MEMORANDUM OF AGREEMENT
AMONG
FEDERAL HIGHWAY ADMINISTRATION,
OKLAHOMA DEPARTMENT OF TRANSPORTATION,
AND THE OKLAHOMA STATE HISTORIC PRESERVATION OFFICE,
REGARDING
ADVERSE EFFECT TO SH-66B BRIDGE OVER CAPTAIN CREEK

WHEREAS, the Oklahoma Department of Transportation (ODOT) plans to address functional and structural deficiencies in the SH-66B over Captain Creek pony truss bridge in Lincoln County, Oklahoma, a property listed on the National Register of Historic Places (NRHP) (NR ID 4000134); and

WHEREAS, ODOT plans to eliminate the fracture-critical status of the structure by removing fracture-critical pier beams and adding a new multi-beam steel superstructure with a concrete deck to which the existing trusses would be attached; and

WHEREAS, the Federal Highway Administration (FHWA) plans to fund the Federal-Aid Project STP-241C(059)PM, State Job J/P 28034(04), thereby making the Project an undertaking subject to review under Section 106 of the National Historic Preservation Act (NHPA, 16 U.S.C. § 470 et seq.), and its implementing regulations, 36 CFR Part 800; and

WHEREAS, the Federal Highway Administration (FHWA) has approved Alternative 2(d) as described in Infrastructure Engineers, Inc. and TransSystems' report entitled *Design Support for Section 4(f) Analysis for Historic Bridges Structure No. 4124 0157 X (NBI No. 3800) SH-66B over Captain Creek*; and

WHEREAS, FHWA and ODOT, in accordance with SHPO concluded that the subject alternative will have an adverse effect to the subject bridge by constructing a new multi-beam steel superstructure with a concrete deck, to which the existing trusses would be re-attached using diaphragms at the lower chord panel points; and

WHEREAS, in accordance with 36 CFR § 800.3(f), ODOT and FHWA, in consultation with the Oklahoma SHPO, identified the Historic Bridge Foundation, the National Park Service Route 66 Corridor Preservation Program, the Oklahoma Route 66 Association, Route 66 Historian Jim Ross, the Oklahoma Historic Bridge and Highway Group, and Preservation Oklahoma, as consulting parties and has invited them to sign this MOA as a concurring party; and

WHEREAS, FHWA has consulted with the Iowa Tribe of Oklahoma, Kickapoo Tribe of Oklahoma, Osage Nation, Sac and Fox Nation, and Wichita and Affiliated Tribes in accordance with 36 CFR § 800.2(c)(2), and determined that no properties of traditional religious cultural significance will be affected by the undertaking; and

WHEREAS, in accordance with 36 CFR § 800.6(a)(1), FHWA has notified the Advisory Council on Historic Preservation (ACHP) of its adverse effect determination with specified documentation

and the ACHP has chosen not to participate in the consultation pursuant to 36 CFR § 800.6(a)(1)(iv) as a signatory to this MOA; and

NOW, THEREFORE, FHWA, Oklahoma Department of Transportation, and the Oklahoma SHPO agree that the undertaking shall be implemented in accordance with the following stipulations in order to take into account the effect of the undertaking on historic properties.

STIPULATIONS

FHWA will ensure that the following measures are carried out. Measures will be met within the timeframes presented for each stipulation.

I. **Documentation.** The subject bridge was listed on the NRHP in 2004. While substantial information was collected to compile the NRHP nomination form, additional research is warranted to complete the documentation of the bridge. Prior to the construction of the new bridge, ODOT will record the existing bridge at the equivalent of Level II documentation as specified by the Historic American Engineering Record (HAER).

A. High Quality, 35 mm color photographs of the bridge documenting its present appearance and major structural or decorative details, together with all negatives on archival gold CD as digital TIFF files that meet or exceed the minimum requirement for pixel depth. The photographs will be a minimum 4" x 6" and no larger than 8" x 10", and will be clearly labeled with the following information:

a. Name of property;
b. Location (county, city, state, and street address);
c. Name of photographer;
d. Date of photograph;
e. Location of photographic negative;
f. Indication of direction camera is pointing; and
g. Number of photograph in series.

Photographs are to be submitted by ODOT and approved by SHPO as meeting the conditions outlined above before any work takes place that will affect the property.

B. Photographic reproduction of selected original (as-built) construction plans and historic photographs, if they exist.

C. Preparation of a brief written technical description of the bridge and historical summary.

D. All documentation will be edited, catalogued and packaged in a manner acceptable to the Oklahoma SHPO. The Oklahoma SHPO will be the repository for the documentation.

E. Within three years of the execution of this MOA, ODOT will provide all research documentation, research materials, copies of photographs, and HAER documentation of the bridge to the Oklahoma SHPO.

II. **Public Interpretation.** ODOT will implement three interpretation measures in order

to engage and educate the public on the history of Route 66 and the Captain Creek Bridge.

A. In consultation with Oklahoma SHPO, ODOT has recognized an absence of public interpretation activities addressing the experience of African-American motorists on Route 66. Using resources such as *The Negro Motorist Green Book*, ODOT will develop a Google Earth and GIS layer of contemporary businesses that were known to provide products and services such as fuel, food, and lodging to African-American customers along Oklahoma's highways, including Route 66. The Google Earth and GIS layers will be made available on ODOT's Route 66 web page: http://www.odotculturalresources.info/route-66.html and will be prepared as a pamphlet that can be distributed at other ODOT public meetings and events. Pamphlets will be placed in the kiosk in the lobby of the ODOT central office.

B. ODOT will develop a historic context addressing the experience of African-American motorists on Oklahoma highways during the twentieth century. The context will explore themes including the availability of merchants willing to provide products and services to African-American travelers, the necessity of identifying and adapting to local and regional behavioral customs, and travel risks such as "sundown towns." The context will be made available on ODOT's web page: http://www.odotculturalresources.info/route-66.html and will be prepared as a pamphlet or other document that can be distributed at other ODOT events if ODOT determines the context to be of appropriate length. If pamphlets are produced, they will be placed in the kiosk in the lobby of the ODOT central office.

III. **Mitigation.** In 2014, ODOT completed the *Historic Bridge Railing Study for Route 66 Bridges* study. The study was undertaken in accordance with goals outlined in the *Route 66 Corridor Management Plan* and the *Route 66 Economic Impact Study* (the study)to maintain the intrinsic qualities of Route 66 and identify the historic route to tourists and the travelling public. The study was also conducted to identify context-sensitive crash-tested railings for Route 66 bridge replacement projects. The report documented 32 historic-age Route 66 bridges that still retained their original railings and identified nine distinct railing types among those structures, which have already been implemented on other Route 66 bridges that were not eligible for or listed on the NRHP. The original railings on the Captain Bridge have been removed, however upon review of the as-built plans, it is clear that the railings were an example of a concrete post and beam within set panels (Railing Type A from the study). The crash-tested replacement recommendation is the Texas T66 railing. ODOT will incorporate the Texas T66 railing in the new bridge carrying SH-66B over Captain Creek.

IV. **Duration.** This MOA will be null and void if its stipulations are not carried out within ten (10) years from the date of its execution. At such time, and prior to work continuing on the undertaking, FHWA shall either (a) execute a MOA pursuant to 36 CFR § 800.6, or (b) request, take into account, and respond to the comments of the ACHP under 36 CFR § 800.7. Prior to such time, FHWA may consult with the other signatories to reconsider the terms of the MOA and amend it in accordance with Stipulation VII

below. FHWA shall notify the signatories as to the course of action it will pursue.

V. **Post-Review Discoveries.** If potential historic properties are discovered or unanticipated effects on historic properties found, FHWA shall follow ODOT Spec 107.09, Protection of Archeological and Unmarked Human Burial Sites.

VI. **Dispute Resolution.** Should any signatory party to this MOA object at any time to any actions proposed or the manner in which the terms of this MOA are implemented, FHWA shall consult with such party to resolve the objection. If FHWA determines that such objection cannot be resolved, FHWA will:

A. Forward all documentation relevant to the dispute, including FHWA's proposed resolution, to the ACHP. The ACHP shall provide FHWA with its advice on the resolution of the objection within thirty (30) days of receiving adequate documentation. Prior to reaching a final decision on the dispute, FHWA shall prepare a written response that takes into account any timely advice or comments regarding the dispute from the ACHP, signatories and concurring parties, and provide them with a copy of this written response. FHWA will then proceed according to its final decision.

B. If the ACHP does not provide its advice regarding the dispute within the thirty (30) day time period, FHWA may make a final decision on the dispute and proceed accordingly. Prior to reaching such a final decision, FHWA shall prepare a written response that takes into account any timely comments regarding the dispute from the signatories and concurring parties to the MOA, and provide them and the ACHP with a copy of such written response.

C. FHWA's responsibility to carry out all other actions subject to the terms of this MOA that are not the subject of the dispute remain unchanged.

VII. **Amendments.** This MOA may be amended when such an amendment is agreed to in writing by all signatories. The amendment will be effective on the date a copy signed by all of the signatories is filed with the ACHP.

VIII. **Termination.** If any signatory to this MOA determines that its terms will not or cannot be carried out, that party shall immediately consult with the other parties to attempt to develop an amendment per Stipulation VII, above. If within thirty (30) days (or another time period agreed to by all signatories) an amendment cannot be reached, any signatory may terminate the MOA upon written notification to the other signatories.

Once the MOA is terminated, and prior to work continuing on the undertaking, FHWA must either (a) execute an MOA pursuant to 36 CFR § 800.6, or (b) request, take into account, and respond to the comments of the ACHP under 36 CFR § 800.7. FHWA shall notify the signatories as to the course of action it will pursue.

Execution of this MOA by FHWA and SHPO and implementation of its terms evidence that

FHWA has taken into account the effects of this undertaking on historic properties and afforded the ACHP an opportunity to comment.

Signatory

MOA Job/Piece 28034(04) SH-66B over Captain Creek in Lincoln County, Oklahoma
(Structure 4124 0157 X; NBI 3800)

OKLAHOMA DEPARTMENT OF TRANSPORTATION

BY: _____ DATE:_____
Siv Sundaram
Environmental Programs Division Engineer

BY: _____ DATE:_____
Kevin Bloss
Division III Engineer

Signatory

MOA Job/Piece 28034(04) SH-66B over Captain Creek in Lincoln County, Oklahoma (Structure 4124 0157 X; NBI 3800)

FEDERAL HIGHWAY ADMINISTRATION

BY: _____ DATE:_____

Elizabeth Romero
Environmental Program Manager
Oklahoma Division

Signatory

MOA Job/Piece 28034(04) SH-66B over Captain Creek in Lincoln County, Oklahoma (Structure 4124 0157 X; NBI 3800)

OKLAHOMA STATE HISTORIC PRESERVATION OFFICER

BY: _____ DATE:_____

Lynda Ozan
Deputy State Historic Preservation Officer

Concurring Party

MOA Job/Piece 28034(04) SH-66B over Captain Creek in Lincoln County, Oklahoma (Structure 4124 0157 X; NBI 3800)

HISTORIC BRIDGE FOUNDATION

BY: _____ DATE:_____

Kitty Henderson
Executive Director

Concurring Party

MOA Job/Piece 28034(04) SH-66B over Captain Creek in Lincoln County, Oklahoma (Structure 4124 0157 X; NBI 3800)

NATIONAL PARK SERVICE ROUTE 66 CORRIDOR PRESERVATION PROGRAM

BY: _____ DATE:_____

Kaisa Barthuli
Program Manager

Concurring Party

MOA Job/Piece 28034(04) SH-66B over Captain Creek in Lincoln County, Oklahoma
(Structure 4124 0157 X; NBI 3800)

OKLAHOMA ROUTE 66 ASSOCIATION

BY: _____ DATE:_____
Brad Nickson
President

Concurring Party

MOA Job/Piece 28034(04) SH-66B over Captain Creek in Lincoln County, Oklahoma (Structure 4124 0157 X; NBI 3800)

JIM ROSS, ROUTE 66 HISTORIAN

BY: _____ DATE:_____
Jim Ross

Concurring Party

MOA Job/Piece 28034(04) SH-66B over Captain Creek in Lincoln County, Oklahoma
(Structure 4124 0157 X; NBI 3800)

OKLAHOMA HISTORIC BRIDGE AND HIGHWAY GROUP

BY: _____ DATE:_____
Weslee Kinsler
Administrator

Concurring Party

MOA Job/Piece 28034(04) SH-66B over Captain Creek in Lincoln County, Oklahoma (Structure 4124 0157 X; NBI 3800)

PRESERVATION OKLAHOMA

BY: _____ DATE:_____

Cayla Lewis
Executive Director

Checklist
for Section 4(f) Programmatic Evaluation of Historic Bridge Projects

Bridge Name: State Highway (SH) 66B Bridge over Captain Creek

Bridge Location: SH-66B, 1.5 miles northeast of SH-66 near Wellston, Oklahoma

County: Lincoln

Division: Field Division 3

Job/Piece (J/P): 28034(04)

Federal-Aid Project Number: STP-241C(059) PM

Highway/Facility: SH-66B

Bridge Type: Camelback Pony Truss

NBI #: 03800 **Structure #:** 4124 0157 X

I. Description of Project Scope/Need and Purpose Statement

The project need results from the structural deficiency and functional obsolescence of the existing SH-66B Bridge over Captain Creek. The bridge is structurally deficient due to deterioration of load-carrying structural elements, including the bridge's superstructure and substructure. Structural deficiencies of a bridge can be rated using National Bridge Inventory (NBI) condition ratings, scored on a scale of 0-Failed to 9-Excellent Condition. The most recent bridge inspection (March 2016) rated the bridge's superstructure in 4-Poor Condition and the substructure in 4-Poor Condition. The superstructure exhibits severe corrosion and section loss of the bottom chords, floorbeams, and stringers, as well as cracks at the Span 1 and 5 beam-to-pier beam connections. The substructure also exhibits extensive cracks and spalls. The inspection showed the abutments and piers to be in poor condition with cracking, spalling, and exposed rebar with section losses. Additionally, a bearing is cracked and split, and another bearing has a sheared corner due to movement of the superstructure.

The bridge is also functionally obsolete due to its narrow width and substandard railings. The bridge currently has a clear roadway width of 22 feet. Current design standards call for a minimum clear roadway width of 28 feet for a two-way roadway based on the functional classification of SH-66B as a rural major collector. The current Average Annual Daily Traffic (AADT) for the roadway at the bridge is 800 vehicles per day, with an anticipated AADT of 1,120 vehicles per day in the year 2035. The bridge's existing metal X-lattice railing, attached to the truss panels, is not crash-tested and may need to be replaced with a crash-tested rail. The bridge's current sufficiency rating is 30.3 out of a possible 100 points.

The project's purpose is to provide a safe crossing and preserve transportation continuity over Captain Creek. The project also seeks to preserve the intrinsic qualities of Route 66. The need of the project is to address the current structural and functional deficiencies of the existing bridge and approach roadway.

II. Determination of Applicability

All must result in a Yes answer for this checklist to be used.

Yes	No	
☒	☐	The project requires the use of a bridge defined as historic per Section 106 regulations (36 CFR 800)
☒	☐	The historic bridge is not a designated National Historic Landmark (NHL).
		The project results in:
☒	☐	Section 4(f) use of a historic bridge, AND
☒	☐	Additional impacts to other protected Section 4(f) properties (if any) are limited to *de minimis* or exception categories as specified in the Scope of Work.

III. Identify additional Section 4(f) properties in the project area

Either exception, de minimis, or another programmatic

There are no additional Section 4(f) properties in the project area.

Comments: N/A

IV. Alternatives Considered/Findings

Alternative 1: No Build *(Indicate all that apply.)*

☒ **Structural Deficiencies**

The No Build alternative does not correct the situation that causes the bridge to be considered structurally deficient or significantly deteriorated. These deficiencies can lead to eventual structural failure/collapse. Normal maintenance is not considered adequate to address these deficiencies.

☒ **Functional/Geometric Deficiencies**

The No Build alternative does not correct the situation that causes the bridge to be considered functionally/geometrically deficient. These deficiencies can lead to safety hazards to the traveling public or place unacceptable restrictions on transport and travel.

☒ **Justification** *(Summary describing constraints posed by terrain; adverse social, economic or environmental effects, engineering and economic considerations, and preservation standards)*

This alternative would leave the existing structure in place without bypass, rehabilitation, or replacement. The existing structure would receive minor superstructure repairs, substructure repairs, and painting. This alternative would avoid use of the historic bridge

as a Section 4(f) property and would have the least impact on the historic integrity of the bridge in the short term.

However, the existing structural deficiencies present in the superstructure and substructure will worsen and develop into more significant defects. In addition, the existing functional inadequacies related to narrow roadway width and substandard non-crash-tested railings would remain unaddressed. If the bridge were closed to traffic in the future due to deteriorating conditions, the detour route length is 0.5 miles and would require Hickory Avenue, which is currently a city street, to be upgraded to state standards prior to being a viable detour route.

This alternative would not meet the project purpose and need because it would not provide a safe crossing and preserve transportation continuity over Captain Creek.

☒ **Recommendation (Mandatory)**

This alternative does not meet the project purpose and need. It fails the Section 4(f) prudent and feasible standard and is not recommended.

Alternative 2: Rehabilitation of Existing Bridge

The following four rehabilitation alternatives were identified and considered for this project:

Alternative 2(a): Rehabilitation and Widening of Existing Bridge, Bridge Remains Fracture-Critical

☒ **Structural Deficiencies**

This rehabilitation alternative would correct the situation that causes the bridge to be considered structurally deficient and significantly deteriorated. However, the bridge would remain fracture-critical. This alterative would leave a fracture critical bridge carrying traffic. Widening of the structure would have resulted in an adverse effect to the bridge and a 4(f) use.

☒ **Functional/Geometric Deficiencies**

The rehabilitation alternative would correct the situation that causes the bridge to be considered functionally/geometrically deficient. Widening of the structure would have resulted in an adverse effect to the bridge and a 4(f) use.

☒ **Justification** *(Summary describing constraints posed by terrain; adverse social, economic or environmental effects, engineering and economic considerations, and preservation standards)*

This alternative would rehabilitate the existing bridge to meet current Oklahoma Department of Transportation (ODOT) and American Association of State Highway and Transportation Officials (AASHTO) design standards regarding structural and functional/geometric adequacy. The existing bridge would remain in place and continue to allow two-way vehicular traffic. The main span would be widened to increase the curb-to-curb width from 22 feet to 28 feet, and both approach spans would be widened by adding

one beam line and an additional six feet of deck width. The rehabilitation would replace the metal X-lattice rail with crash-tested, context-sensitive guardrails. Substructure modifications would include several new steel H-piles at the abutments and one new drilled shaft at each pier. Abutments and piers would also require augmentation to accommodate the widened portion of the structure. The substructure work would be designed and constructed to closely match the look of the existing abutments and piers. All remaining structural steel would be cleaned and painted, which would likely require special containment due to the presence of lead-based paint. The total cost of this alternative is estimated to be $1,799,338.

This alternative would rehabilitate the bridge so that it is no longer structurally deficient or functionally obsolete. However, the bridge would remain fracture critical due to a lack of load path redundancy to the pony truss main span. The deteriorated superstructure and substructure elements would be replaced or repaired. The bridge would meet current design standards for roadway width and would have railings that meet full-scale crash criteria.

