Superstructure (Truss)	1	LS	$160,000	$160,000.00
5	0503946	Reset Existing Superstructure (Truss)	1	LS	$200,000	$200,000.00
6	0513003	1-1/2" Polyvinyl Chloride Plastic Pipe	24	LF	$40	$960.00
7	0520035	Silicone Expansion Joint System	32	LF	$380	$12,160.00
8	0522155	Replace Bridge Bearings	7	EA	$400	$2,800.00
9	0522156	Replace Expansion Bearings	7	EA	$400	$2,800.00
10	0522281	Steel Bearing Assemblies	4	EA	$800	$3,200.00
11	0601201	Class "F" Concrete	30	CY	$1,000	$30,000.00
12	0602006	Deformed Steel Bars- Epoxy Coated	5,250	LBS	$2	$10,500.00
13	0603142	Field Touch up Painting	710	SF	$30	$21,300.00
14	0603270	Orthotropic Steel Deck	2,752	SF	$50	$137,600.00
15	0603446	Painting of Structural Steel (Truss)	7,100	SF	$20	$142,000.00
16	0603653	Class 1 Containment and Collection of Surface Preparation Debris	7,100	SF	$20	$142,000.00
17	0603851	Structural Steel (Low Alloy)	280	CWT	$450	$126,000.00
18	0603851X	Structural Steel (Low Alloy) - Eyebars	2,480	LBS	$50	$124,000.00
19	0603444	Lead Health Protection Program	1	LS	$25,000	$25,000.00
20	0707001	Membrane Waterproofing (Woven Glass Fabric)	360	SY	$40	$14,400.00
21	0904042	Metal Bridge Rail (Combination) - Alum	384	LF	$95	$36,480.00
22	120900X	Painted Pavement Makings	516	LF	$2.0	$1,032.00
23	1401045	Handling Water	1	LS	$20,000	$20,000.00
24	1500126	Utility Conduit Relocation	500	LF	$10.00	$5,000.00

FOR HIGHWAY

	Item #	Item	Qty	Unit	Unit Price	Total
25	202000	EARTH EXCAVATION	250	CY	$15.00	$3,750.00
26	207000	BORROW	100	CY	$12.00	$1,200.00
27	212000	SUBBASE	125	CY	$40.00	$5,000.00
28	304002	PROCESSED AGGREGATE BASE	50	CY	$45.00	$2,250.00
29	406171	HMA S0.5	60	TON	$120.00	$7,200.00
30	703010	STANDARD RIPRAP	310	CY	$80.00	$24,800.00
31	815001	BITUMINOUS CONCRETE LIP CURBING	275	LF	$5.00	$1,375.00
32	922501	BITUMINOUS CONCRETE DRIVEWAY	55	SY	$35.00	$1,925.00

STRUCTURE ESTIMATE

Subtotal	$1,365,732.00
Minor Items-10%	$136,573
Subtotal (A)	$1,502,305.20

HIGHWAY ESTIMATE

Subtotal	$47,500.00
Minor Items-10%	$4,750.00
Subtotal (B)	$52,250.00

STUCTURE AND HIGHWAY SUBTOTAL

Subtotal (C)	$1,554,555.20

FOR LUMP SUM ITEMS

Item #	Item	Qty	Unit	Unit Price	Total
201030	Clearing & Grubbing (3% of C)	1	LS		$46,636.66
971001 A	Maintenance & Protection of Traffic (4% of C)	1	LS		$62,182.21
975002	Mobilization (7% of C)	1	LS		$108,818.86
980001 A	Construction Staking (1% of C)	1	LS		$15,545.55
	LUMP SUM ESTIMATE				
				TOTAL (D)	$233,183.28
				ROADWAY/STRUCTURES TC	$1,787,738.48

ADDITIONAL ITEMS

INCIDENTALS 25% OF E)	$446,934.62
CONTINGENCIES (7% OF E)	$125,141.69

TOTAL CONTRACT CONSTRUCTION COST (2013)	$2,359,815
TOTAL CONSTRUCTION COST WITH 4% INFLATION (2015)	$2,552,376
TOTAL CONSTRUCTION COST	$2,560,000