This alternative would result in a use of the bridge as a Section 4(f) property, through widening the current 22-foot width of the bridge, which the Oklahoma State Historic Preservation Office (SHPO) has identified as a defining characteristic of the bridge. These alterations would result in a loss of the bridge's historic integrity and would result in an adverse effect to the bridge. This alternative is therefore not considered an avoidance alterative.

☒ **Recommendation (Mandatory)**

This alternative fails the Section 4(f) prudent and feasible standard and is not recommended.

Alternative 2(b): Rehabilitation and Widening of Existing Bridge, Eliminating Fracture- Critical Designation

☒ **Structural Deficiencies**

This rehabilitation alternative would correct the situation that causes the bridge to be considered structurally deficient and significantly deteriorated, and would also eliminate the fracture-critical status of the bridge. This alterative would result in a use of the Section 4(f) property and is not considered an avoidance alternative.

☒ **Functional/Geometric Deficiencies**

The rehabilitation alternative would correct the situation that causes the bridge to be considered functionally/geometrically deficient. However, this alterative would result in a use of the Section 4(f) property and is not considered an avoidance alternative.

☒ **Justification** *(Summary describing constraints posed by terrain; adverse social, economic or environmental effects, engineering and economic considerations, and preservation standards)*

This alternative is similar to alternative 2(a), with the following exceptions: Alternative 2(b) would provide load path redundancy to the pony truss main span through replacement of the truss span as the primary load-carrying element with a new multi-beam steel superstructure and concrete deck, to which the existing trusses would be reattached using diaphragms at the lower chord panel points. The trusses would continue to support their own weight in order to appear functional. Fracture-critical pier beams would be removed and intermediate piers would be completely reconstructed. New piers would support the new beams for the main span, the existing and new beams for the approach spans, and the existing trusses. The total cost of this alternative is estimated to be $2,008,707.

This alternative would rehabilitate the bridge so that it is no longer structurally deficient, functionally obsolete, or fracture critical. The deteriorated superstructure and substructure elements would be replaced or repaired. The bridge would meet current design standards for roadway width and would have railings that meet full-scale crash criteria.

ODOT originally selected this alternative as it's preferred. Consultation with SHPO resulted in an adverse effect determination, which would be considered a 4(f) use. This alternative would result in a use of the bridge as a Section 4(f) property through widening the current 22-foot width of the bridge, which the Oklahoma SHPO has identified as a defining characteristic of the bridge. The SHPO has also stated that the replacement of the truss span as the primary load-carrying element is not a rehabilitation of the bridge, but rather the replacement of the existing historic bridge with a new bridge using salvaged elements from the existing bridge. These alterations would result in a loss of the bridge's historic integrity and would result in an adverse effect to the bridge. This alternative is therefore not considered an avoidance alterative.

☒ **Recommendation (Mandatory)**

This alternative fails the Section 4(f) prudent and feasible standard and is not recommended.

Alternative 2(c): Rehabilitation of Existing Bridge, Bridge Remains Fracture-Critical; Design Exception to Keep Existing Bridge Width

☒ **Structural Deficiencies**

This rehabilitation alternative would correct the situation that causes the bridge to be considered structurally deficient and significantly deteriorated, but would not eliminate the fracture-critical status of the bridge. This alterative would not result in a use of the Section 4(f) property and is considered an avoidance alternative.

☒ **Functional/Geometric Deficiencies**

The rehabilitation alternative would not correct the situation that causes the bridge to be considered functionally/geometrically deficient. However, this alterative would not result in a use of the Section 4(f) property and is considered an avoidance alternative.

☒ **Justification** *(Summary describing constraints posed by terrain; adverse social, economic or environmental effects, engineering and economic considerations, and preservation standards)*

This alternative would include replacement of the stringers and floorbeams with new members made of higher-strength steel than is currently in place, and would also include deck replacement for the main span and approach spans. The existing trusses would be jacked in order to install new bearings, either from locations on the piers or abutments, or using temporary supports braced to the existing piers. The existing substructure would require widespread concrete remediation, and holes for new adhesive or mechanical anchor bolts would be drilled as part of the bearing replacement. The roadway barriers and pedestrian railings would also be upgraded to crash tested and approved railings. As with the other rehabilitation options, all remaining structural steel would be cleaned and painted, which would likely require special containment due to the presence of lead-based paint. The total cost of this alternative is estimated to be $1,128,206.

This alternative would rehabilitate the bridge so that it is no longer structurally deficient, but it would remain both functionally obsolete and fracture critical. The deteriorated superstructure and substructure elements would be replaced or repaired. The bridge would not meet current design standards for roadway width, but would have railings that meet full-scale crash criteria.

This alternative would not result in a use of the bridge as a Section 4(f) property, since the truss span would retain both its visual appearance and its role as the primary load-carrying element of the bridge. This alternative would result in no adverse effect to the bridge. This alternative is therefore considered an avoidance alterative.

☒ **Recommendation (Mandatory)**

This alternative fails the Section 4(f) prudent and feasible standard and is not recommended. This alternative leaves a fracture critical bridge in place and carrying traffic. Fracture critical structures require more frequent inspections and maintenance.

Alternative 2(d): Rehabilitation of Existing Bridge, Eliminating Fracture-Critical Designation; Design Exception to Keep Existing Bridge Width

☒ **Structural Deficiencies**

This rehabilitation alternative would correct the situation that causes the bridge to be considered structurally deficient and significantly deteriorated, and would eliminate the fracture-critical status of the bridge. However, this alterative would result in a use of the Section 4(f) property and is not considered an avoidance alternative.

☒ **Functional/Geometric Deficiencies**

The rehabilitation alternative would not correct the situation that causes the bridge to be considered functionally/geometrically deficient. This alterative would also result in a use of the Section 4(f) property and is not considered an avoidance alternative.

☒ **Justification** *(Summary describing constraints posed by terrain; adverse social, economic or environmental effects, engineering and economic considerations, and preservation standards)*

Alternative 2(d) would provide load path redundancy to the pony truss main span through replacement of the truss span as the primary load-carrying element with a new multi-beam steel superstructure and concrete deck, to which the existing trusses would be reattached using diaphragms at the lower chord panel points. The trusses would continue to support their own weight in order to appear functional. Fracture-critical pier beams would be removed and intermediate piers would be completely reconstructed. New piers would support the new beams for the main span, the existing and new beams for the approach spans, and the existing trusses. The total cost of this alternative is estimated to be $1,367,792.

This alternative would rehabilitate the bridge so that it is no longer structurally deficient or fracture critical, but it would remain functionally obsolete. The deteriorated superstructure and substructure elements would be replaced or repaired. The bridge would not meet current design standards for roadway width, but would have railings that meet full-scale crash criteria.

This alternative would result in a use of the bridge as a Section 4(f) property through replacement of the truss span as the primary load-carrying element, which the Oklahoma SHPO considers to not be a rehabilitation of the bridge, but rather the replacement of the existing historic bridge with a new bridge using salvaged elements from the existing bridge. These alterations would result in a loss of the bridge's historic integrity and would result in an adverse effect to the bridge. This alternative is therefore not considered an avoidance alterative. However, of the listed alternatives, this alternative has the lowest effect on the bridge's historic integrity while still eliminating the structurally-deficient and fracture-critical status of the bridge that would allow its continued safe use.

☒ **Recommendation (Mandatory)**

This alternative addresses the purpose and need of the project while providing the most cost-effective and reasonable solution to address the current conditions of the bridge. This alternative and **is recommended.** FHWA-Oklahoma Division reviewed and approved Alternative 2(d) on March 15, 2018.

Alternative 3: Build on New Location

The following three alternatives that involved building on a new location were identified and considered for this project:

Alternative 3(a): Retain Existing Bridge in Vehicular Service as Part of a One-Way Couplet, Bridge Remains Fracture- Critical

☒ **Structural Deficiencies**

The new location/one-way pair alternative would correct the situation that causes the bridge to be considered structurally deficient and significantly deteriorated. However, the bridge would remain fracture critical. This alternative would also result in a use of the Section 4(f) property and is not considered an avoidance alternative.

☒ **Functional/Geometric Deficiencies**

The new location/one-way pair alternative would correct the situation that causes the bridge to be considered functionally/geometrically deficient. However, this alterative would result in a use of the Section 4(f) property and is not considered an avoidance alternative.

☒ **Justification** *(Summary describing constraints posed by terrain; adverse social, economic or environmental effects, engineering and economic considerations, and preservation standards)*

This alternative consists of construction of a new bridge adjacent to the historic bridge and use of each structure to carry one lane of one-way traffic plus shoulders in a single direction. The existing bridge would be substantially rehabilitated in similar fashion to Alternative 2(c) above, to address structural issues and substandard railings. The existing bridge would be striped for one 12-foot-wide travel lane with an 8-foot-wide outside shoulder and a 2-foot-wide inside shoulder in order to provide a means to pass should a vehicle break down in the travel lane.

The new bridge and roadway relocation would require additional right-of-way. The cost of this alternative is estimated to be $1,128,206 for the rehabilitation of the existing structure. The cost of a new bridge is estimated at $1,100,000 based on the analysis of Alternative 4. The total cost for Alternative 3a is roughly $2,228,206.

This alternative would meet the project purpose and need to provide a structurally sound bridge by correcting the structural deficiencies and functional obsolescence now present with the existing bridge. The deteriorated superstructure and substructure elements on the existing bridge would be replaced or repaired. Both bridges would meet current design standards and would have railings that meet full-scale crash criteria.

Construction of a new bridge on a parallel alignment would significantly alter the bridge's setting, which would negatively impact the historic integrity and would result in an adverse effect to the bridge, however this adverse effect would not be a 4(f) use due to the fact that the preservation intent of 4(f) is being met. This alternative is considered an avoidance alterative. This alternative also results in extraordinary additional project construction costs through construction of a new bridge and roadway approaches on new parallel alignment, as well as additional maintenance and operational costs associated with retention of the existing bridge as part of a one-way pair. The alternative will cause economic impacts to adjacent property owners through additional permanent right-of-way acquisition.

☒ **Recommendation (Mandatory)**

This alternative fails the Section 4(f) prudent and feasible standard and is not recommended.

Alternative 3(b): Retain Existing Bridge in Vehicular Service as Part of a One-Way Couplet, Eliminating Fracture- Critical Designation

☒ **Structural Deficiencies**

This alternative would correct the situation that causes the bridge to be considered structurally deficient and significantly deteriorated, and the bridge would no longer be fracture critical. However, this alternative would also result in a use of the Section 4(f) property and is not considered an avoidance alternative.

☒ **Functional/Geometric Deficiencies**

This alternative would correct the situation that causes the bridge to be considered functionally/geometrically deficient. However, this alterative would result in a use of the Section 4(f) property and is not considered an avoidance alternative.

☒ **Justification** *(Summary describing constraints posed by terrain; adverse social, economic or environmental effects, engineering and economic considerations, and preservation standards)*

This alternative consists of construction of a new bridge adjacent to the historic bridge and use of each structure to carry one lane of one-way traffic plus shoulders in a single direction. The existing bridge would be substantially rehabilitated in similar fashion to Alternative 2(d) above, to address structural issues and substandard railings. A new multi-beam steel superstructure with a concrete deck would become the primary load carrying element for the bridge, to which the existing trusses would be reattached using diaphragms at the lower chord panel points, thus providing load path redundancy to the pony truss main span. The existing bridge would be striped for one 12-foot-wide travel lane with an 8-foot-wide outside shoulder and a 2-foot-wide inside shoulder in order to provide a means to pass should a vehicle break down in the travel lane.

The new bridge and roadway relocation would require additional right-of-way, which is estimated to result in impacts: permanent acquisition of property and temporary construction easements. The cost of this alternative is estimated to be $1,243,447. The cost of a new bridge is estimated at for $1,100,000 as indicated in Alternative 4, below.. The total cost for Alternative 3b would be $2,343,447.

This alternative would meet the project purpose and need to provide a structurally sound bridge by correcting the structural deficiencies and functional obsolescence now present with the existing bridge. The deteriorated superstructure and substructure elements on the existing bridge would be replaced or repaired. Both bridges would meet current design standards and would have railings that meet full-scale crash criteria.

This alternative would result in a use of the existing bridge as a Section 4(f) property due to alterations with the existing bridge. These alterations, in addition to the construction of a new bridge on a parallel alignment, would significantly alter the historic integrity of the bridge, and would result in an adverse effect to the bridge. This alternative is therefore not considered an avoidance alterative. This alternative also results in extraordinary additional project construction costs through construction of a new bridge and roadway approaches on new parallel alignment, as well as additional maintenance and operational costs associated with retention of the existing bridge as part of a one-way pair. The alternative will cause economic impacts to adjacent property owners through additional permanent right-of-way acquisition from adjacent landowners.

☒ **Recommendation (Mandatory)**

This alternative fails the Section 4(f) prudent and feasible standard and is not recommended.

Alternative 3(c): Retain Existing Bridge in Place as a Non-Functional "Monument" or as a Non-Vehicular Pedestrian or Bicycle Facility

☒ **Structural Deficiencies**

This alternative would result in the bridge no longer being considered structurally deficient, since the bridge would no longer be carrying vehicular traffic.

☒ **Functional/Geometric Deficiencies**

This alternative would cause the bridge to no longer be considered functionally/geometrically deficient, since it would be restricted to pedestrian and bicyclist usage at most.

☒ **Justification** *(Summary describing constraints posed by terrain; adverse social, economic or environmental effects, engineering and economic considerations, and preservation standards)*

This alternative consists of retaining the bridge for non-vehicle use, such as a dedicated bridge for pedestrians and bicyclists. An analysis of the bridge based on a pedestrian load of 90 pounds per square foot concluded that the existing truss in its current configuration and condition would function adequately as a pedestrian bridge. No improvements or strengthening are required, with the exception of some minor repairs to the existing floorbeams and stringers due to section loss. Minor substructure repairs are also recommended, along with painting the entire structure. In order to preserve transportation continuity, a new bridge would be constructed to parallel the existing truss structure, once converted into e monument or pedestrian bridge. The cost of this alternative is estimated to be $418,660 for the rehabilitation work on the truss and $1,100,000 for the construction of the new bridge. The total cost of this alternative would be $1,518,660.

This alternative would meet the project purpose and need to provide a safe crossing and preserve transportation continuity over Captain Creek, by constructing a new facility. Although pedestrians and bicyclists could continue to use the bridge for transportation, vehicular traffic would no longer be allowed to use the existing bridge.

The elimination of vehicular traffic on this bridge would also eliminate the bridge's association with Historic Route 66, which was the basis of the bridge's NRHP nomination under Criterion A. Closure of the bridge to vehicular traffic would also negatively impact the historic integrity of the Route 66 alignment upon which the bridge lies. While this alternative would result in an adverse effect, it would not be considered a 4(f) use.

☒ **Recommendation (Mandatory)**

This alternative fails the Section 4(f) prudent and feasible standard and is not recommended.

Alternative 4: New Bridge with Existing Trusses Added as an Architectural/Historic Feature (New or Existing Alignment)

☒ **Structural Deficiencies**

This rehabilitation alternative would result in a new bridge that is neither structurally deficient nor fracture critical. However, this alterative would result in a use of the Section 4(f) property and is not considered an avoidance alternative.

☒ **Functional/Geometric Deficiencies**

The rehabilitation alternative would result in a new bridge that is not functionally/geometrically deficient. However, this alterative would also result in a use of the Section 4(f) property and is not considered an avoidance alternative.

☒ **Justification** *(Summary describing constraints posed by terrain; adverse social, economic or environmental effects, engineering and economic considerations, and preservation standards)*

This alternative would remove the existing bridge and construct a new bridge that would carry two-way traffic on the existing SH-66B alignment. The existing bridge trusses would be mounted on each side of the new bridge in Span 2. The new bridge would consist of three spans in a 70'-100'-70' configuration and an approximately 30 degree skew. Type IV PC beams would be utilized for both approach spans, with either Type IV PC beams or steel I-beams for the main span. If Type IV PC beams are used throughout, the total cost of this alternative is estimated to be $1,079,090.

This alternative would meet the project purpose and need to provide a structurally sound bridge through construction of a new bridge and removal of the existing structurally deficient/functionally obsolete bridge from service. However, removal of this bridge would result in the elimination of an NRHP-listed structure.

☒ **Recommendation (Mandatory)**

This alternative fails the Section 4(f) prudent and feasible standard and is not recommended.

V. Measures to Minimize Harm

Indicate all that apply, but a minimum of one must be selected. Verify that the project includes all possible planning to minimize harm.

☐ Measures taken to preserve historic integrity per preservation standards

☐ Measures taken to market historic bridge for alternative use:

☒ Alternative design measures taken to address deficiencies that complies with codes:

- As part of the project, it will be necessary to address the approach and main span railings. As depicted in the current photographs of the bridge, the approach and main span currently have a 'W' rail that is not original to the bridge. The main span retains the lattice rail, however (though it is protected by the 'W' rail). According to the as-built plans for the structure, the original railings on the approaches would have been the post and double rail, which is identified as a Railing Type C in the *Historic Bridge Railing Study for Route 66 Bridges*. The recommended replacement for this railing is a Texas T66 railing. ODOT proposes to implement this railing for the approach spans.

  The as-built plans indicate that the lattice railing for the main span is original to the structure. ODOT has had a policy of adding crash-tested 'W' railings on many truss bridges that exhibit the lattice feature. ODOT proposes a compatible Texas T1W rail for the main span. The lattice will be retained in-place. The T1W was proposed as a context-sensitive solution for bridges with lattice rails in the Route 66 bridge rail study.
- Replacement bridge will incorporate truss panels into the new structure.

☐ Other measures taken to address deficiencies that complies with codes:

VI. Mitigation Commitment

Describe mitigation agreed to in consultation with SHPO and other consulting parties.

☐ Programmatic

☒ Customized

- Context study of African American experience on Route 66 in Oklahoma
- HAER Level II equivalency documentation for the SH-66B Bridge over Captain Creek.
- Implementation of context-sensitive bridge rail.

VII. Summary and Approval

The environmental review, consultation, and other actions required by applicable Federal environmental laws for this project are being, or have been, carried out by ODOT pursuant to 23 U.S.C. 327, and executed by the Federal Highway Administration (FHWA) and ODOT.

The proposed project meets all the applicability criteria set forth by the FHWA guidance for Programmatic Bridge Section 4(f) Evaluation. All alternatives set forth in the subject programmatic were fully evaluated and the findings made are clearly applicable to this project. There are **no feasible and prudent alternatives** to the use of the historic bridge.

The project includes all possible planning to minimize harm. ODOT will include the measures to minimize harm as environmental commitments in the applicable National Environmental Policy Act (NEPA) document.

The following **MUST** be attached to this checklist to ensure proper documentation of the Historic Bridge Programmatic Section 4(f):

- ☒ Design Analysis Report to Support the 4(f) [NOTE: The Design Analysis Report was prepared using March 2016 bridge inspection data.]
- ☒ Photographs of the bridge detailing conditions cited in alternatives analyses
- ☒ Comparative no-use alternatives analysis chart
- ☐ Proof of Historic Bridge Marketing
  NOTE: elements of the existing bridge are being incorporated into the new facility.

VIII. ODOT and FHWA Approval Signatures

ODOT-CRP Technical Expert Reviewer Certification

I reviewed this checklist and all attached documentation and confirm that the above historic bridge and proposed project meet the requirements of 23 CFR 774 for a Historic Bridge Programmatic Section 4(f) finding.

8.2.18

Cultural Resources Program Director *Date*

8/2/18

Environmental Programs Division *Date*

FHWA Historic Bridge Programmatic Section 4(f) Final Approval

Based upon the above considerations, this Historic Bridge Programmatic Section 4(f) satisfies the requirements of 23 CFR 774.

FHWA-Oklahoma Division *Date*

Oklahoma Historical Society *Founded May 27, 1893*
State Historic Preservation Office
Oklahoma History Center • 800 Nazih Zuhdi Drive • Oklahoma City, OK 73105-7917
(405) 521-6249 • Fax (405) 522-0816 • www.okhistory.org/shpo/shpom.htm

March 1, 2018

Mr. Scott Sundermeyer, Director
ODOT Cultural Resources Program
111 East Chesapeake, Rm. 102, OU
Norman, OK 73019

RE: File #0822-18 (Previously #0852-17); Lincoln County FHWA Project #J/P 28034(04), Proposed Improvements to SH-66B over Captain Creek, Lincoln County, Oklahoma

Dear Mr. Sundermeyer:

We have reviewed the preliminary design plans submitted with your January 31, 2018 cover letter (received February 2, 2018) for the proposed rehabilitation of the Captain Creek Bridge in Lincoln County. Based on these preliminary plans, we find that the proposed project will have an **adverse effect** on the Captain Creek Bridge, a property individually listed on the National Register of Historic Places under Criterion A for its association with Route 66.

On September 18, 2017, we issued a conditional no adverse effect determination indicating that project plans and specifications for Design Alternative 2(d) as presented in the report prepared by Infrastructure Engineers, Inc. and TransSystems, *Design Support for Section 4(f) Analysis for Historic Bridges Structure No. 4124 0157 X (NBI No. 03800) SH-66B over Captain Creek*, shall be submitted to SHPO for review prior to the solicitation of bids for the project, any commitment of funds (such as a construction contract), or any construction work. The purpose of the review was to confirm that the proposed work is consistent with the *Secretary of the Interior's Standards and Guidelines for Rehabilitation*. Based on our review of the recently submitted proposed plans in conjunction with the scope of work presented in the report, we have determined that Design Alternative 2(d) does not meet the *Standards*. Our opinion is based on the fact that Alternative 2(d) is not a rehabilitation of the Captain Creek Bridge, but rather the replacement of the existing historic bridge with a new bridge using salvaged elements from the existing bridge.

In light of this information, we reevaluated the four options presented under Design Alternative 2 – Rehabilitation without Affecting the Historic Character of the Bridge – and it has come to our attention that three out of the four options are replacement bridges with salvaged elements from the existing historic bridge, not rehabilitations that preserve the historic integrity of the existing bridge. Of the four rehabilitation options under Alternative 2, options 2(a) and 2(b) proposed to widen the bridge, and you requested our comment on your preferred alternative, option 2(b) in your February 13, 2017 cover letter submitted with the Infrastructure Engineers, Inc and TransSystems report. You stated in that cover letter that Alternative 2(b) was preferred for three reasons. First, the width of the bridge was not a character defining feature due to the bridge's listing in the National Register of Historic Places under Criterion A only, and not Criterion C for architecture or design. Second, it eliminated the functional obsolescence because the width would increase from 22-feet to 28-feet, bringing it up to AASHTO Standards and eliminating the bridge's functional obsolescence. Third, the bridge was considered fracture critical due to deterioration of elements in the superstructure and substructure, and that a new multi-beam system would eliminate this status, although the piers would have to be reconstructed.

RE: File #0822-18 (Previously #0852-17); Lincoln County FHWA Project #J/P 28034(04), Proposed Improvements to SH-66B over Captain Creek, Lincoln County, Oklahoma

After we received the Cultural Resources Assessment with your April 24, 2017 cover letter, we responded on May 16, 2017 and determined that Alternative 2(b) would result in an adverse effect determination because the bridge retains a high degree of integrity, which includes its width. We also suggested that Alternative 2(d) would be a better option because it retains the historic width of the existing bridge while removing its fracture critical status, though it would retain its functional obsolescence due to the retention of the historic width. We made this conclusion based on the fact that the section "Distinguishing Characteristics That Convey Historic Significance" states that eliminating fracture critical elements will introduce new elements to the underside of the bridge that are reversible and not affect the distinctive characteristics of the bridge, and further, that the advantages and disadvantages of the option were identical to the advantages and disadvantages of Alternative 2(c). One of several advantages under 2(c) clearly states that it "maintains the historic integrity of the existing bridge with little or no adverse effects." Thus, on August 31, 2017, you responded that you were willing to consider Alternative 2(d), and gave us the option to issue a conditional no adverse effect determination contingent upon the receipt of plans for this alternative. We exercised this option in our September 18, 2017 cover letter.

We received the plans for Alternative 2(d) on February 2, 2018. After evaluating Alternative 2(d) in relation to the plans, we discovered that the design of the reconstructed piers had not been submitted, and Jennifer Bailey, Historic Preservation Specialist, sent an email to you on February 23, 2018 inquiring as to whether or not the pier reconstruction was still part of the design alternative and if those plans had been developed. You responded via telephone and email on February 26, 2018 that the new piers had not been designed. Also, during this evaluation, Ms. Bailey discovered notes on Plan Sheet B001 stating that several elements of the existing historic bridge would be salvaged and reattached to the "new bridge" constructed on new piers and abutments. On February 27, 2018, Ms. Bailey called you to discuss this note on the plans, and you confirmed via telephone that the end result will be a new bridge with a new NBI number that has yet to be assigned. Ms. Bailey expressed her concern with this information and how it has been presented as a rehabilitation and not as demolition and new construction, and that the report indicated fracture critical status would involve new, reversible elements to the underside of the bridge, not replacement of the entire bridge structure. At that point, it was concluded that even if we had the design of the new piers, a completely new bridge superstructure and substructure on new piers and abutments with salvaged elements is not a rehabilitation, and that Alternative 2(d) was in no way similar to Alternative 2(c) and does not maintain the historic integrity of the bridge with little or no adverse effects. Thus, Alternative 2(d) does not meet *Standards 5* and *6* because the distinctive features, finishes, and construction techniques exemplified in this bridge are not preserved and because the deteriorated features beyond repair are not replaced to match the historic features.

In light of this information, we reevaluated all four options presented under Alternative 2 and have determined that the only option that resembles a rehabilitation of the existing historic bridge structure that preserves the integrity and repairs the deteriorated elements is Design Alternative 2(c).

RE: File #0822-18 (Previously #0852-17); Lincoln County FHWA Project #J/P 28034(04), Proposed Improvements to SH-66B over Captain Creek, Lincoln County, Oklahoma

Design Alternative 2(c) replaces the severely deteriorated historic floor beams and stringers with members made of a stronger steel material with comparable depth as the existing floor beams and stringers, which will also require replacement of the non-historic deck (c. 2008). More importantly, Alternative 2(c) retains the visual appearance of the truss span, which is not deficient, while replacing the bearings and maintaining it as the primary load carrying element, the extant historic piers and abutments, and the historic lattice railing. The concrete substructure is considered in poor condition due to extensive cracks and spalls; however, Alternative 2(c) proposes widespread remediation of the concrete substructure and holes for new adhesive or mechanical anchor bolts drilled as part of the truss bearing replacement.

Alternative 2(c) still requires jacking the trusses to install new bearings. Further analysis will be required to determine whether this jacking can be accomplished from locations on either the abutments or piers or by using temporary supports to the existing piers. Also, some additional evaluation of the bridge's gusset plates will be required to determine if they need to be strengthened or replaced in order to maintain the truss as the primary load carrying element. However, we believe that performing these analyses will result in a more thorough investigation of the bridge's existing conditions and will better inform the design decisions, resulting in a more responsible rehabilitation project that will truly maintain the historic integrity of the bridge.

We welcome the opportunity to continue consultation with you to mitigate, minimize, or eliminate the adverse effect of the proposed project. However, if we are unable to eliminate the adverse effect of the project, the Oklahoma Department of Transportation (ODOT) will need to contact and invite the participation of the Advisory Council on Historic Preservation (ACHP) in order to complete the Section 106 process as outlined in 36 CFR Part 800. Should the ACHP choose not to participate in the consultation, Federal Highway Administration (FHWA) and the SHPO may execute a Memorandum of Agreement (MOA). Upon the execution of an MOA, a copy must be filed with the ACHP to complete the Section 106 process.

Thank you for the opportunity to review this project. If you have any questions, please do not hesitate to call Catharine M. Wood, Historical Archaeologist, at 405/521-6381 or Jennifer K. Bailey, Historic Preservation Specialist at 405-522-4479. Please reference the above underlined file number when responding.

Sincerely,

Lynda Ozan
Deputy State Historic
Preservation Officer

LO:pm

Scott Sundermeyer

From: Scott Sundermeyer
Sent: Monday, February 26, 2018 3:15 PM
To: Jennifer K. Bailey
Cc: Lynda Ozan; Catharine Wood
Subject: RE: SHPO Project #0822-18 (Previously 0852-17), Captain Creek Bridge Rehabilitation, SH-66B, Lincoln County (JP 28034(04))

Hi Jennifer –

I reached out to the designer and the piers are not drawn up yet. There are a couple of ways that they could go about constructing them. I believe they were anxious to get me the superstructure plans because they felt those were what you needed to see. I did not convey, nor did I remember, the details about the intermediate piers and abutments as presented in the Design Analysis. In short – the plans are preliminary and the pier sheets have not been developed yet.

Regarding your second questions, I did receive the broken down costs, last March, but I do not have record of having sent them to Kitty. I will forward those now.

Best-
Scott

Scott A. Sundermeyer, RPA
Director - ODOT Cultural Resources Program
405.325.7201

From: Jennifer K. Bailey
Sent: Friday, February 23, 2018 10:58 AM
To: Scott Sundermeyer <SSundermeyer@odot.org>
Cc: Lynda Ozan <lozan@okhistory.org>; Catharine Wood <cwood@okhistory.org>
Subject: SHPO Project #0822-18 (Previously 0852-17), Captain Creek Bridge Rehabilitation, SH-66B, Lincoln County (JP 28034(04))

Scott,

I am reviewing the plans for the Captain Creek Bridge rehabilitation, which we received on February 2, 2018 with your January 31, 2018 cover letter. Your cover letter indicates that the plans are consistent with the project as presented in Alternative 2(D) in the Design Analysis report, which was submitted to our office in February 2017. This alternative states that the intermediate piers will require complete reconstruction. Is this still the case? If so, then the plans included with your January 31, 2018 cover letter do not provide a design for the reconstructed intermediate piers. The elevation drawing on Sheet B0001 show the piers and abutments; however, the plans do not provide a section of said piers and abutments indicating the final design. If the existing abutments and piers are to be reused, and not reconstructed as indicated in the Design Analysis report, then this needs to be clarified.

Also, we received a copy of an email from February 10, 2017 with a request from the Historic Bridge Foundation for breakdown of costs associated with each of the alternatives. Do you happen to have the Foundation's response to the alternatives after they received the costs analysis?

Let me know if you have any questions or concerns.

Thanks,
--
Jennifer K. Bailey

Historic Preservation Specialist/Tax Incentives Coordinator
Oklahoma State Historic Preservation Office
Oklahoma Historical Society
800 Nazih Zuhdi Dr.
Oklahoma City, OK 73105
Phone: 405-522-4479
Fax: 405-522-0816

OKLAHOMA DEPARTMENT OF TRANSPORTATION
CULTURAL RESOURCES PROGRAM
111 E. Chesapeake, Room 102, University of Oklahoma
Norman, OK 73019-5111
Phone: 405-325-7201/325-8665; FAX: 405-325-7604

January 31, 2018

Ms. Lynda Schwan Ozan
Deputy State Historic Preservation Officer
State Historic Preservation Office
800 Nazih Zuhdi Drive
Oklahoma City, Oklahoma 73105-7917

Dear Ms. Ozan:

Re: Lincoln County FHWA Project: JP 28034(04); Improvements to SH-66B over Captain Creek; SHPO File #0852-17.

Thank you for your comments of September 18, 2017 on the referenced project regarding the conditions necessary to meet a "no adverse effect" finding.

Please find the attached project plans (bridge plan and profile sheets) for the referenced undertaking. We agreed to provide these to your office prior to soliciting bids on the project. As indicated in the plans, the rehabilitation project is consistent with Alternative 2D, as presented in the Design Analysis report. The plans are consistent with construction of a new multi-beam steel superstructure with a concrete deck, to which the existing trusses would be re-attached using diaphragms at the lower chord panel points. The trusses will continue to support their own weight.

Also indicated in the attached plans are the proposed bridge rail sheets, which are consistent with that described in our August 31, 2017 correspondence.

With this submittal, we believe the work proposed is consistent with the *Secretary of the Interior's Standards and Guidelines for Rehabilitation.*

We look forward to receiving your comments on the proposed undertaking. If you have any questions regarding this project, please contact me at 325-7201.

Sincerely,

Scott Sundermeyer
ODOT Cultural Resources Program Director

OKLAHOMA DEPARTMENT OF TRANSPORTATION
CULTURAL RESOURCES PROJECT REEVALUATION REPORT

County:	Lincoln	**Request Date:**	December 8, 2017
JP Number:	28034(04)	**Completion Date:**	December 14, 2017
Original CR Report Date:	April 24, 2017	**Consultant:**	Geoff Canty
Original SHPO File #:	0852-17	**Staff CRP Reviewer:**	Kristina Wyckoff
		ODOT Division:	Div. 3

Project Description: SH-66B over Captain Creek, 1.5 miles northeast of SH-66

RESULTS OF PREVIOUS CULTURAL RESOURCES SURVEY

__ No Historic Properties Identified in Project APE

XXX Historic Properties Identified in Project APE

__ Historic Properties Adjacent to APE

__ Off Project Avoidance Areas

XXX Historic Property plan note (dated October 23, 2017)

REEVALUATION REVIEW

File Review XXX NRHP List XXX SHPO DOE List XXX State Archeological Site Files

XXX No Additional Cultural Resources Recorded in Project APE

__ Additional Cultural Resources Recorded in Project APE

__ Not NRHP eligible __ NRHP eligible __ Non-assessed for NRHP eligibility

__ Additional Off Project Avoidance Areas (attach revised avoidance memo)

XXX **Original Cultural Resources Study Adequate for Project APE**

__ Additional Survey Conducted

__ Historic Property Mitigation Measures: __ Complete __ Not Complete

XXX **No further Cultural Resources Concerns**

Comments:
The footprint for the cultural resources assessment of this project was originally surveyed and reported on April 24, 2017 (File #0852-17). The existing bridge carrying SH-66B over Captain Creek (Structure 4124 0157 X/NBI 03800) is comprised of a camelback pony truss main span with I-beam approach spans at either end. The bridge was constructed in 1932 and was listed on the NRHP in 2004 under Criterion A (Transportation) for its association with Route 66. The current re-evaluation of the project is due to changes in the study footprint and is based on the Preliminary Field Review plans dated November 11, 2017. The boundaries of the proposed project footprint were georeferenced and compared to historic maps and photos, and to the original cultural resources assessment. This additional area (1.57 acres) was inspected and shovel tested, and one auger test was excavated in the additional area northeast of the bridge. No cultural resources were identified in the additional area, and the original cultural resources study is adequate for the project APE.
A plan note, completed at the time of the initial report, dated October 23, 2017, details the railing types which must be used in the rehabilitation of the existing bridge.

From:	Scott Sundermeyer
To:	"pathfinder66@earthlink.net"; Barthuli, Kaisa; Oklahoma Route 66 Association; brad@oklahomaroute66.com; Kitty Henderson; wkinsler@wkinsler.com; David Pettyjohn
Subject:	Lincoln County SH-66B over Captain Creek - ODOT project 28034(04)
Date:	Tuesday, September 26, 2017 10:24:00 AM
Attachments:	Lincoln 28034(04) SH-66B Captain Creek consultation with SHPO.pdf

Good morning –

Last April, I reached out to you to invite your comments on the proposed Route 66 bridge project near Wellston. Our letter informed you that ODOT wished to proceed with a rehabilitation alternative that widened the bridge from 22-feet wide to 28-feet wide (Alternative 2B). The Oklahoma State Historic Preservation Office (SHPO) disagreed with our finding of 'no adverse effect', citing that the width of the structure was a character-defining feature of the bridge. Widening the structure to 28-feet would alter this character-defining feature and adversely affect the historic integrity of the bridge. SHPO indicated that Alternative 2D, retaining the bridge width at 22 feet, was a better choice, and that there was no evidence of safety concerns with the bridge continuing to carry traffic at its existing width – as it has done for over 80 years. The Design Analysis report (provided to you in April) indicated that the current average daily traffic is approximately 800 vehicles per day and there is no accident history on the bridge to support the need to widen the structure.

ODOT reviewed these comments and concurred with the SHPO. As such, ODOT has decided to continue with the rehabilitation, as indicated in Alternative 2D, and will proceed with this alternative. This alternative is similar to the originally proposed option, but retaing the existing bridge width. As part of the project, ODOT will be changing the bridge and approach rails. Currently the W-beam metail approach rails (which are retained across the bridge as well) are not original. According to the original plans, the bridge had a concrete post and double-beam railing, which I am sure you have seen on many other Oklahoma Route 66 bridges. ODOT intends to replace the approach rails with a crash-tested T66 rail. There are no crash-tested equivalents to the post and double-beam. The T66 approach rail will connect to a T1W rail across the main span of the structure. The lattice railing on the main span will be retained. Examples of these railings can be found at the following location: http://www.odotculturalresources.info/route-66.html or http://www.odotculturalresources.info/uploads/6/6/6/2/6662788/140527a_odot_route_66_bridge_rail_study__final_december_2014_.pdf.

Please find the attached consultation with SHPO. The material is sorted starting from the most recent correspondence. The initial SHPO response, dated May 16, is in response to the April 22 materials we sent all consulting parties.

As a consulting party, you have a demonstrated interest in the project and we invite you to comment so that these can be considered in the decisions ODOT and Federal Highway Administration (FHWA) must make.

Thank you –
Scott

Scott A. Sundermeyer, RPA
Cultural Resources Program Director
Oklahoma Department of Transportation

Oklahoma Archeological Survey
111 E. Chesapeake Avenue, Rm. 102
Norman, OK 73019
405.325.7201
ssundermeyer@odot.org
ssundermeyer@ou.edu
http://www.odotculturalresources.info/

https://www.facebook.com/OKDOT

OKLAHOMA DEPARTMENT OF TRANSPORTATION
CULTURAL RESOURCES PROGRAM
111 E. Chesapeake, Room 102, University of Oklahoma
Norman, OK 73019-5111
Phone: 405-325-7201/325-8665; FAX: 405-325-7604

September 22, 2017

Ms. Lynda Schwan Ozan
Deputy State Historic Preservation Officer
State Historic Preservation Office
800 Nazih Zuhdi Drive
Oklahoma City, Oklahoma 73105-7917

Dear Ms. Ozan:

Re: Lincoln County FHWA Project: JP 28034(04); Improvements to SH-66B over Captain Creek; SHPO File #0852-17.

Thank you for your comments of September 18, 2017 on the referenced project regarding the conditions necessary to meet a "no adverse effect" finding. Mr. Kevin Bloss, ODOT Field Division Engineer for Division 3, has signed the attached letter accepting these conditions.

If you have any questions regarding this project, please contact me at 325-7201.