* Prepared in accordance with the *Connecticut Department of Transportation's Preliminary Cost Estimating Guidelines - 2013.*

G:\WT11\0001\Bridge\Calcs\Alt 1A - HS7 - 14' Roadway\[Estimate - Alt 1A (HS-7).xlsx]Alt 2

Town of Canton
Rehabilitation of Bridge No. 05222
Town Bridge Road over Farmington River

Alternative 1B (HS20)
Preliminary Construction Cost Estimate

FOR STRUCTURE

	Item #	Item	Qty	Unit	Unit Price	Total
1	0219001	Sedimentation Control Systems	250	LF	$4	$1,000.00
2	0406173	H.M.A S0.25	60	TON	$125	$7,500.00
3	0503000	Removal of Floorbeams and Deck	2,800	SF	$50	$140,000.00
4	0503001	Removal of Superstructure (Truss)	1	LS	$160,000	$160,000.00
5	0503946	Reset Existing Superstructure (Truss)	1	LS	$200,000	$200,000.00
6	0513003	1-1/2" Polyvinyl Chloride Plastic Pipe	24	LF	$40	$960.00
7	0520035	Silicone Expansion Joint System	32	LF	$380	$12,160.00
8	0522155	Replace Bridge Bearings	7	EA	$400	$2,800.00
9	0522156	Replace Expansion Bearings	7	EA	$400	$2,800.00
10	0522281	Steel Bearing Assemblies	4	EA	$800	$3,200.00
11	0601201	Class "F" Concrete	30	CY	$1,000	$30,000.00
12	0602006	Deformed Steel Bars- Epoxy Coated	5,250	LBS	$2	$10,500.00
13	0603142	Field Touch up Painting	710	SF	$30	$21,300.00
14	0603270	Orthotropic Steel Deck	2,752	SF	$50	$137,600.00
15	0603446	Painting of Structural Steel (Truss)	7,100	SF	$20	$142,000.00
16	0603653	Class 1 Containment and Collection of Surface Preparation Debris	7,100	SF	$20	$142,000.00
17	0603851	Structural Steel (Low Alloy)	550	CWT	$450	$247,500.00
18	0603851X	Structural Steel (Low Alloy) - Eyebars	3,500	LBS	$50	$175,000.00
19	0603444	Lead Health Protection Program	1	LS	$25,000	$25,000.00
20	0707001	Membrane Waterproofing (Woven Glass Fabric)	360	SY	$40	$14,400.00
21	0904042	Metal Bridge Rail (Combination) - Alum	384	LF	$95	$36,480.00
22	120900X	Painted Pavement Makings	516	LF	$2.0	$1,032.00
23	1401045	Handling Water	1	LS	$20,000	$20,000.00
24	1500126	Utility Conduit Relocation	500	LF	$10.00	$5,000.00

FOR HIGHWAY

	Item #		Item	Qty	Unit	Unit Price	Total
25	202000	0	EARTH EXCAVATION	250	CY	$15.00	$3,750.00
26	207000	0	BORROW	100	CY	$12.00	$1,200.00
27	212000	0	SUBBASE	125	CY	$40.00	$5,000.00
28	304002	0	PROCESSED AGGREGATE BASE	50	CY	$45.00	$2,250.00
29	406171	0	HMA S0.5	60	TON	$120.00	$7,200.00
30	703010	0	STANDARD RIPRAP	310	CY	$80.00	$24,800.00
31	815001	0	BITUMINOUS CONCRETE LIP CURBING	275	LF	$5.00	$1,375.00
32	922501	0	BITUMINOUS CONCRETE DRIVEWAY	55	SY	$35.00	$1,925.00

STRUCTURE ESTIMATE

Subtotal	$1,533,232.00
Minor Items-10%	$153,323
Subtotal (A)	$1,686,555.20

HIGHWAY ESTIMATE

Subtotal	$47,500.00
Minor Items-10%	$4,750.00
Subtotal (B)	$52,250.00

STUCTURE AND HIGHWAY SUBTOTAL

Subtotal (C)	$1,738,805.20

FOR LUMP SUM ITEMS

Item #	Item	Qty	Unit	Unit Price	Total
201030	Clearing & Grubbing (3% of C)	1	LS		$52,164.16
971001 A	Maintenance & Protection of Traffic (4% of C)	1	LS		$69,552.21
975002	Mobilization (7% of C)	1	LS		$121,716.36
980001 A	Construction Staking (1% of C)	1	LS		$17,388.05
	LUMP SUM ESTIMATE				
				TOTAL (D)	$260,820.78
				ROADWAY/STRUCTURES TC	$1,999,625.98

ADDITIONAL ITEMS

INCIDENTALS 25% OF E)	$499,906.50
CONTINGENCIES (7% OF E)	$139,973.82

TOTAL CONTRACT CONSTRUCTION COST (2013)	$2,639,506
TOTAL CONSTRUCTION COST WITH 4% INFLATION (2015)	$2,854,890
TOTAL CONSTRUCTION COST	$2,860,000

* Prepared in accordance with the *Connecticut Department of Transportation's Preliminary Cost Estimating Guidelines - 2013.*

G:\WT11\0001\Bridge\Calcs\Alt 1A - HS20 - 14' Roadway\[Estimate - Alt 1A (HS-20).xlsx]Alt 2

Town of Canton
Rehabilitation of Bridge No. 05222
Town Bridge Road over Farmington River

Alternative 1C (HS20)
Preliminary Construction Cost Estimate

FOR STRUCTURE

	Item #	Item	Qty	Unit	Unit Price	Total
1	0203000	Structure Excavation - Earth (Complete)	1,045	CY	$40	$41,800.00
2	0216000	Pervious Structure Backfill	330	CY	$50	$16,500.00
3	0219001	Sedimentation Control Systems	250	LF	$4	$1,000.00
4	0406173	H.M.A S0.25	80	TON	$125	$10,000.00
5	0503000	Removal of Floorbeams and Deck	2,800	SF	$50	$140,000.00
6	0503001	Removal of Superstructure (Truss)	1	LS	$160,000	$160,000.00
7	503946	Reset Existing Superstructure (Truss)	1	LS	$200,000	$200,000.00
8	0513003	1-1/2" Polyvinyl Chloride Plastic Pipe	24	LF	$40	$960.00
9	0520035	Silicone Expansion Joint System	44	LF	$380	$16,720.00
10	0522155	Replace Bridge Bearings	9	EA	$400	$3,600.00
11	0522156	Replace Expansion Bearings	9	EA	$400	$3,600.00
12	0522281	Steel Bearing Assemblies	4	EA	$800	$3,200.00
13	0601000	Class "A" Concrete	85	CY	$800	$68,000.00
14	0601201	Class "F" Concrete	40	CY	$1,000	$40,000.00
15	0602000	Deformed Steel Bars	10,200	LBS	$1.75	$17,850.00
16	0602006	Deformed Steel Bars- Epoxy Coated	7,000	LBS	$2	$14,000.00
17	0603142	Field Touch up Painting	710	SF	$30	$21,300.00
18	0603270	Orthotropic Steel Deck	3,741	SF	$50	$187,050.00
19	0603444	Painting of Structural Steel (Truss)	7,100	SF	$20	$142,000.00
20	0603653	Class 1 Containment and Collection of Surface Preparation Debris	7,100	SF	$20	$142,000.00
21	0603851	Structural Steel (Low Alloy)	1,130	CWT	$450	$508,500.00
22	0603851X	Structural Steel (Low Alloy) - Eyebars	3,500	LBS	$50	$175,000.00
23	0707001	Membrane Waterproofing (Woven Glass Fabric)	489	SY	$40	$19,560.00
24	0708001	Damproofing	40	SY	$20	$800.00
25	0904042	Metal Bridge Rail (Combination) - Alum	384	LF	$95	$36,480.00
26	120900X	Painted Pavement Makings	516	LF	$2.0	$1,032.00
27	1401045	Handling Water	1	LS	$20,000	$20,000.00
28	1500126	Utility Conduit Relocation	500	LF	$10.00	$5,000.00