Sincerely,

Scott Sundermeyer
Director, ODOT Cultural Resources Program

Oklahoma Historical Society *Founded May 27, 1893*
State Historic Preservation Office
Oklahoma History Center • 800 Nazih Zuhdi Drive • Oklahoma City, OK 73105-7917
(405) 521-6249 • Fax (405) 522-0816 • www.okhistory.org/shpo/shpom.htm

September 18, 2017

Mr. Scott Sundermeyer, Director
ODOT Cultural Resources Program
111 East Chesapeake, Room 102, OU
Norman, OK 73019

RE: File #0852-17; Lincoln County Federal Highway Administration Project #JP-28034(04); Proposed Improvements to SH-66B over Captain Creek, 1.5 miles northeast of SH-66.

Dear Mr. Sundermeyer:

We have received and reviewed your letter of August 31, 2017, submitted on the proposed improvements to Captain Creek Bridge in Lincoln County, a property individually listed on the National Register of Historic Places under Criterion A for its association with Route 66.

It is our understanding that you are committed to rehabilitating the bridge at its current and historic width, which is outlined in Design Alternative 2D as described in the *Design Support for Section 4(f) Analysis for Historic Bridges: Structure No. 4124 0157 X (NBI No. 038) SH-66B over Captain Creek, Lincoln County, Oklahoma*, and submitted to our office on February 15, 2017. Our May 16, 2017 letter indicated that we considered Design Alternative 2D a better choice over Design Alternative 2B because it would retain the historic trusses, connectors, and width, while resolving the structural deficiencies and fracture critical status, further eliminating the need for load posting and reducing overall construction and maintenance costs.

Your August 31, 2017 letter indicates that rehabilitation plans have not been produced, as the design is in its very early stages. It also requests that we issue a conditional no adverse effect determination contingent upon our review of the rehabilitation plans. Thus, we believe that the proposed project will have no adverse effect on the Captain Creek Bridge as long as the following condition is met:

CONDITION:

> Project plans and specifications shall be submitted to SHPO for review prior to the solicitation of bids for the project, any commitment of funds (such as a construction contract), or any construction work. The purpose of the review is to confirm that the proposed work is consistent with the *Secretary of the Interior's Standards and Guidelines for Rehabilitation.*

If this condition is acceptable to you, please return this document with the signature as indicated on Page 2 of this letter, confirming your concurrence. When we receive it, your agency will have completed the Section 106 process as outlined in the Advisory Council on Historic Preservation's regulations, 36 CFR Part 800. Specifically, 36 CFR Part 800.5(b) provides that modification of an undertaking in accordance with conditions imposed by the SHPO shall result in a "no adverse effect" determination.

RE: File #0852-17; Lincoln County Federal Highway Administration Project #JP-28034(04); Proposed Improvements to SH-66B over Captain Creek, 1.5 miles northeast of SH-66.

Thank you for the opportunity to review this project. If you have any questions, please do not hesitate to call Ms. Jennifer Bailey, Historic Preservation Specialist, at (405)522-4479.

Sincerely,

Lynda Ozan
Deputy State Historic
Preservation Officer

LO:pm

I hereby accept the conditions stated in this letter.

Signature

9-21-17
Date

OKLAHOMA DEPARTMENT OF TRANSPORTATION
CULTURAL RESOURCES PROGRAM
111 E. Chesapeake, Room 102, University of Oklahoma
Norman, OK 73019-5111
Phone: 405-325-7201/325-8665; FAX: 405-325-7604

August 31, 2017

Ms. Melvena Heisch
Deputy State Historic Preservation Officer
Oklahoma History Center
800 Nazih Zuhdi Drive
Oklahoma City, Oklahoma 73105

Dear Ms. Heisch:

Re: File 0852-17 Lincoln County Federal Highway Administration (FHWA)-funded project: J/P 28034(04); Proposed improvements to SH-66B over Captain Creek, 1.5 miles northeast of SH-66.

Thank you for your comments of May 16, 2017 regarding the proposed undertaking.and ODOT's desire to proceed with Alternative 2B. Alternative 2B proposes widening the curb-to-curb width of the bridge from 22 feet to 28 feet, constructing a new load-bearing multi-beam steel superstructure, and re-attaching the existing trusses using diaphragms at the lower chord panel chord points. Your office commented that this alternative would have an adverse effect to the structure, and that Alternative 2D would be a better choice. Alternative 2D proposes a similar rehabilitation as Alternative 2B, but retains the existing 22-foot-wide bridge width.

ODOT and FHWA have considered your comments and will proceed with Alternative 2D, as described in the *Design Support for Section 4(f) Analysis for Historic Bridges: Structure No. 4124 0157 X (NBI No. 03800) SH-66B over Captain Creek, Lincoln County, Oklahoma,* and retain the existing bridge width at 22-feet.

As part of the project, it will be necessary to address the approach and main span railings. As depicted in the current photographs of the bridge, the approach and main span currently have a 'W' rail that is not original to the bridge. The main span retains the lattice rail, however (though it is protected by the 'W' rail). According to the as-built plans for the structure, the original railings on the approaches would have been the post and double rail, which is identified as a Railing Type C in the *Historic Bridge Railing Study for Route 66 Bridges* (report provided for comment under File 0857-15). The recommended replacement for this railing is a Texas T66 railing. ODOT proposes to implement this railing for the approach spans.

The as-built plans indicate that the lattice railing for the main span is original to the structure. ODOT has had a policy of adding crash-tested 'W' railings on many truss bridges that exhibit the lattice feature. The current structure is no exception. In lieu of continuing with the 'W' rail configuration, ODOT proposes a more aesthetically compatible Texas T1W rail for the main span. The lattice will be retained in-place. The T1W was proposed as a context-sensitive solution for bridges with lattice rails in the Route 66 bridge rail study.

At this time, plans have not been produced, as the design is in its very early stages. It is our intention to proceed with Alternative 2D and, based on your prior comments, it is our opinion that the selection of Alternative 2D would result in a *no adverse effect* to the structure.

We are requesting comments to our opinion that proceeding with Alternative 2D as described in the Design Analysis, would result in no adverse effect to the structure. Should you require a review of plans, we respectfully request a concurrence with our effect finding to be conditional upon your review of the plans. This letter, however, represents our commitment to proceed with Alternative 2D.

If you have any questions regarding this project, or require any additional information, please contact me at 405-325-7201 or via email at ssundermeyer@odot.org.

Sincerely,

Scott A. Sundermeyer
ODOT Cultural Resources Program Director

Oklahoma Historical Society *Founded May 27, 1893*
State Historic Preservation Office
Oklahoma History Center • 800 Nazih Zuhdi Drive • Oklahoma City, OK 73105-7917
(405) 521-6249 • Fax (405) 522-0816 • www.okhistory.org/shpo/shpom.htm

May 16, 2017

Mr. Scott Sundermeyer, Director
ODOT Cultural Resources Program
111 East Chesapeake, Rm. 102, OU
Norman, OK 73019

RE: File #0852-17; Lincoln County Federal Highway Administration Project #JP-28034(04); Proposed Improvements to Captain Creek Bridge on SH-66B, 1.5 miles northeast of SH-66

Dear Mr. Sundermeyer:

We have received and reviewed the cultural resources survey report and photographs submitted on the proposed improvements to Captain Creek Bridge in Lincoln County, a property individually listed in the National Register of Historic Places under Criterion A for its association with Route 66.

According to your letter of April 24, 2017, it is our understanding that an alternative has not yet been chosen and that at this time you are only gathering comments on the proposed alternatives that will be incorporated into the decision making process. Therefore, based on the information provided in the cultural resources survey report and the preliminary assessment of proposed alternatives presented in the report prepared by Infrastructure Engineers, Inc. and TransSystems, *Design Support for Section 4(f) Analysis for Historic Bridges Structure No. 4124 0157 X (NBI No. 03800) SH-66B over Captain Creek*, it is our preliminary opinion that the preferred Alternative 2B for the project would have an adverse effect on Captain Creek Bridge.

Our opinion is based on the fact that the 22-foot width of the bridge is a defining characteristic, and thus as proposed in Alternative 2B, widening the bridge 6-feet, constructing a new load-bearing, multi-beam superstructure, and re-attaching the existing trusses using diaphragms at the lower chord panel chord points would adversely effect the historic integrity of the bridge's design.

We respectfully disagree with the cultural resource report's assessment that the bridge is not significant for its design, materials, and workmanship simply because it is listed in the National Register of Historic Places under Criterion A in Transportation for its association with Route 66, and not Criterion C. Regardless of the criterion under which a property is listed in the NRHP, it must possess both significance and integrity. Although the bridge is not listed for the significance of its design, it retains its *integrity* of design. The National Register nomination specifically states that the bridge "retains excellent integrity of design, materials, workmanship, location, appearance, feeling, and association." We agree that the structural elements, specifically the trusses to the flooring system to maintain the truss lines, are significant features. However, the bridge exemplifies the state-standard construction details in place at the time of the bridge's construction in 1932, specifically the early-1930s geometric design used for state highways, including Route 66. Those standards included bridge width; thus, the width is a character of the design standards of that time, and this bridge retains that characteristic.

RE: File #0852-17; Lincoln County Federal Highway Administration Project #JP-28034(04); Proposed Improvements to Captain Creek Bridge on SH-66B, 1.5 miles northeast of SH-66

Based on the report and your correspondence, the main concern is the structural deficiency of the bridge; it was determined to be "fracture critical" due to the fact that the trusses, floor beams for Span 2 (Pony Truss Span), and pier beams for Spans 1 and 3 are failing. The functional obsolescence of the bridge does not appear to be as critical an issue, even though it fails to meet the current minimum AASHTO standards of 28-feet. The report indicates that no impact damage exists and that there were no accidents reported between 2009 and 2014, the date of the report. Although we believe that Alternative 2B is a good alternative, and would resolve the fracture critical status and the functional obsolescent status of the bridge, we believe that Alternative 2D is the better choice, as it resolves the fracture critical status without widening the bridge. Alternative 2D rehabilitates the bridge by creating a new, multi-beam superstructure with a concrete deck, to which the existing trusses would be re-attached using diaphragms at the lower chord panel points. Alternative 2D would retain the historic trusses, connectors, and width, while resolving the structural deficiencies and facture critical status, further eliminating the need for load posting and reducing overall construction and maintenance costs. The bridge may remain functionally obsolescent, but, based on the report and the correspondence thus far, it is our understanding that the safety issues stem from the structural deficiencies and fracture critical status of the bridge and not its width.

Thank you for the opportunity to comment on the preliminary design alternatives for this project. We look forward to working with you as the alternative selection proceeds and design details are developed during project planning.

If you have any questions, please contact Catharine M. Wood, Historical Archaeologist, at (405) 521-6381. Please reference the above underlined file number. Thank you.

Sincerely,

Melvena Heisch
Deputy State Historic
Preservation Officer

MH:pm

Oklahoma Archeological Survey

THE UNIVERSITY OF OKLAHOMA

May 17, 2017

Scott Sundermeyer
Director, ODOT Cultural Resources Program
Oklahoma Department of Transportation
111 E Chesapeake, Room 102, University of Oklahoma
Norman, OK 73019-5111

Re: *Oklahoma Department of Transportation Cultural Resources Survey Report JP28034(04): Proposed Improvements to SH-66 B over Captain Creek, 1.5 Miles Northeast of SH-66B.* Report by Kristina Wyckoff and Anna Eddings (ODOT).
Legal Description: Sections 14 and 15, T14N, R2E, Lincoln County, Oklahoma.

Dear Mr. Sundermeyer:

This agency received the above-referenced cultural resources survey report of investigations for review and comment. The initial survey was conducted on March 30, 2017 by ODOT. The survey involved the field inspection of approximately 8.38 acres constituting the project's direct Area of Potential Effect. During this survey, the archaeologists did not observe any archaeological resources within the project area. This agency confirms the recommendations contained in this report as they pertain to prehistoric archaeological resources. This review has been conducted in cooperation with the Oklahoma SHPO. You must also have a letter from that office to document your consultation pursuant to Section 106 of the National Historic Preservation Act

Sincerely,

Debra K. Green
Assistant State Archaeologist

Kary L. Stackelbeck
State Archaeologist

:brb

cc: SHPO

111 E. Chesapeake, Room 102, Norman, Oklahoma 73019-5111 PHONE: (405) 325-7211 FAX: (405) 325-7604
A UNIT OF ARTS AND SCIENCES SERVING THE PEOPLE OF OKLAHOMA

OKLAHOMA DEPARTMENT OF TRANSPORTATION
CULTURAL RESOURCES PROGRAM
111 E. Chesapeake, Room 102, University of Oklahoma
Norman, OK 73019-5111
Phone: 405-325-7201/325-8665; FAX: 405-325-7604

April 24, 2017

Ms. Melvena Heisch
Deputy State Historic Preservation Officer
Oklahoma History Center
800 Nazih Zuhdi Drive
Oklahoma City, Oklahoma 73105

Dear Ms. Heisch:

Re: Lincoln County Federal Highway Administration (FHWA)-funded project: J/P 28034(04); Proposed improvements to SH-66B over Captain Creek, 1.5 miles northeast of SH-66; SHPO File #0852-17

Attached are a cultural resources survey report and photographs for the referenced project, prepared by the ODOT Cultural Resources Program. No archeological sites or buildings were identified during this investigation. The existing SH-66B bridge over Captain Creek (Structure 4124 0157 X; NBI 03800) contains a single camelback pony truss main span with an I-beam approach span at each end. Constructed in 1932, it was listed on the National Register of Historic Places (NRHP) in 2004 under Criterion A in Transportation for its association with Route 66.

ODOT conducted a cultural resources investigation for a proposed rehabilitation of the Captain Creek Bridge in 2007 under JP 23208(04) (SHPO File #1734-07), but did not conclude consultation because state funds were used on the project. Because ODOT subsequently revised the rehabilitation plans to eliminate a proposed concrete parapet, which was the cause for an adverse effect determination, our assessment is that the 2007 rehabilitation project had no adverse effect on the Captain Creek Bridge.

We have previously submitted for your review on February 13, 2017 the *Design Support for Section 4(f) Analysis for Historic Bridges: Structure No. 4124 0157 X (NBI No. 03800) SH-66B over Captain Creek, Lincoln County, Oklahoma,* which Infrastructure Engineers, Inc. and TranSystems prepared for ODOT. This design analysis outlines several alternatives for the project. ODOT is seriously considering Alternative 2B, which proposes rehabilitation and widening of the existing bridge, eliminating its fracture critical designation. This alternative proposes widening the curb-to-curb width of the bridge from 22 feet to 28 feet, constructing a new load-bearing multi-beam steel superstructure, and re-attaching the existing trusses using diaphragms at the lower chord panel chord points.

It is our opinion that Alternative 2B, including incorporating context-sensitive guardrails, would retain the historic design, setting, feeling, and association of the bridge with Route 66, by retaining the character-defining truss elements that make the bridge significant and maintain the intrinsic qualities of historic Route 66. Therefore, our preliminary assessment is that Alternative 2B would

have no adverse effect on the Captain Creek Bridge. In addition, because Alternative 2B retains the character-defining truss elements and maintains the integrity of location, design, setting, feeling, and retains the bridge in place as a feature of Route 66, it is our opinion that Alternative 2B does not result in a 4(f) use.

We welcome your comments on any of the proposed alternatives, so that we may incorporate the comments into the decision-making process. We will continue consultation with your office as alternative selection proceeds and design details are developed during project planning.

If you have any questions regarding this project, or require any additional information, please contact me at 405-325-7201 or via email at ssundermeyer@odot.org.

Sincerely,

Scott A. Sundermeyer
ODOT Cultural Resources Program Director

Cc: State Archeologist

OKLAHOMA DEPARTMENT OF TRANSPORTATION
CULTURAL RESOURCES PROGRAM
111 E. Chesapeake, Room 102, University of Oklahoma
Norman, OK 73019-5111
Phone: 405-325-7201/325-8665; FAX: 405-325-7604

April 24, 2017

Dear Consulting Party:

Re: Lincoln County Federal Highway Administration (FHWA)-funded project: J/P 28034(04); Proposed improvements to SH-66B over Captain Creek, 1.5 miles northeast of SH-66

Attached are a cultural resources survey report and photographs for the referenced project, prepared by the ODOT Cultural Resources Program. No archeological sites or buildings were identified during this investigation. The existing SH-66B bridge over Captain Creek (Structure 4124 0157 X; NBI 03800) contains a single camelback pony truss main span with an I-beam approach span at each end. Constructed in 1932, it was listed on the National Register of Historic Places (NRHP) in 2004 under Criterion A in Transportation for its association with Route 66. Other consulting parties, identified as those listed in the carbon copy, below, are also receiving a copy of this report, as are the State Historic Preservation Office (SHPO) and the Oklahoma Archeological Survey (OAS), under separate cover.

We have previously submitted for your review on January 27, 2017 the *Design Support for Section 4(f) Analysis for Historic Bridges: Structure No. 4124 0157 X (NBI No. 03800) SH-66B over Captain Creek, Lincoln County, Oklahoma,* which Infrastructure Engineers, Inc. and TranSystems prepared for ODOT. This design analysis outlines several alternatives for the project. ODOT is seriously considering Alternative 2B, which proposes rehabilitation and widening of the existing bridge, eliminating its fracture critical designation. It is our opinion that Alternative 2B, including incorporating context-sensitive guardrails, would retain the historic design, setting, feeling, and association of the bridge with Route 66, by retaining the character-defining truss elements that make the bridge significant and maintain the intrinsic qualities of historic Route 66. Therefore, our preliminary assessment is that Alternative 2B would have no adverse effect on the Captain Creek Bridge. In addition, because Alternative 2B retains the character-defining truss elements and maintains the integrity of location, design, setting, feeling, and retains the bridge in place as a feature of Route 66, it is our opinion that Alternative 2B does not result in a 4(f) use.

We welcome your comments on any of the proposed alternatives, so that we may incorporate the comments into the decision-making process.

If you have any questions regarding this project, or require any additional information, please contact me at 405-325-7201 or via email at ssundermeyer@ou.edu.

Sincerely,

Scott A. Sundermeyer
ODOT Cultural Resources Program Director

cc: Historic Bridge Foundation
National Park Service Route 66 Corridor Preservation Program
Oklahoma Route 66 Association
Jim Ross
Oklahoma Historic Bridge and Highway Group
Preservation Oklahoma
Lincoln County Historical Society and Museum of Pioneer History
Route 66 Interpretive Center

OKLAHOMA DEPARTMENT OF TRANSPORTATION
CULTURAL RESOURCES SURVEY REPORT

Prepared by: ODOT Cultural Resources Program

County:	Lincoln		
J/P Number:	28034(04)		
Surveyed By:	Kristina Wyckoff and Anna Eddings	**Prepared By:**	Kristina Wyckoff and Anna Eddings
Survey Date:	March 30, 2017	**Report Date:**	April 24, 2017

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1. PROJECT DESCRIPTION:

This report documents a cultural resources investigation for proposed improvements to the SH-66B crossing over Captain Creek located 1.5 miles northeast of SH-66. The existing SH-66B bridge at this location was built using 1932 design standards, which are now obsolete. Its clear roadway width of 22 feet is substandard for its functional classification as a rural major collector: current AASHTO (American Association of State Highway and Transportation Officials) standards require a minimum clear roadway width of 28 feet for this type of roadway. The pier beams for the approach spans, and the pony truss's bottom chords, verticals, and diagonals are classified as fracture critical. This means that these are steel beams in tension, or partial tension, whose failure would probably cause full or partial collapse of the bridge. Besides its functional obsolescence, the bridge is classified as structurally deficient, and has a sufficiency rating of 30.3 on a scale of 100.The bridge superstructure has a NBI (National Bridge Inspection) Condition Rating of 4 (poor condition), because of severe corrosion causing section loss in numerous truss members, and cracks in the pier beam connections. The substructure also has a NBI Condition Rating of 4 because of extensive cracks and spalls. Because of these conditions, the bridge is weight-restricted as follows: Single Unit Truck, 19 tons; Semi-Truck, 25 tons; and Combination Truck, 42 tons. A prior cultural resources investigation for proposed rehabilitation of this bridge was conducted by Robert Bartlett in 2007 (Lincoln JP 23208[04]; SHPO File no. 1734-07).