FOR HIGHWAY

	Item #		Item	Qty	Unit	Unit Price	Total
29	202000	0	EARTH EXCAVATION	250	CY	$15.00	$3,750.00
30	207000	0	BORROW	250	CY	$12.00	$3,000.00
31	212000	0	SUBBASE	135	CY	$40.00	$5,400.00
32	304002	0	PROCESSED AGGREGATE BASE	60	CY	$45.00	$2,700.00
33	406171	0	HMA S0.5	75	TON	$120.00	$9,000.00
34	703010	0	STANDARD RIPRAP	310	CY	$80.00	$24,800.00
35	815001	0	BITUMINOUS CONCRETE LIP CURBING	275	LF	$5.00	$1,375.00
36	922501	0	BITUMINOUS CONCRETE DRIVEWAY	55	SY	$35.00	$1,925.00

STRUCTURE ESTIMATE

Subtotal	$1,995,952.00
Minor Items-10%	$199,595
Subtotal (A)	$2,195,547.20

HIGHWAY ESTIMATE

Subtotal	$51,950.00
Minor Items-10%	$5,195.00
Subtotal (B)	$57,145.00

STUCTURE AND HIGHWAY SUBTOTAL

Subtotal (C)	$2,252,692.20

FOR LUMP SUM ITEMS

Item #	Item	Qty	Unit	Unit Price	Total
201030	Clearing & Grubbing (3% of C)	1	LS		$67,580.77
971001 A	Maintenance & Protection of Traffic (4% of C)	1	LS		$90,107.69
975002	Mobilization (7% of C)	1	LS		$157,688.45
980001 A	Construction Staking (1% of C)	1	LS		$22,526.92
	LUMP SUM ESTIMATE				
				TOTAL (D)	$337,903.83
				ROADWAY/STRUCTURES TC	$2,590,596.03

ADDITIONAL ITEMS

INCIDENTALS 25% OF E)	$647,649.01
CONTINGENCIES (7% OF E)	$181,341.72

TOTAL CONTRACT CONSTRUCTION COST (2013)	$3,419,587
TOTAL CONSTRUCTION COST WITH 4% INFLATION (2015)	$3,698,625
TOTAL CONSTRUCTION COST	$3,700,000

* Prepared in accordance with the *Connecticut Department of Transportation's Preliminary Cost Estimating Guidelines - 2013.*

G:\WT11\0001\Bridge\Calcs\Alt 1B - HS20 - 20' Roadway\[Estimate - Alt 1B.xlsx]Alt 2

Town of Canton
Rehabilitation of Bridge No. 05222
Town Bridge Road over Farmington River

Alternative 2 (HL93)
Preliminary Construction Cost Estimate

FOR STRUCTURE

	Item #	Item	Qty	Unit	Unit Price	Total
1	0203000	Structure Excavation - Earth (Complete)	540	CY	$40	$21,600.00
2	0204001	Cofferdam and Dewatering	100	LF	$230	$23,000.00
3	0216000	Pervious Structure Backfill	300	CY	$50	$15,000.00
4	0219001	Sedimentation Control Systems	1,000	LF	$4	$4,000.00
5	0406173	H.M.A S0.25	180	TON	$125	$22,500.00
6	0508001	Shear Connectors	1	LS	$10,435	$10,435.00
7	0513003	1-1/2" Polyvinyl Chloride Plastic Pipe	48	LF	$40	$1,920.00
8	0520035	Silicone Expansion Joint System	139	LF	$380	$52,820.00
9	0521001	Elastomeric Bearing Pads	6,912	CI	$1.5	$10,368.00
10	0601000	Class "A" Concrete	140	CY	$800	$112,000.00
11	0601201	Class "F" Concrete	660	CY	$1,000	$660,000.00
12	0602000	Deformed Steel Bars	16,800	LBS	$1.75	$29,400.00
13	0602006	Deformed Steel Bars- Epoxy Coated	127,750	LBS	$2	$255,500.00
14	0603102	Abrasive Blast Cleaning and Field Painting of Structure	7,100	SF	$30	$213,000.00
15	0603653	Class 1 Containment and Collection of Surface Preparation Debris	7,100	SF	$20	$142,000.00
16	0603851	Structural Steel (Low Alloy)	6,950	CWT	$450	$3,127,500.00
17	0702101	Furnishing Steel Piles	135,000	LBS	$1	$135,000.00
18	0702111	Driving of Steel Piles	1,600	LF	$30	$48,000.00
19	0702115	Splicing of Steel Piles	4	EA	$470	$1,880.00
20	0702XXX	Test Pile	4	EA	$12,000	$48,000.00
21	0702120	Point Reinforcement for Steel Piles	20	EA	$200	$4,000.00
22	0702797	Dynamic Pile Driving Analysis (P.D.A) Test	4	EA	$5,000	$20,000.00
23	0707001	Membrane Waterproofing (Woven Glass Fabric)	1,220	SY	$40	$48,800.00
24	0708001	Damproofing	150	SY	$20	$3,000.00
25	0904041	Metal Bridge Rail (Combination)	824	LF	$450	$370,800.00
26	120900X	Painted Pavement Makings	1,176	LF	$2.0	$2,352.00
27	1401045	Handling Water	1	LS	$20,000	$20,000.00
28	1500126	Utility Conduit Relocation	500	LF	$10.00	$5,000.00

FOR HIGHWAY

	Item #	Item	Qty	Unit	Unit Price	Total
29	202000	EARTH EXCAVATION	1,800	CY	$12.50	$22,500.00
30	207000	BORROW	1,800	CY	$9.00	$16,200.00
31	212000	SUBBASE	1,000	CY	$30.00	$30,000.00
32	304002	PROCESSED AGGREGATE BASE	400	CY	$35.00	$14,000.00
33	406171	HMA S0.5	525	TON	$105.00	$55,125.00
34	507001	TYPE 'C' CATCH BASIN	10	EA	$2,400.00	$24,000.00
35	651012	15" R.C. PIPE	250	LF	$50.00	$12,500.00
36	703010	STANDARD RIPRAP	225	CY	$80.00	$18,000.00
37	815001	BITUMINOUS CONCRETE LIP CURBING	1,850	LF	$5.00	$9,250.00
38	921001	CONCRETE SIDEWALK	525	SF	$10.00	$5,250.00
39	921022 A	STONE DUST FOR PATHWAY	4,600	SF	$1.00	$4,600.00
40	922501	BITUMINOUS CONCRETE DRIVEWAY	690	SY	30	20700
		STRUCTURE ESTIMATE				

Subtotal	$5,407,875.00
Minor Items-10%	$540,788

Subtotal (A)	$5,948,662.50

HIGHWAY ESTIMATE

Subtotal	$232,125.00
Minor Items-10%	$23,212.50
Subtotal (B)	$255,337.50

STUCTURE AND HIGHWAY SUBTOTAL

Subtotal (C)	$6,204,000.00

FOR LUMP SUM ITEMS

Item #	Item	Qty	Unit	Unit Price	Total
201030	Clearing & Grubbing (3% of C)	1	LS		$186,120.00
971001 A	Maintenance & Protection of Traffic (4% of C)	1	LS		$248,160.00
975002	Mobilization (7% of C)	1	LS		$434,280.00
980001 A	Construction Staking (1% of C)	1	LS		$62,040.00

LUMP SUM ESTIMATE

TOTAL (D)	$930,600.00
ROADWAY/STRUCTURES TO	$7,134,600.00

ADDITIONAL ITEMS

INCIDENTALS 25% OF E)	$1,783,650.00
CONTINGENCIES (7% OF E)	$499,422.00

TOTAL CONTRACT CONSTRUCTION COST (2013)	$9,417,672
TOTAL CONSTRUCTION COST WITH 4% INFLATION (2015)	$10,186,154
TOTAL CONSTRUCTION COST	$10,190,000

* Prepared in accordance with the *Connecticut Department of Transportation's Preliminary Cost Estimating Guidelines -*

G:\WT11\0001\Bridge\Calcs\Alt 4 - 26' Roadway, New Alignment\[Estimate Alt-4.xlsx]Alt 3