The current ODOT project study area begins approximately 1,250 feet west of the SH-66B/Hickory Avenue intersection and follows SH-66B through the intersection with Hickory Avenue at the northwestern end of Wellston; the study area also extends south along Hickory Avenue, where the study area is confined to the existing right-of-way (33 feet from the existing Hickory Avenue roadway center). Along SH-66B, study area follows the existing SH-66B right-of-way (approximately 65 feet northwest and 200 feet southeast of the existing SH-66B centerline. At the southwest and northeast corners of the SH-66B/Hickory Avenue intersection the study area extends beyond the existing right-of-way, reaching up to 280 feet south and 110 feet north of the SH-66B centerline, respectively. In total, the project study area encompasses approximately 8.38 acres.

The existing SH-66B bridge over Captain Creek (Structure 4124 0157 X; NBI 03800) contains a 102-foot camelback pony truss main span with a 62-foot, 8-inch, I-beam approach span at each end, for a total length of 227 feet and 4 inches. All spans are skewed 39 degrees, 13 feet, 30 inches to accommodate the flow of Captain Creek. The bridge's substructure includes concrete abutments and concrete column piers with concrete web wall. It is located on the west edge of Wellston. Constructed in 1932, it was listed on the National Register of Historic Places (NRHP) in 2004 under Criterion A in Transportation for its association with Route 66.

Legal Location:	T14N R2E Sections 14-15
U.S.G.S. Quadrangle:	Wellston (1966 PR 1981)

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2. ENVIRONMENTAL SETTING:

Geomorphic/Physiographic Region:

The study area is mapped in the Central Red-Bed Plains where Permian red shales and sandstones form gently-rolling hills and broad, flat plains.

Geology and Soils:

The study area is mapped across Quaternary alluvium deposits of gravel, sand, silt and clay dating to the Holocene epoch.

The study area is mapped across Yahola-Roebuck-Pulaski-Port-Keokuk and Zaneis-Renfrow-Grainola-Coyle associations. The Pulaski soil series is mapped along Hickory Avenue, and is comprised of reddish-brown to reddish-yellow fine sandy loam; the Teller soil series is mapped at the northeastern project extent and is comprised of dark brown to yellow-red sandy loam. Soils mapped throughout the remainder of the study area, west of Hickory Avenue, all have potential to contain buried soils; Ustibuck silty clay (124-203 centimeters below the surface [cmbs]), Tribbey fine sandy loam (127-165 cmbs), Ashport silty clay loam (91-132 cmbs), and Miller clay (89-152 cmbs). A sampling of auger tests will be excavated in the base of shovel tests throughout this portion of the study area to assess the potential for buried archaeological materials.

Vegetation:

The vegetation of the study area, as mapped, is known colloquially as the Cross Timbers. It is a mosaic of Post oak and Blackjack oak woodlands and mixed-grass clearings.

According to the USGS Land Cover map, the study area the study area is comprised mainly of developed open space along the existing US-66B highway and overlaps forest and herbaceous vegetation which generally represents pasture land. Google Earth imagery indicates the study area is comprised of the existing SH-66B right-of-way, the existing Hickory Avenue right-of-way, and wooded portions south of SH-66B and at the northeastern study area extent. Google Earth imagery indicates the existing right-of-way appears to be comprised of manicured short grasses and vegetation coverage is likely to be near 100%; wooded portions of the study area could potentially have equally poor visibility.

Vegetation Coverage:

XXX	0-25%	Eroded areas and creek banks
	25-50%	
XXX	50-75%	Wooded portions of the study area
XXX	75-100%	Short grasses and manicured grasses in residential yards and existing right-of-way

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3. CULTURAL BACKGROUND:

A. Background Research:

XXX State Site Files at Oklahoma Archeological Survey (OAS)

XXX SHPO NRHP and DOE Files

XXX Native American Tribes and Nations Consulted by Procedures Established with FHWA and ODOT: Iowa Tribe of Oklahoma, Kickapoo Tribe of Oklahoma, Osage nation, Sac and Fox Nation, Wichita and Affiliated Tribes.

XXX Other sources: General Land Office (GLO) Original Survey Map (1872, 1893)
USGS Luther 15' Quadrangle (1909)
USGS Wellston 7.5' Quadrangle (1966, 1981)
Lincoln County aerial imagery (1954, 1962)
Lincoln County General Highway and Transportation Maps (GHM) (1936, 1950, 1957, 1962, 1967, 1973, 1982)
Google Earth imagery (1995-2014)

Brooks, Robert L.
1985 Resource Protection Planning Process Management Region 5. Report submitted to the State Historic Preservation Office Oklahoma Historical Society. Unpublished manuscript on file at the Oklahoma Archeological Survey, Norman.

Cassity, Michael
2004 "Captain Creek Bridge," National Register of Historic Places Nomination Form. Oklahoma State Historic Preservation Office, http://nr_shpo.okstate.edu/ (accessed April 6, 2017).

Infrastructure Engineers & TranSystems
2016 *Design Support for Section 4(f) Analysis for Historic Bridges: Structure No. 4124 0157 X (NBI No. 03800) SH-66B over Captain Creek, Lincoln County, Oklahoma*, prepared for ODOT JP #28034(04), ODOT Engineering Contract Number: 1499A.

2005 Oklahoma Atlas of Archaeological Sites and Management Activities. http://www.ou.edu/cas/archsur/Atlas/atlas.htm accessed online March 29, 2017.

Mead & Hunt
2014 *Historic Bridge Railing Study for Route 66 Bridges,* prepared for Oklahoma Department of Transportation.

SHPO file #1734-07, Section 106 file for ODOT Lincoln County SH-66B over Captain Creek Bridge rehabilitation project, SAB-141C(162), J/P 23208(04). ODOT Cultural Resources Program, Norman, Oklahoma, 2007.

Goins, Charles Robert and Danney Goble
2006 *Historical Atlas of Oklahoma*, 4th Ed. University of Oklahoma Press. Norman, OK.

US Geological Survey, 20140331, NLCD 2011 Land Cover (2011 Edition) US Geological Survey, Sioux Falls, SD.

1970 *Soil Survey Lincoln County, Oklahoma*. United States Department of Agriculture, Soil Conservation Service, and Oklahoma Experiment Station. U.S. Government Printing Office, Washington, D.C.

RESULTS OF BACKGROUND RESEARCH/SUMMARY OF CULTURAL BACKGROUND:

As noted above, the Captain Creek Bridge (Structure 4124 0157 X; NBI 03800) was listed on the National Register of Historic Places (NRHP) in 2004 under Criterion A for its significance in the area of Transportation. It is listed under the Multiple Property Nomination "Route 66 and Associated Historic Resources in Oklahoma," representing the property type, "Road Bridges on Route 66." Its period of significance is the year 1933, the year it was completed and opened to traffic. This year reflects its short but significant association with Route 66: the Oklahoma State Highway Commission built this bridge and the alignment of US Highway 66 it carried through the town of Wellston with state funds, while using federal aid funds to construct the shorter alignment of this highway bypassing Wellston, which the Bureau of Public Roads designated as the federally-sanctioned alignment of US Highway 66 (Cassity 2004: 10, 15-17).

The portions of the current ODOT project study area within the existing SH-66B right-of-way were previously reviewed during the 2007 ODOT cultural resources investigation for project Lincoln JP 23208(04), which also proposed improvements to the SH-66B bridge over Captain Creek. The 2007 ODOT project study area was

confined to the existing SH-66B right-of-way. No archaeological sites or materials were documented or recorded during the 2007 investigation. The bridge originally had concrete post-and-beam railing on the approach spans, conforming to the "Railing Type C" designated in the *Historic Bridge Railing Study for Route 66 Bridges* (Mead & Hunt 2014: 3). This had been removed and replaced with steel W-rail on I-beam posts in 1995, with the W-rail continuing across the original lattice railing on the truss span. The 2007 proposed rehabilitation of the bridge was to include replacing the deck and curbs with concrete, and replacing the steel railings with a solid concrete parapet on both the approach and truss spans (2' 8" high on the approaches, 1' 5" high on the truss); the result of consultation in 2007 was that the proposed replacement parapet would have an adverse effect on the Captain Creek Bridge (SHPO File no. 1734-07). Subsequently, state funds were used in this rehabilitation project and ODOT did not conclude consultation. However, ODOT later revised the rehabilitation plans to retain the existing railing [SHPO file #1734-07, Section 106 file for ODOT Lincoln County SH-66B over Captain Creek Bridge rehabilitation project, SAB-141C(162), J/P 23208(04)].

A review of the Oklahoma Archeological Survey (OAS) maps indicates there are no previously-recorded archaeological sites in the project study area or within the project's one mile vicinity.

Robert Brooks included Lincoln County in "Region 5" of his Resource Protection Planning Process Management manuscript (Brooks 1985). Region 5, the largest management region defined by Brooks, consists of southern tall grass prairie and cross- timbers. Much of the archaeological work in this region has focused on surveys and excavations of sites threatened by major reservoir construction (Brooks 1985:5). This region includes sites from Paleoindian, Archaic, Woodland, Village Farming, Protohistoric, and 19th and 20th century periods (Brooks 1985).

In 2004, according to the Oklahoma Atlas of Archaeological Sites and Management Activities, 158 archaeological sites had been recorded in Lincoln County (Brooks 2005). At that time, the recorded sites included two sites with Paleoindian period occupations, 10 sites with Archaic period occupations, five sites with Woodland period occupations, three sites with Village Farming period occupations, and 82 sites with 19th or 20th century occupations.

Although no previously-recorded archaeological sites are mapped in the project study area or the one-mile vicinity, two prehistoric and several 20th century archaeological sites are indicated elsewhere on the Wellston quadrangle. These prehistoric archaeological sites consist of thin scatters of flakes and tested Ogallala cobbles, and are situated on rises overlooking major drainages (Bear Creek and Captain Creek); the 20th century farmsteads are recorded in areas where century buildings or occupations are indicated on historic maps and/or aerial imagery. No buildings or occupations are indicated on the reviewed historic maps or aerials, and therefore no 19th or 20th century archaeological sites are expected to occur in the study area. Although few prehistoric sites have been recorded in the area there is potential for prehistoric archaeological sites throughout the study area. Archaeological materials could be located on the surface and in near surface deposits, as is the case for the two previously-recorded prehistoric sites mapped on the quadrangle; however, considering the geology of the study area consists of Quaternary alluvium deposits and the documented potential for soil series to contain buried A horizons, archaeological materials in the study area could be more deeply-buried.

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4. METHODOLOGY:

Field Investigation Methodology:

_____ 100% Windshield Survey

_____ Windshield survey with sample pedestrian survey

__XXX__ 100% pedestrian survey

__XXX__ Subsurface Testing. Describe methodology of testing under comments, below:

DISCUSSION OF METHODOLOGY:

The entire study area was subjected to pedestrian archaeological survey with shovel tests excavated at 30 meter intervals throughout, and excavated dirt screened through ¼" mesh. Based on the background research, the two previously-recorded prehistoric archaeological sites in the study area are surface scatters of lithic artifacts mapped on rises overlooking major drainages (Bear Creek and Captain Creek); however, because the study area is mapped across Holocene alluvium deposits and because soil series mapped throughout the western portion of the study area have documented potential for buried A horizons (beginning between 80 and 127 cmbs), the study area has potential for more deeply buried deposits. To assess the potential for the study area to yield deeply-buried archaeological materials, auger tests were excavated at approximately-90-meter intervals throughout the southwestern portion of the study area; these auger tests were excavated with a three-inch bucket auger into the base of every third shovel test. Soils excavated in shovel and auger tests in the portions of the study area west of Hickory Street consisted of reddish-brown silt loam (approximately 0-20 cmbs) which overlay damp reddish-brown clay loam (approximately 20-100 cmbs), which graded into a very dry yellow-red sandy clay (approximately 100-175 cmbs), which overlay a darker, reddish-brown clay extending beyond the limits of the auger (between 200-215 cmbs). No cultural materials were observed in shovel or auger tests. Additionally, all exposed cut banks of Captain Creek were examined for evidence of buried soils and/or archaeological materials; no buried soils, artifact deposits, or cultural features were noted in the two- to five-meter cut banks along Captain Creek.

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5. RESULTS OF INVESTIGATION:

XXX No archeological sites or buildings recorded in study area.

_____ Resources recorded in study area assessed as **not eligible** for the NRHP. Forms being submitted for agency review.

_____ Oklahoma Archeological Site Survey Form(s) for State Archeologist files.

_____ Historic Preservation Resource Identification Form(s) for SHPO files.

_____ Oklahoma Bridge Survey and Inventory Form.

_____ **NRHP-eligible properties** recorded in study area.

Forms being submitted for agency review.

_____ Oklahoma Archeological Site Survey Form(s) for State Archeologist files.

_____ Historic Preservation Resource Identification Form(s) for SHPO files.

_____ Oklahoma Bridge Survey and Inventory Form.

_____ Archeological sites requiring further assessment (i.e. evaluative testing)

COMMENTS AND DESCRIPTION OF FINDINGS:

No archaeological sites or buildings were recorded or documented in the study area.

A portion of the study area south of the SH-66B right-of-way and west of Captain Creek had been disturbed by timber grubbing and pushing prior to survey. Soils excavated in shovel and auger tests in the portions of the study area west of Hickory Street consisted of reddish-brown silt loam (approximately 0-20 cmbs) which overlay damp reddish-brown clay loam (approximately 20-100 cmbs), which graded into a very dry yellow-red sandy clay (approximately 100-175 cmbs), which overlay a darker, reddish-brown clay extending beyond

the limits of the auger (between 200-215 cmbs). Soils observed in shovel tests in the northeastern portion of the study area, between SH-66B and the existing railroad right-of-way, consisted of reddish-brown fine sandy loam (approximately 0-15 cmbs), which overlay reddish-brown fine sandy loam (approximately 15-65 cmbs), which in turn overlay yellow red sandy clay loam. No cultural materials were observed in any shovel or auger tests throughout the study area. Additionally, all exposed cut banks of Captain Creek were examined for evidence of buried soils and/or archaeological materials; no buried soils, artifact deposits, or cultural features were noted in the two- to five-meter cut banks along Captain Creek.

The existing SH-66B bridge over Captain Creek (Structure 4124 0157 X; NBI 03800) is composed of a single camelback pony truss main span with an I-beam approach span at each end (see attached photographs 1-8). Constructed in 1932, it was listed on the National Register of Historic Places (NRHP) in 2004 under Criterion A in Transportation for its association with Route 66.

In 2007, ODOT conducted a cultural resources investigation for the Lincoln County project JP 23208(04), which also proposed improvements to the SH-66B bridge over Captain Creek. The original concrete post-and-beam railing on the bridge approach spans had been removed and replaced in 1995 with steel W-rail on I-beam posts, with the W-rail continuing across the original lattice railing on the truss span. The 2007 proposed rehabilitation of the bridge was to include replacing the deck and curbs with concrete, and replacing the steel railings with a solid concrete parapet on both the approach and truss spans; the result of consultation in 2007 was that the proposed replacement parapet would have an adverse effect on the Captain Creek Bridge. Subsequently, state funds were used in this rehabilitation project and ODOT did not conclude consultation. However, ODOT later revised the rehabilitation plans to retain the existing railing (see photographs 3-4). Because ODOT revised the plans to eliminate the replacement parapet, which was the cause for the adverse effect determination, and retained the existing railing, our assessment is that the 2007 rehabilitation project had no adverse effect on the Captain Creek Bridge.

Character-defining elements of the Captain Creek Bridge are important to consider. In 2016, ODOT engaged Infrastructure Engineers, Inc. and TranSystems to prepare *Design Support for Section 4(f) Analysis for Historic Bridges: Structure No. 4124 0157 X (NBI No. 03800) SH-66B over Captain Creek, Lincoln County, Oklahoma* (previously submitted for your review on February 13, 2017). This report identifies distinguishing characteristics that convey historic significance linked to the bridge's technological context under National Register Criterion A, which encompasses the bridge's association with Route 66. The bridge is an example of a state-standard camelback pony truss bridge design, a bridge type associated with Route 66. As such, its character-defining elements are the pony truss main span incorporating state standard construction details: truss members including rolled I-beams and built-up beams, and rigid connections (see photographs 4 and 6). Flooring system members are not character-defining, but mechanical connection of the trusses to the flooring system is, to maintain the truss lines (Infrastructure Engineers & TranSystems 2016: 3, 19).

The *Design Support for Section 4(f) Analysis for Historic Bridges: Structure No. 4124 0157 X (NBI No. 03800) SH-66B over Captain Creek, Lincoln County, Oklahoma* outlines several alternatives for this proposed project for improvements to the SH-66B crossing over Captain Creek. ODOT is seriously considering Alternative 2B, which proposes rehabilitation and widening of the existing bridge, eliminating its fracture critical designation. To meet current standards, the bridge would need to be widened from its current 22-foot-width to 28-feet curb-to-curb (retention of the current 22-foot-wide geometry would require a design exception from FHWA). To eliminate the fracture critical nature of the structure, the Department would need to replace the truss span, currently the primary load carrying element, with a new multi-beam steel superstructure with a concrete deck. The existing trusses would be re-attached using diaphragms at the lower chord panel points. The current metal X-lattice rail, attached to the truss panels, is not crash-tested and may need to be replaced with a crash-tested rail. As noted above, the concrete post-and-beam guardrail on the approaches was replaced with a steel W-beam guardrail in 1995. Rehabilitation of the bridge would incorporate context-sensitive guardrails. As-built plans for the bridge illustrate "Type C" railing, as defined in the *Historic Bridge Railing Study for Route 66 Bridges* (Mead & Hunt 2014: 3).

Please note that although the majority of Oklahoma's historic truss bridges are significant under Criterion C, for their design and engineering aspects, the Captain Creek bridge is not listed in the NRHP under Criterion C. Because the Captain Creek bridge is significant under Criterion A for its association with Route 66, and not for its distinctive design or engineering characteristics, it is our opinion that we may have some latitude in the rehabilitation of this bridge – as long as the character-defining features of the bridge and the aspects of integrity of a structure listed in the NRHP under Criterion A are maintained. Properties significant under Criterion C should retain integrity of design, materials, and workmanship. Properties significant under Criterion A should retain historic integrity of location, design, feeling, and association in order to convey the significance of the event or broad pattern of history.

It is our opinion that Alternative 2B, including incorporating context-sensitive guardrails, would retain the historic design, setting, feeling, and association of the bridge with Route 66, by retaining the character-defining truss elements that make the bridge significant and maintain the intrinsic qualities of historic Route 66. Therefore, our assessment is that Alternative 2B would have no adverse effect on the Captain Creek Bridge.

---

6. RECOMMENDATIONS:

_____ **Plan Notes** requiring avoidance of cultural resources in off-project areas

XXX **Approval to proceed** with the proposed project as planned with no additional research. If subsurface archaeological materials are exposed during construction, the Contractor and Resident Engineer shall notify the Department Archaeologist in accordance with Section 202.04(a), Standard Specifications for Highway Construction.

_____ **Approval NOT Recommended,** until one or more of the following measures are completed.

_____ **Additional consultation with SHPO** regarding NRHP-listed Properties

_____ **Revise design** to avoid/protect resources

_____ **NRHP Eligibility Archaeological Test Excavations**

_____ **Implementation of MOA** with SHPO regarding Mitigation of Adverse Effects to Historic Properties

SUMMARY AND COMMENTS REGARDING RECOMMENDATIONS:

The SH-66B bridge over Captain Creek (Structure 4124 0157 X; NBI 03800) contains a single camelback pony truss main span with an I-beam approach span at each end. Built in 1932, it was listed on the National Register of Historic Places in 2004 under Criterion A in Transportation for its association with Route 66.

ODOT conducted a cultural resources investigation for a proposed rehabilitation of the Captain Creek Bridge in 2007 under JP 23208(04) (SHPO File #1734-07), but did not conclude consultation because state funds were used on the project. Because ODOT subsequently revised the rehabilitation plans to eliminate a proposed concrete parapet, which was the cause for an adverse effect determination, our assessment is that the 2007 rehabilitation project had no adverse effect on the Captain Creek Bridge.

It is our opinion that Alternative 2B, including incorporating context-sensitive guardrails, would retain the historic design, setting, feeling, and association of the bridge with Route 66, by retaining the character-defining truss elements that make the bridge significant and maintain the intrinsic qualities of historic Route 66. Therefore, our assessment is that Alternative 2B would have no adverse effect on the Captain Creek Bridge.

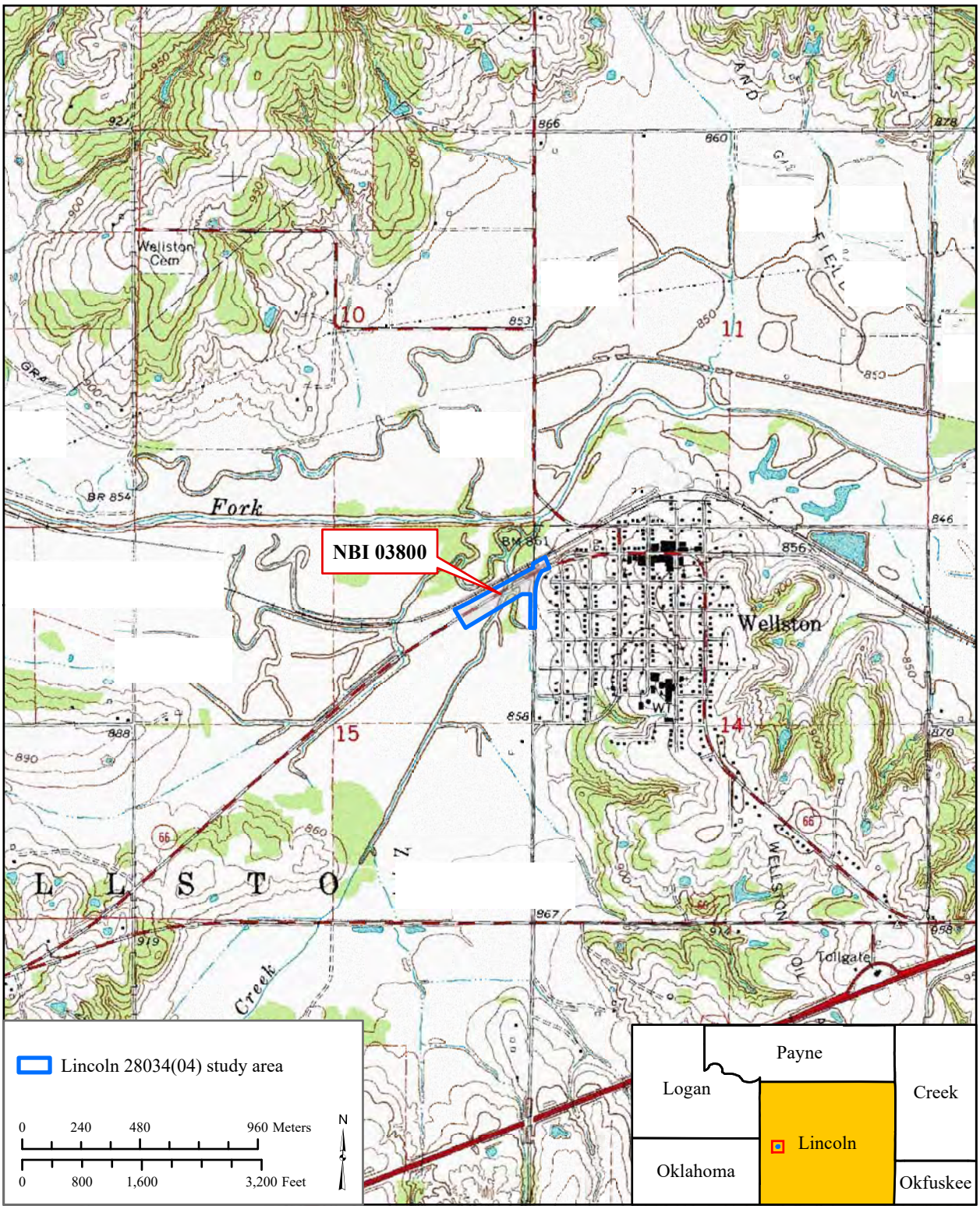

Figure 1. Lincoln 28034(04) SH-66B bridge over Captain Creek, 1.5 miles northeast of SH-66.

Basemap: Wellston (1966 PR 1981) 7.5' USGS Quadrangle
Legal: T14N R2E Sections 14-15

Oklahoma Department of Transportation

Figure 2. Lincoln 28034(04) SH-66B bridge over Captain Creek, 1.5 miles northeast of SH-66; showing areas subjected to auger testing.

Basemap: 2015 NAIP imagery; Wellston (1966 PR 1981) 7.5' USGS Quadrangle
Legal: T14N R2E Sections 14-15

OKLAHOMA DEPARTMENT OF TRANSPORTATION

Tribal Coordination
200 N.E. 21st Street, Room 3A8
Oklahoma City, OK 73105-3204
www.odot.org

January 19, 2017

Iowa Tribe of Oklahoma
Attn: Chairman Bobby Walkup
335588 East 750 Road
Perkins, OK 74059

Dear Chairman Walkup:

Re: Section 106 consultation for proposed Federal-Aid undertaking in Lincoln County, Oklahoma; JP# 28034(04)

Pursuant to 36 CFR Part 800.2(c)(2), the Oklahoma Department of Transportation is initiating consultation on behalf of the Federal Highway Administration regarding historic properties that may be affected by the following project.

County	Lincoln	**Job Piece #**	28034(04)	**Anticipated Let Date**	2019
Project description	Bridge replacement and approach improvements on State Highway 66B over Captain Creek, 1.5 miles northeast of State Highway 66				
Location	Sections 14 & 15 T14N R2E. See enclosed map.				
Additional information	This project is on a new alignment: ☐ yes ☒no This project will require new or temporary right of way: ☒ yes ☐no This project involves ground disturbance: ☒ yes ☐no				

If this undertaking may affect properties of religious and cultural significance to your tribe, please notify me as soon as possible. Likewise, if this undertaking occurs on land held in trust for the tribe and the tribe has 101(d)(2) status from the National Park Service, please make this office aware of the location of the trust property. In order to provide the most thorough consideration of these properties in the planning process, we appreciate receiving your response to this request within 30 days. Please rest assured that we will respect your wishes regarding the confidentiality of any information that you provide.

The proposed project area will be subject to a cultural resources survey. The goal of this survey is to make a reasonable and good faith effort to identify historic properties within the area of potential effect, in accordance with 36 CFR Part 800.4. The survey will be performed in consultation with the Oklahoma State Historic Preservation Office and other consulting parties as appropriate. You will be provided a copy of the cultural resources report upon its completion.

If you have any questions or would like to meet regarding this project, please contact me by telephone at 405.521.3632 or email at rfair@odot.org.

Sincerely,

Rhonda S. Fair, Ph.D.
Director
ODOT Tribal Coordination

cc: Historic Preservation Office

OKLAHOMA DEPARTMENT OF TRANSPORTATION

Tribal Coordination
200 N.E. 21st Street, Room 3A8
Oklahoma City, OK 73105-3204
www.odot.org

April 24, 2017

Iowa Tribe of Oklahoma
Attn: Chairman Bobby Walkup
335588 East 750 Road
Perkins, OK 74059

Dear Chairman Walkup:

Re: Section 106 consultation for proposed Federal-Aid undertaking in Lincoln County, Oklahoma; JP# 28034(04)

Pursuant to 36 CFR Part 800.2(c)(2), the Oklahoma Department of Transportation is consulting on behalf of the Federal Highway Administration regarding historic properties that may be affected by the following project.

County	Lincoln	**Job Piece #**	28034(04)	**Anticipated Let Date**	2019
Project description	Bridge replacement and approach improvements on State Highway 66B over Captain Creek, 1.5 miles northeast of State Highway 66				

In accordance with 36 CFR Part 800.4, the proposed project area was surveyed for cultural resources in order to identify historic properties that may be affected by the undertaking. A copy of this report is enclosed.

No archeological sites or buildings were identified during this investigation. The existing SH-66B bridge over Captain Creek contains a single camelback pony truss main span with an I-beam approach span at each end. Constructed in 1932, the bridge was listed on the National Register of Historic Places in 2004 for its association with Route 66. ODOT is considering rehabilitating and widening the bridge while incorporating context-sensitive guardrails to retain the historic design, setting, feeling, and association of the bridge with Route 66. Our preliminary assessment is that this would have no adverse effect on the bridge.

If this undertaking may affect properties of religious and cultural significance to your tribe or tribal trust land, please notify me as soon as possible. In order to provide the most thorough consideration of these properties in the planning process, we appreciate receiving your response to this request within 30 days. Please rest assured that we will respect your wishes regarding the confidentiality of any information that you provide.

If you have any questions or would like to meet regarding this project, please contact me by telephone at 405.521.3632 or by email at rfair@odot.org.

Sincerely,

Rhonda S. Fair, Ph.D.
Director
ODOT Tribal Coordination

cc: Historic Preservation Office

OKLAHOMA DEPARTMENT OF TRANSPORTATION

Tribal Coordination
200 N.E. 21st Street, Room 3A8
Oklahoma City, OK 73105-3204
www.odot.org

January 19, 2017

Kickapoo Tribe of Oklahoma
Attn: Chairman David Pacheco, Jr.
Post Office Box 70
McLoud, OK 74851

Dear Chairman Pacheco:

Re: Section 106 consultation for proposed Federal-Aid undertaking in Lincoln County, Oklahoma; JP# 28034(04)

Pursuant to 36 CFR Part 800.2(c)(2), the Oklahoma Department of Transportation is initiating consultation on behalf of the Federal Highway Administration regarding historic properties that may be affected by the following project.

County	Lincoln	**Job Piece #**	28034(04)	**Anticipated Let Date**	2019
Project description	Bridge replacement and approach improvements on State Highway 66B over Captain Creek, 1.5 miles northeast of State Highway 66				
Location	Sections 14 & 15 T14N R2E. See enclosed map.				
Additional information	This project is on a new alignment: ☐ yes ☒no This project will require new or temporary right of way: ☒ yes ☐no This project involves ground disturbance: ☒ yes ☐no				

If this undertaking may affect properties of religious and cultural significance to your tribe, please notify me as soon as possible. Likewise, if this undertaking occurs on land held in trust for the tribe and the tribe has 101(d)(2) status from the National Park Service, please make this office aware of the location of the trust property. In order to provide the most thorough consideration of these properties in the planning process, we appreciate receiving your response to this request within 30 days. Please rest assured that we will respect your wishes regarding the confidentiality of any information that you provide.

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If you have any questions or would like to meet regarding this project, please contact me by telephone at 405.521.3632 or email at rfair@odot.org.

Sincerely,

Rhonda S. Fair, Ph.D.
Director
ODOT Tribal Coordination

cc: Kent Collier

OKLAHOMA DEPARTMENT OF TRANSPORTATION

Tribal Coordination
200 N.E. 21st Street, Room 3A8
Oklahoma City, OK 73105-3204
www.odot.org

April 24, 2017

Kickapoo Tribe of Oklahoma
Attn: Chairman David Pacheco, Jr.
Post Office Box 70
McLoud, OK 74851

Dear Chairman Pacheco:

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If this undertaking may affect properties of religious and cultural significance to your tribe or tribal trust land, please notify me as soon as possible. In order to provide the most thorough consideration of these properties in the planning process, we appreciate receiving your response to this request within 30 days. Please rest assured that we will respect your wishes regarding the confidentiality of any information that you provide.

If you have any questions or would like to meet regarding this project, please contact me by telephone at 405.521.3632 or by email at rfair@odot.org.

Sincerely,

Rhonda S. Fair, Ph.D.
Director
ODOT Tribal Coordination

cc: Kent Collier

OKLAHOMA DEPARTMENT OF TRANSPORTATION

Tribal Coordination
200 N.E. 21st Street, Room 3A8
Oklahoma City, OK 73105-3204
www.odot.org

January 19, 2017

Osage Nation
Attn: Principal Chief Geoffrey Standing Bear
627 Grandview
Pawhuska, OK 74056

Dear Principal Chief Standing Bear:

Re: Section 106 consultation for proposed Federal-Aid undertaking in Lincoln County, Oklahoma; JP# 28034(04)

Pursuant to 36 CFR Part 800.2(c)(2), the Oklahoma Department of Transportation is initiating consultation on behalf of the Federal Highway Administration regarding historic properties that may be affected by the following project.

County	Lincoln	**Job Piece #**	28034(04)	**Anticipated Let Date**	2019
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Location	Sections 14 & 15 T14N R2E. See enclosed map.				
Additional information	This project is on a new alignment: ☐ yes ☒no This project will require new or temporary right of way: ☒ yes ☐no This project involves ground disturbance: ☒ yes ☐no				

If this undertaking may affect properties of religious and cultural significance to your tribe, please notify me as soon as possible. Likewise, if this undertaking occurs on land held in trust for the tribe and the tribe has 101(d)(2) status from the National Park Service, please make this office aware of the location of the trust property. In order to provide the most thorough consideration of these properties in the planning process, we appreciate receiving your response to this request within 30 days. Please rest assured that we will respect your wishes regarding the confidentiality of any information that you provide.

The proposed project area will be subject to a cultural resources survey. The goal of this survey is to make a reasonable and good faith effort to identify historic properties within the area of potential effect, in accordance with 36 CFR Part 800.4. The survey will be performed in consultation with the Oklahoma State Historic Preservation Office and other consulting parties as appropriate. You will be provided a copy of the cultural resources report upon its completion.

If you have any questions or would like to meet regarding this project, please contact me by telephone at 405.521.3632 or email at rfair@odot.org.

Sincerely,

Rhonda S. Fair, Ph.D.
Director
ODOT Tribal Coordination

cc: Tribal Historic Preservation Office

TRIBAL HISTORIC PRESERVATION OFFICE

Date: **February 21, 2017** **File: 1617-1843OK-1**

RE: **ODOT JP# 28034(04) Bridge Replacement and Approach Improvements on State Highway 66B over Captain Creek in Lincoln County, Oklahoma**

Oklahoma Department of Transportation
Rhonda Fair
200 NE 21st Street, Room 3A8
Oklahoma City, OK 73105-3204

Dear Dr. Fair,

The Osage Nation Historic Preservation Office has received notification and accompanying information for the proposed project ODOT JP# 28034(04) Bridge Replacement and Approach Improvements on State Highway 66B over Captain Creek in Lincoln County, Oklahoma. There are no known Osage resources within the project area. This office looks forward to reviewing the final report.

Should you have any questions or need any additional information, please feel free to contact me at the number listed below. Thank you for consulting with the Osage Nation on this matter.

Sincerely,

James Munkres
Archaeologist

627 Grandview, Pawhuska, OK 74056, (918) 287-5328, Fax (918) 287-5376

OKLAHOMA DEPARTMENT OF TRANSPORTATION

Tribal Coordination
200 N.E. 21st Street, Room 3A8
Oklahoma City, OK 73105-3204
www.odot.org

April 24, 2017

Osage Nation
Attn: Principal Chief Geoffrey Standing Bear
627 Grandview
Pawhuska, OK 74056

Dear Principal Chief Standing Bear:

Re: Section 106 consultation for proposed Federal-Aid undertaking in Lincoln County, Oklahoma; JP# 28034(04)

Pursuant to 36 CFR Part 800.2(c)(2), the Oklahoma Department of Transportation is consulting on behalf of the Federal Highway Administration regarding historic properties that may be affected by the following project.

County	Lincoln	**Job Piece #**	28034(04)	**Anticipated Let Date**	2019
Project description	Bridge replacement and approach improvements on State Highway 66B over Captain Creek, 1.5 miles northeast of State Highway 66				

In accordance with 36 CFR Part 800.4, the proposed project area was surveyed for cultural resources in order to identify historic properties that may be affected by the undertaking. A copy of this report is enclosed.

No archeological sites or buildings were identified during this investigation. The existing SH-66B bridge over Captain Creek contains a single camelback pony truss main span with an I-beam approach span at each end. Constructed in 1932, the bridge was listed on the National Register of Historic Places in 2004 for its association with Route 66. ODOT is considering rehabilitating and widening the bridge while incorporating context-sensitive guardrails to retain the historic design, setting, feeling, and association of the bridge with Route 66. Our preliminary assessment is that this would have no adverse effect on the bridge.

If this undertaking may affect properties of religious and cultural significance to your tribe or tribal trust land, please notify me as soon as possible. In order to provide the most thorough consideration of these properties in the planning process, we appreciate receiving your response to this request within 30 days. Please rest assured that we will respect your wishes regarding the confidentiality of any information that you provide.

If you have any questions or would like to meet regarding this project, please contact me by telephone at 405.521.3632 or by email at rfair@odot.org.

Sincerely,

Rhonda S. Fair, Ph.D.
Director
ODOT Tribal Coordination

cc: Tribal Historic Preservation Office

OKLAHOMA DEPARTMENT OF TRANSPORTATION

Tribal Coordination
200 N.E. 21st Street, Room 3A8
Oklahoma City, OK 73105-3204
www.odot.org

January 19, 2017

Sac and Fox Nation
Attn: Chief Elizabeth Kay Rhoads
920883 S Highway 99, Building A
Stroud, OK 74079

Dear Chief Rhoads:

Re: Section 106 consultation for proposed Federal-Aid undertaking in Lincoln County, Oklahoma; JP# 28034(04)

Pursuant to 36 CFR Part 800.2(c)(2), the Oklahoma Department of Transportation is initiating consultation on behalf of the Federal Highway Administration regarding historic properties that may be affected by the following project.

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Additional information	This project is on a new alignment: ☐ yes ☒no This project will require new or temporary right of way: ☒ yes ☐no This project involves ground disturbance: ☒ yes ☐no				

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The proposed project area will be subject to a cultural resources survey. The goal of this survey is to make a reasonable and good faith effort to identify historic properties within the area of potential effect, in accordance with 36 CFR Part 800.4. The survey will be performed in consultation with the Oklahoma State Historic Preservation Office and other consulting parties as appropriate. You will be provided a copy of the cultural resources report upon its completion.

If you have any questions or would like to meet regarding this project, please contact me by telephone at 405.521.3632 or email at rfair@odot.org.

Sincerely,

Rhonda S. Fair, Ph.D.
Director
ODOT Tribal Coordination

cc: Sandra Kaye Massey

OKLAHOMA DEPARTMENT OF TRANSPORTATION

Tribal Coordination
200 N.E. 21st Street, Room 3A8
Oklahoma City, OK 73105-3204
www.odot.org

April 24, 2017

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Stroud, OK 74079

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Sincerely,

Rhonda S. Fair, Ph.D.
Director
ODOT Tribal Coordination

cc: Sandra Massey

OKLAHOMA DEPARTMENT OF TRANSPORTATION

Tribal Coordination
200 N.E. 21st Street, Room 3A8
Oklahoma City, OK 73105-3204
www.odot.org

January 19, 2017

Wichita and Affiliated Tribes
Attn: President Terri Parton
Post Office Box 729
Anadarko, OK 73005

Dear President Parton:

Re: Section 106 consultation for proposed Federal-Aid undertaking in Lincoln County, Oklahoma; JP# 28034(04)

Pursuant to 36 CFR Part 800.2(c)(2), the Oklahoma Department of Transportation is initiating consultation on behalf of the Federal Highway Administration regarding historic properties that may be affected by the following project.

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Sincerely,

Rhonda S. Fair, Ph.D.
Director
ODOT Tribal Coordination

cc: Historic Preservation Office

OKLAHOMA DEPARTMENT OF TRANSPORTATION

Tribal Coordination
200 N.E. 21st Street, Room 3A8
Oklahoma City, OK 73105-3204
www.odot.org

April 24, 2017

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Post Office Box 729
Anadarko, OK 73005

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Sincerely,

Rhonda S. Fair, Ph.D.
Director
ODOT Tribal Coordination

cc: Historic Preservation Office

Oklahoma Historical Society *Founded May 27, 1893*
State Historic Preservation Office
Oklahoma History Center • 800 Nazih Zuhdi Drive • Oklahoma City, OK 73105-7917
(405) 521-6249 • Fax (405) 522-0816 • www.okhistory.org/shpo/shpom.htm

February 28, 2017

Mr. Scott Sundermeyer, Director
ODOT Cultural Resources Program
111 East Chesapeake, Rm. 102, OU
Norman, OK 73019

RE: File #0852-17; Lincoln County Federal Highway Administration Project #JP-28034(04); Proposed Improvements to Captain Creek Bridge on SH-66B, 1.5 miles northeast of SH-66

Dear Mr. Sundermeyer:

We have received and reviewed the documentation submitted on the proposed improvements to Captain Creek Bridge in Lincoln County, a property individually listed in the National Register of Historic Places under Criterion A for its association with Route 66.

It is our understanding that a cultural resources study and report that includes a review of archaeological resources and the built environment in the project area is pending and that we may reserve our comments on the proposed alternatives to the Captain Creek Bridge as outlined in the report prepared by Infrastructure Engineers, Inc. and TransSystems, *Design Support for Section 4(f) Analysis for Historic Bridges Structure No. 4124 0157 X (NBI No. 03800) SH-66B over Captain Creek*, until we receive the rest of the project materials for review. We will exercise this option.

Thank you for the opportunity to comment on this project. We look forward to working with you in the future. If you have any questions, please contact Catharine M. Wood, Historical Archaeologist, at 405/521-6381.

Should further correspondence pertaining to this project be necessary, please reference the above underlined file number. Thank you.

Sincerely,

Melvena Heisch
Deputy State Historic
Preservation Officer

MH:pm

OKLAHOMA DEPARTMENT OF TRANSPORTATION
CULTURAL RESOURCES PROGRAM
111 E. Chesapeake, Room 102, University of Oklahoma
Norman, OK 73019-5111
Phone: 405-325-7201/325-8665; FAX: 405-325-7604

February 13, 2017

Ms. Melvena Heisch
Deputy State Historic Preservation Officer
Oklahoma History Center
800 Nazih Zuhdi Drive
Oklahoma City, Oklahoma 73105

Dear Ms. Heisch:

Re: Lincoln County Federal Highway Administration (FHWA)-funded project: J/P 28034(04); Proposed improvements to SH-66B over Captain Creek, 1.5 miles northeast of SH-66

The Oklahoma Department of Transportation (ODOT) is proposing to correct deficiencies with the above-referenced bridge, which crosses Captain Creek on an alignment of Route 66 in Wellston. The bridge was individually listed on the National Register of Historic Places (NRHP) in 2004. ODOT considered a federal-aid undertaking to rehabilitate this bridge in 2007 under JP 23208(04); SHPO File 1734-07, but never concluded consultation as State Funds were used on the project.

The subject bridge is a 227'-4" long, three span bridge consisting of a 102'-0" long Camelback Pony Truss main span flanked on each end by a 62'-8" long steel multi-beam span. The bridge was constructed in 1932 and is listed on the NRHP under criterion A for its association with Route 66.

ODOT has invited the following organizations and invited them to be consulting parties for this undertaking: Historic Bridge Foundation, National Park Service Route 66 Corridor Preservation Program, Oklahoma Route 66 Association, Jim Ross, Oklahoma Historic Bridge and Highway Group, Preservation Oklahoma, Lincoln County Historical Society and Museum of Pioneer History Route 66 Interpretive Center. Please consider this transmittal an initiation of the Section 106 process for his undertaking.

Attached please find, for your information, a copy of the *Design Support for Section 4(f) Analysis for Historic Bridges Structure No. 4124 0157 X (NBI No. 03800) SH-66B over Captain Creek* report, prepared by Infrastructure Engineers, Inc. and TranSystems for ODOT. As a NRHP-property, the Captain Creek Bridge is afforded protection under Section 4(f) of the U.S. Department of Transportation Act of 1966. This design analysis outlines several alternatives for the project. ODOT is seriously considering Alternative 2B, which proposes rehabilitation and widening of the existing bridge, eliminating fracture critical designation. Also attached is a study footprint, currently considered the area of potential effect (APE) for the project.

We welcome any comments you have to the proposed alternatives, however we recognize that you

may wish to reserve comment until a cultural resources study and report has been completed and submitted to your office. The cultural resources report will include an archaeological and built environment investigation of the study area. We will also provide a summary of the 2007 state-funded rehabilitation, discussed above, and an opinion of whether those alterations affected the historic integrity of the bridge.

Please consider this submittal as an initiation of the Section 106 process, pursuant to 36 CFR 800.3. If you have any questions regarding this project, or require any additional information, please contact me at 405-325-7201 or via email at ssundermeyer@odot.org.

Sincerely,

Scott A. Sundermeyer
ODOT Cultural Resources Program Director

OKLAHOMA DEPARTMENT OF TRANSPORTATION
CULTURAL RESOURCES PROGRAM
111 E. Chesapeake, Room 102, University of Oklahoma
Norman, OK 73019-5111
Phone: 405-325-7201/325-8665; FAX: 405-325-7604

January 27, 2017

Dear Consulting Party:

Re: Lincoln County Federal Highway Administration (FHWA)-funded project: J/P 28034(04); Proposed improvements to SH-66B over Captain Creek, 1.5 miles northeast of SH-66

The Oklahoma Department of Transportation (ODOT) is proposing to correct deficiencies with the above-referenced bridge, which crosses Captain Creek on an alignment of Route 66 in Wellston. The bridge was individually listed on the National Register of Historic Places (NRHP) in 2004. Under Section 106 of the National Historic Preservation Act (NPA), federal agencies must consider effects to historic properties, identify parties with a demonstrated interest in the undertaking, and consult with these parties regarding the potential effect to historic properties. Because of your interest in this bridge, historic properties, or this project specifically, ODOT and FHWA are inviting your organization to be a consulting party on this project. Other potential consulting parties have been identified as those listed in the carbon copy, below. ODOT will initiate consultation with the State Historic Preservation Office (SHPO) and the Oklahoma Archeological Survey (OAS) under separate cover.

Attached please find, for your information, a copy of the *Design Support for Section 4(f) Analysis for Historic Bridges Structure No. 4124 0157 X (NBI No. 03800) SH-66B over Captain Creek* report, prepared by Infrastructure Engineers, Inc. and TranSystems for ODOT. As a NRHP-property, the Captain Creek Bridge is afforded protection under Section 4(f) of the U.S. Department of Transportation Act of 1966. This design analysis outlines several alternatives for the project. ODOT is seriously considering Alternative 2B, which proposes rehabilitation and widening of the existing bridge, eliminating fracture critical designation.

The subject bridge is a 227'-4" long, three span bridge consisting of a 102'-0" long Camelback Pony Truss main span flanked on each end by a 62'-8" long steel multi-beam span. The bridge was constructed in 1932 and is listed on the NRHP under criterion A for its association with Route 66.

As a consulting party, you will receive documentation regarding ODOT's efforts to identify historic properties on this project, and you will be afforded an opportunity to comment on the project and its affect to the Captain Creek Bridge. We appreciate you taking time to respond to this letter in writing or via email with any comment you may have, so that we may integrate your concerns or suggestions into the planning process. Should you not care to be a consulting party in this process, we respectfully ask that you inform us of this decision as well.

If you have any questions regarding this project, or require any additional information, please contact me at 405-325-7201 or via email at ssundermeyer@odot.org.

Sincerely,

Scott A. Sundermeyer
ODOT Cultural Resources Program Director

Cc: Historic Bridge Foundation
National Park Service Route 66 Corridor Preservation Program
Oklahoma Route 66 Association
Jim Ross
Oklahoma Historic Bridge and Highway Group
Preservation Oklahoma
Lincoln County Historical Society and Museum of Pioneer History
Route 66 Interpretive Center

OKLAHOMA DEPARTMENT OF TRANSPORTATION
CULTURAL RESOURCES PROGRAM
111 E. Chesapeake, Room 102, University of Oklahoma
Norman, OK 73019-5111
Phone: 405-325-7201/325-8665; FAX: 405-325-7604

December 22, 2016

Mr. Faria Emamian
FHWA Oklahoma Division
5801 N Robinson Ave., Suite 300
Oklahoma City, OK 73118

Dear Mr. Emamian:

Re: Lincoln County FHWA-funded project: J/P 28034(04); Proposed improvements to SH-66B over Captain Creek, 1.5 miles northeast of SH-66.

As discussed in our meeting of November 17, 2016, ODOT Division 3 has selected Alternative 2B, as described in the *Design Support for Section 4(f) Analysis for Historic Bridges Structure No. 4124 0157 X (NBI No. 03800) SH-66B over Captain Creek* report prepared by Infrastructure Engineers, Inc. and TranSystems. Alternative 2B proposes rehabilitation and widening of the existing bridge, eliminating fracture critical designation.

The subject bridge is a 227'-4" long, three span bridge consisting of a 102'-0" long Camelback Pony Truss main span flanked on each end by a 62'-8" long steel multi-beam span. The bridge was constructed in 1932 and is associated with Historic Route 66. The bridge was listed on the National Register of Historic Places (NRHP) in March, 2004 under criterion A, and is significant for its association with Route 66. For reference, properties can be listed on the NRHP under one or more of four different criteria:

Criterion A, Property is associated with events that have made a significant contribution to the broad patterns of our history.
Criterion B, Property is associated with the lives of persons significant in our past.
Criterion C, Property embodies the distinctive characteristics of a type, period, or method of construction or represents the work of a master, or possesses high artistic values, or represents a significant and distinguishable entity whose components lack individual distinction.
Criterion D, Property has yielded, or is likely to yield information important in prehistory or history

In order for *significant* properties to be eligible for inclusion or listed on the NRHP, such properties must also retain *historic integrity*. The National Historic Preservation Act (NHPA) has defined seven aspects of integrity that a property may have (in any combination) that allows the property to convey its historic significance: location, design, setting, materials, workmanship, feeling, and association.

In Oklahoma, the majority of historic truss bridges are significant under criterion C, for their design and engineering aspects. The Captain Creek bridge is not listed in the NRHP under criterion C. Because the Captain Creek bridge is significant for its association with Route 66, and not for its distinctive design or engineering characteristics, the Department's Cultural Resources Program believes that the Department may have some latitude in the rehabilitation of the structure. Properties significant under criterion C should retain integrity of design, materials, and workmanship. Properties significant under criterion A should retain historic integrity of location, design, feeling, and association in order to convey the significance of the event or broad pattern of history.

As a NRHP property, the bridge is afforded protection under Section 4(f) of the U.S. Department of

Transportation Act of 1966. The Design Analysis, discussed above, outlines several alternatives that, in accordance with FHWA's *Programmatic Section 4(f) Evaluation and Approval for FHWA Projects that Necessitate the Use of Historic Bridges*, maintain the significance of the bridge and, we would argue, avoid the 'use' of the structure. In other words, the preservation intent of 4(f) is being realized by way of each of the alternatives discussed in the Design Analysis. While each of these alternatives presents different measures for retention and/or rehabilitation, they all retain the historic design, setting, feeling, and association of the bridge with Route 66.

It is the Department's intention to move forward with Alternative 2B. This alternative proposes to widen the bridge and eliminate the fracture critical nature of the structure. To meet current standards, the bridge would need to be widened from its current 22-foot-width to 28-feet curb-to-curb (retention of the current 22-foot-wide geometry would require a design exception from FHWA). To eliminate the fracture critical nature of the structure, the Department would need to replace the truss span, currently the primary load carrying element, with a new multi-beam steel superstructure with a concrete deck,. The existing trusses would be re-attached using diaphragms at the lower chord panel points. The current metal X-lattice rail, attached to the truss panels, is not crash-tested and may need to be replaced with a crash-tested rail. The as-built plans illustrate a concrete post and double beam rail on the approaches. This rail has been replaced with a metal W-beam guardrail. Rehabilitation of the bridge would incorporate context-sensitive guardrails.

Under Section 4(f), USDOT agencies cannot approve the use of land from publicly owned parks, recreational areas, wildlife and waterfowl refuges, or public and private historical sites unless there is a feasible and prudent alternative to the use of that resource. A proposed action will use a bridge that is on or eligible for inclusion on the National Register of Historic Places when the action will impair the historic *integrity* of the bridge either by rehabilitation or demolition. Historic integrity of design, setting, feeling, and association will be retained through the selection of Alternative 2B. In other words, the features that make the bridge *significant* and the intrinsic qualities of historic Route 66 will be maintained through the retention of the truss elements of the bridge. The Department's Cultural Resources Program plans to proceed in consultation with SHPO and other consulting parties with the argument that Alternative 2B meets the preservation intent of 4(f) and that the selection of this alternative does not constitute an adverse effect to the structure under the NHPA.

By submittal of this letter, the Department is asking for your review of the above information. With respect to our opinion that Alternative 2B retains the historic integrity and significance of the bridge, we ask that you concur with our opinion that the Department's preferred alternative does not constitute a 4(f) use of the structure. Should you believe that Alternative 2B does "use" the structure, we recommend that you refrain from concurring with our preferred alternative until the Department has moved forward with the Section 106 process sufficiently to determine whether there are any unique factors that would cause us to reconsider our alternative.

If you have any questions regarding this project, please contact me at 405-325-7201 or ssundermeyer@odot.org.

Sincerely,

Scott A. Sundermeyer
ODOT Cultural Resources Program Director

Design Support for Section 4(f) Analysis for Historic Bridges

Structure No. 4124 0157 X (NBI No. 03800)
SH-66B over Captain Creek
Lincoln County, Oklahoma

ODOT JP #28034(04)
ODOT Engineering Contract Number: 1499A

April 2016

Report Prepared By: Infrastructure Engineers & Transystems

Design Support for Section 4(f) Analysis for Historic Bridges

Structure No. 4124 0157 X (NBI No. 03800)
SH-66B over Captain Creek
Lincoln County, Oklahoma

ODOT JP #28034(04)
ODOT Engineering Contract Number: 1499A

LICENSED PROFESSIONAL ENGINEER
GREGG A. HOSTETLER
25904
OKLAHOMA

Gregg Hostetler

Gregg A. Hostetler, P.E.

Gregg Hostetler

Digitally signed by Gregg Hostetler
DN: cn=Gregg Hostetler, o=Infrastructure Engineers, Inc., ou=Operations, email=ghostetler@go-iei.com, c=US
Date: 2016.04.27 17:17:31 -05'00'

Date

INFRASTRUCTURE ENGINEERS, INC.

Infrastructure Engineers, Inc. (Cert. of Auth. 2518 PE)
609 S. Kelly Avenue, Suite J-1, Edmond, OK

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Appendices

F: Field Review Notes and Photographs

G: March 2016 Bridge Inspection Report and 2015 Traffic Data

H: Select Plan Sheets and Obsolete ODOT Bridge Standards

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Introduction

Section 4(f) regulations (CRF 23 774) state that FHWA (Federal Highway Administration) may not approve an action that uses public park and recreation land, or historic properties, when there is a feasible and prudent alternative to the action. In most cases, actions that use an historic bridge are those that result in demolition/removal of the historic structure or that reconstruct it to such an extent that the character defining features that give it historic significance are eliminated or substantially impaired.

To simplify the 4(f) process, FHWA has established a nationwide Programmatic 4(f) evaluation for historic bridges that specifies a limited set of avoidance alternatives that must be evaluated and rejected before an action that uses an historic bridge can be approved. Programmatic 4(f) evaluations also expedite the 4(f) process because they are approved at the state level by FHWA Division Offices without national legal sufficiency review. To reject an avoidance alternative, FHWA must demonstrate that it cannot be constructed as a matter of sound engineering practice (not feasible) and that it is not a reasonable expenditure of public funds (not prudent). This evaluation must be made in light of the preservation intent of the law and the definition of "feasible and prudent avoidance alternative" in 23 CFR 774.17. If an avoidance alternative exists that is both feasible and prudent, it must be selected by FHWA.

ODOT and FHWA will assess the feasibility and prudence of avoidance alternatives based in part on the information generated in this report. This information may also be used by the agencies to evaluate and incorporate measures to minimize harm resulting from use of an historic bridge that cannot be avoided.

Existing Conditions[1]

Located in the City of Wellston, the bridge carrying two lanes of SH-66B over Captain Creek (Structure No. 4124 0157 X, NBI No. 03800) is a 227'-4" long, three span bridge consisting of a 102'-0" long through Camelback Pony Truss main span flanked on each end by a 62'-8" long steel multi-beam span. The bridge is positioned within a tangent and flat section of Route 66B, but all spans are skewed 39° 13' 30" due to the alignment of Captain Creek. The bridge roadway horizontal clearance is 22'-0" curb-to-curb, which matches the approach roadway, and there is no vertical clearance restriction.

The bridge was built in 1932 utilizing state design standards, which are now obsolete. The truss span is supported by two column reinforced concrete intermediate piers. The approach spans are supported by reinforced concrete abutments at each end of the bridge and by a steel pier beam at each intermediate pier. The pier beam is supported by the same two column reinforced concrete intermediate piers that support the truss span. See Figures 1 and 2 for a

[1] The bridge information included in this section is taken from original bridge plan sheets and standards, the January 30, 2014 ODOT Bridge Inspection Report and notes from a field review performed by Infrastructure Engineers, Inc. in October 2014. Information taken from other documents is referenced separately.

location map and vicinity map of the bridge respectively, and Figures 3 through 11 for photos of the existing bridge, at the end of this section of the report.

The posted speed for the roadway at the bridge, classified as a rural major collector, is 45 miles per hour. The current Average Annual Daily Traffic (AADT) is 800 vehicles per day[2]; the future AADT is 1,120 vehicles per day in the year 2035.

The bridge is classified as structurally deficient due to the existing weight restriction and the superstructure and substructure having NBI Condition Ratings of 4 (poor condition). In addition to being structurally deficient, the bridge has a substandard clear roadway width of 22'-0." Current AASHTO standards require a minimum clear width of 28'-0" for the functional classification of the roadway. The bridge, however, shows no signs of impact damage and there is no accident history at the bridge from 2009 through 2014.

The following information is from the March 28, 2016 bridge inspection report (Refer to Appendix G): The bridge has a sufficiency rating of 30.3 (scale of 1 to 100). The bridge superstructure is in poor condition (NBI Rating = 4) due to severe corrosion and section loss of the bottom chords, floorbeams and stringers; and cracks at the Span 1 and 5 beam to pier beam connections. The truss upper chords, web members and end posts are in fair to satisfactory condition. The substructure is in poor condition (NBI Rating = 4) due to extensive cracks and spalls, and the deck is in good condition (NBI Rating = 7), having been replaced in 2008.

The bridge is weight restricted and posted as follows: Single Unit Truck, 19 Tons; Semi-Truck, 25 Tons; and Combination Truck, 42 Tons. See Figure 5 for a photo of one of the current posting signs. All photographs in this report (Figures 12 through 22) were taken during a field review on October 16, 2014.

The trusses (bottom chords, verticals, and diagonal members in tension), floorbeams for Span 2 (Pony Truss Span) and the pier beams for Spans 1 and 3 are classified as fracture critical members; defined as a steel member in tension, or with a tension element, whose failure would probably cause a portion of or the entire bridge to collapse[3].

[2] Traffic Data, ODOT, January 2015
[3] 23 CFR Part 650, National Bridge Inspection Standards

Distinguishing Characteristics That Convey Historic Significance

The bridge has been listed on the National Register of Historic Places (NRHP) as a key resource holding intrinsic value in this section of the Route 66 National Scenic Byway. It is considered a bridge with "High" historic significance under Criterion A.

While all truss members are type defining, not all are equally important to conveying historic significance. The distinguishing characteristics that convey historic significance are linked to historic context, particularly the technological context.

While not possessing early or innovative details, the 1933 bridge is historic as an example of a state-standard bridge design utilizing period construction details, like rigid field connections and rolled, as well as built-up, I-shape sections. The camelback pony truss was a state standard design for a 100-ft span. With its 22'-wide roadway, it represents early-1930s geometric design used for state highways. The bridge emerged as an effort by the local community to have a paved section of Route 66 pass through the town. In 1933, the state paved the section of the road that connected Wellston with other points on the road and built this bridge. The United States Bureau of Public Roads required the state to follow a shorter route that bypassed the town to the south; therefore, two sections of road were built, but the route south of town became the new Route 66 alignment.

The distinguishing characteristics that convey the historic significance of the bridge are the pony truss main span and state standard construction details; rigid connections, use of I-shapes, and built-up members. Maintaining the design of all truss spans and in-kind replacement of members, meaning mechanical connections and use of I-shape steel sections, will preserve the distinctive characteristics that convey the historic significance of the bridge. Adding material to the bridge to strengthen it or make needed repairs to deteriorated portions of members should not adversely affect the bridge since the distinguishing characteristics will remain. Features or elements that are not distinctive characteristics are the flooring system members, as long as how they are connected to the trusses is maintained.

Eliminating fracture critical elements will introduce new elements to the underside of the bridge, but they are reversible and will not affect the distinctive characteristics of the bridge. What is important is to connect the wider in-kind replacement floorbeams, brackets, and bracing using mechanical connections This way the truss designs and truss lines themselves, which are the key distinctive elements of the bridge, will be preserved and remain in use. Placing traffic barriers that meet current safety requirements is also a reversible addition that does not alter the distinguishing characteristics, but does obscure the view of the trusses from the roadway.

Figure 1: Bridge location map

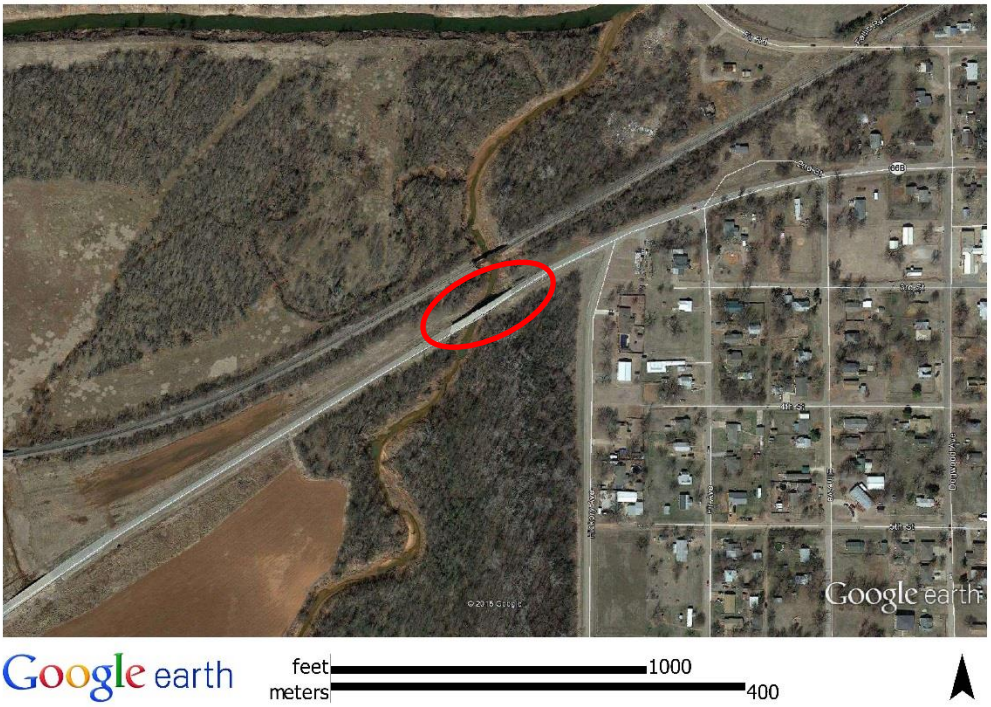

Figure 2: Bridge vicinity map

Figure 3: North elevation, main span (Span 2)

Figure 4: South elevation, Spans 2 and 3

Figure 5: Current bridge posting

Figure 6: West approach looking east

Figure 7: East approach looking west

Figure 8: Abutment 1 (west) and underside of Span 1 (looking west)

Figure 9: Abutment 2 (east) and underside of Span 3 (looking east)

Figure 10: Pier 2 (west pier), west face

Figure 11: Pier 3 (east pier), west face

Figure 12: Span 2 (main span), Floor Beam 0, strengthening angle & plate

Figure 13: Span 2 (main span), Stringer 1 at Floor Beam 0, previous repair

Figure 14: Span 2, Stringer 1 connection to Floor Beam 0, south side connection

Figure 15: Span 2, Stringer 1 between Floorbeams 5 and 6, 100 percent section loss

Figure 16: Typical corrosion and pack rust at floor beam to truss connection

Figure 17: Span 2, North Truss, Panel Point L1 (typical of Panel Points L1 and L4 on both trusses)

Figure 18: Span 2, South Truss, Panel Point L2 (typical of Panel Points L2 and L3 on both trusses)

Figure 19: Span 2, South Truss, Panel Point L5 (typical of Panel Points L0 and L5 on both trusses)

Figure 20: Span 2, South Truss, Panel Point U2 (conditions typical of upper panel points at both trusses)

Figure 21: Span 2, North Truss, bearing at L0 (west end), anchor bolt bent to the west due to slot exceeding limits of expansion

Figure 22: Typical condition of pier beam bearings at Spans 1 and 3, Piers 1 and 2 respectively

Purpose & Need for the Project

The following purpose and need for the project were provided by ODOT:

The purpose of the project is to provide a safe crossing and preserve transportation continuity over Captain Creek. The need of the project is to address the current structural and functional deficiencies of the existing bridge and approach roadway.

Alternatives Analysis

Alternatives that would avoid replacement of the existing bridge have been evaluated to determine probable costs and the extent of work required to satisfy the project purpose and need. To that end, the following alternatives have been evaluated:

- Alternative 1: Do Nothing
- Alternative 2: Rehabilitation Without Affecting Historic Integrity of the Bridge
    - Alternative 2(a): Rehabilitation and widening of existing bridge, bridge remains fracture critical
    - Alternative 2(b): Rehabilitation and widening of existing bridge, eliminating fracture critical designation
    - Alternative 2(c): Rehabilitation of existing bridge, bridge remains fracture critical; design exception to keep existing bridge width
    - Alternative 2(d): Rehabilitation of existing bridge, eliminating fracture critical designation; design exception to keep existing bridge width
- Alternative 3: Build on New Location
    - Alternative 3(a): Retain existing bridge in vehicular service as part of a one-way pair, bridge remains fracture critical
    - Alternative 3(b): Retain existing bridge in vehicular service as part of a one-way pair, eliminating fracture critical designation
    - Alternative 3(c): Retain existing bridge in place, either as a non-functional "monument" or as a non-motorized pedestrian or bicycle facility
- Alternative 4: New bridge with existing trusses added as an architectural/historic feature (new or existing alignment)

All analyses have been performed in accordance with the American Association of State Highway and Transportation Officials (AASHTO) Manual for Bridge Evaluation, 2nd Edition and AASHTO Standard Specifications for Highway Bridges, 17th Edition. Models were prepared using

available state design standard drawings from the era of construction[4], supplemented with the results of the field review performed in October 2014.

Alternative 1 - Do Nothing

The do nothing alternative consists of no improvements to correct the structurally deficient or functionally obsolete aspects of the bridge, but does include some minor superstructure repairs, substructure repairs, and painting of the bridge to facilitate turning the bridge over to Lincoln County. Because portions of the bridge structure are above the roadway level, the bridge may require periodic closures (lane closures with flagging operations or full bridge closure) to perform needed maintenance, like painting the top chords, diagonals, and bolting supplemental plates to strengthen members with section loss.

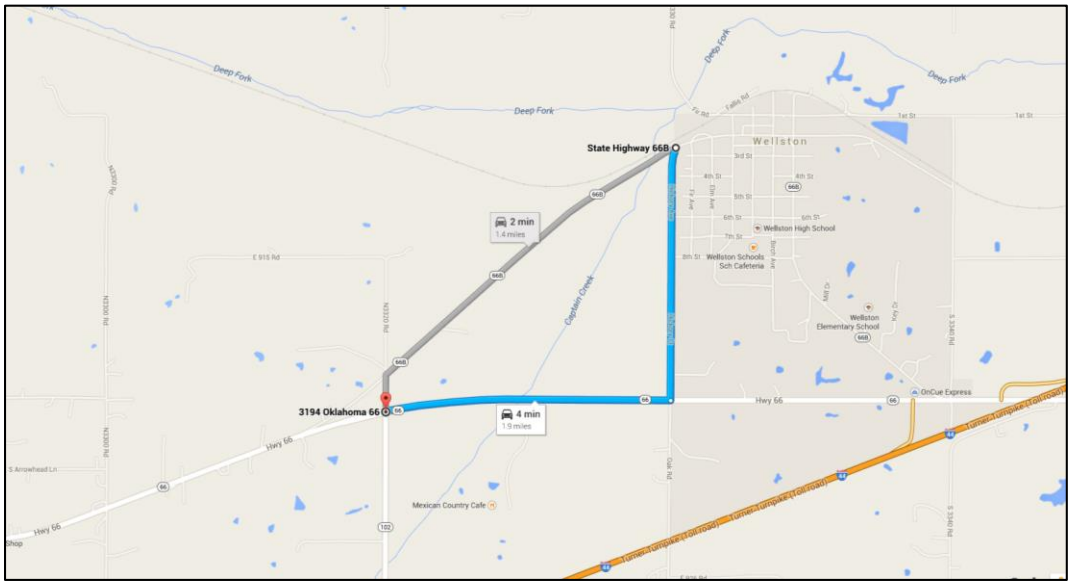

Figure 23: Potential Detour Route using Hickory Ave. This detour adds 0.5 miles to the trip.

As the bridge gets older, it will require more frequent inspections. If the bridge was closed to traffic in the future due to deteriorating conditions, the detour, via Hickory Ave, is about 0.5 miles. Hickory Avenue is currently a city street and would require upgrading to state standards prior to being a viable detour route.

This alternative has the following advantages:

- Minimal roadway construction and utility impact costs
- Minimal traffic disruptions
- Minimal environmental impacts, including no adverse effects to the NRHP-eligible bridge
- Minimal engineering costs

[4] ODOT Standard Drawings IB-4 and C-100, various sheets dated between 1932 and 1938.

This alternative has the following disadvantages:

- Does not address the major structural and functional deficiencies
- Bridge remains fracture critical
- Bridge remains load posted
- Periodic bridge closures (lane or complete) for maintenance
- Many elements not up to current design standards for a new bridge
- Does not meet the project purpose and need

The anticipated effect of this alternative on several key bridge ratings/indicators is as follows:

NBI Item #	NBI Item Description	March 2016 Rating	Anticipated Rating
58	Deck	7 - Good	7 - Good
59	Superstructure	4 - Poor	4 – Poor or 5 – Fair
60	Substructure	4 – Poor	4 – Poor
NA	Status	Structurally Deficient	Structurally Deficient
NA	Sufficiency Rating	30.3	30.3 to 45.3

The preliminary construction cost estimate (refer to Appendix A) for this alternative is $420 thousand. This cost does not include any bridge approach roadway work. The estimated 20-year cost for maintenance and inspection of the bridge for this alternative is approximately $410 thousand in 2016 dollars.

Alternative 2 - Rehabilitation Without Affecting Historic Integrity of the Bridge

The bridge was constructed in 1932. Design specifications in place at the time of construction are generally considered to provide a 50 year service life[5], which has long since been exceeded. Rehabilitation of the bridge includes the cost of performing repairs, strengthening and replacing bridge components as needed.

In order to fairly consider rehabilitation, the minimum roadway width required by the AASHTO Green Book[6] was researched. For a rural major collector with future ADT of 1,120 vehicles per day and a 45 mph design speed, Table 6-7 lists the minimum clear roadway width for bridges to remain in place as 22 feet. Table 6-6 allows for 3 feet wide shoulders on each side, making the minimum required curb to curb width 28 feet, so long as the approach roadway width, shoulders included, does not exceed the clear width on the bridge. Currently the approach

[5] Bridge Preservation Guide, FHWA, August 2011.
[6] A Policy on Geometric Design of Highways and Streets, AASHTO, 6th Edition, 2011. This publication is commonly referred to as the "AASHTO Green Book."

roadway at both ends of the existing bridge is approximately 22 feet wide, so the 28 feet clear width on the bridge would be acceptable. Although the 28 feet clear width on the bridge is required to meet current standards, options were also considered that maintain the existing 22 feet clear width. These options require a design exception.

ODOT has also requested an evaluation of solutions that would eliminate the fracture critical status of the bridge, including whether it is feasible to do so without affecting the bridge's historic significance. Therefore the following options are considered within this alternative:

- 2(a) - Rehabilitation and widening of existing bridge, bridge remains fracture critical: Widen existing bridge to provide 28 feet clear roadway width, retaining truss as primary load carrying element so that bridge remains fracture critical
- 2(b) - Rehabilitation and widening of existing bridge, eliminating fracture critical designation: Widen existing bridge to provide 28 feet clear roadway width, providing additional means of load path redundancy to eliminate fracture critical status of bridge
- 2(c) - Rehabilitation of existing bridge, bridge remains fracture critical: Design exception to maintain existing 22 feet clear roadway width, retaining truss as primary load carrying element so that bridge remains fracture critical
- 2(d) - Rehabilitation of existing bridge, eliminating fracture critical designation: Design exception to maintain existing 22 feet clear roadway width, providing additional means of load path redundancy to eliminate fracture critical status of bridge

Alternative 2(a) – Rehabilitation and widening of existing bridge, bridge remains fracture critical

A three-dimensional model of Span 2 (main truss span) was created using STAAD.Pro V8i to evaluate member forces in the truss after improving the geometry of the bridge to eliminate functional obsolescence by increasing the curb to curb width from 22 feet to 28 feet (refer to Appendix B for the analysis). Only primary members were reviewed as part of the analysis; adequacy of gusset plates was not considered and is not necessary to determine the likely cost to rehabilitate, since the other work is significant. See Figure 24. In order to provide this minimum width, the deck, stringers and floorbeams require replacement. The deck, stringers and floorbeams are not considered to be character defining features of the historic bridge, so they can be replaced without having an adverse effect on the structure's historic significance – the trusses remain[7] but are moved slightly to accommodate the wider roadway section.

[7] Guidelines for Historic Bridge Rehabilitation and Replacement, AASHTO, November 2008.

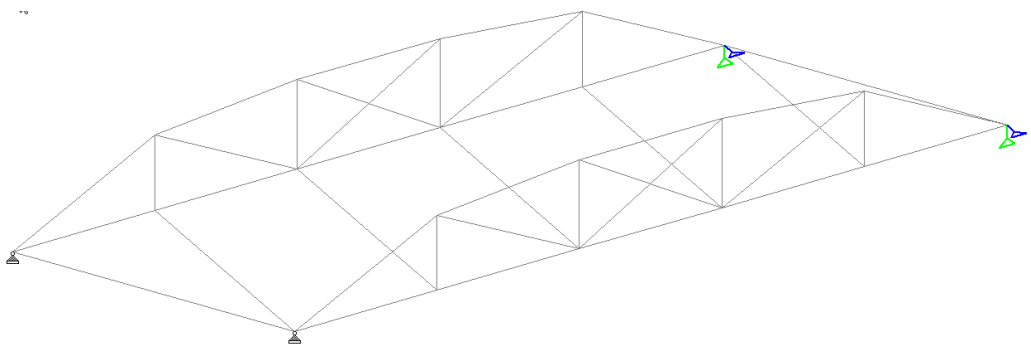

Figure 24: STAAD.Pro Model of Truss Span

The increased loads from the proposed widening (preferably to one side) of the bridge result in the top chord and diagonal members of the truss being overstressed. The only members not overstressed are the verticals and bottom chord. See Figure 25.

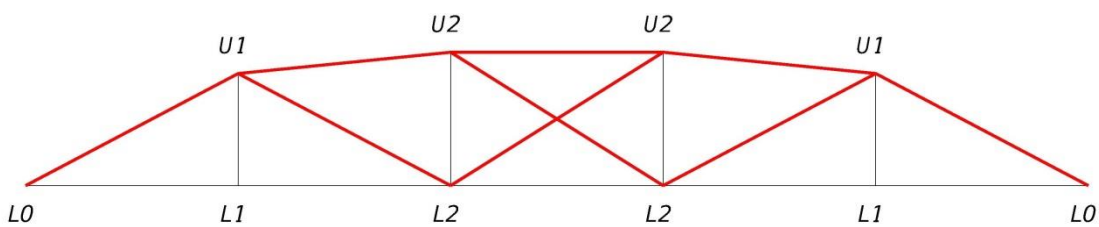

Figure 25: Overstressed Main Truss Members (in red) – Rehabilitation with Widening

The top chords are limited by buckling of the built-up sections. They can be strengthened by bolting a plate between the back-to-back channel flanges or bolting additional material to the channel webs.

The outer truss span diagonals are overstressed in tension. Because these members are very slender and they require load path continuity through the gusset plates, replacement with similar shapes using modern higher strength steel is an option. The diagonals in the center panel are controlled by buckling; they should be replaced with modern higher strength steel. They could be replaced with channels of the same depth to facilitate connection to the rest of the truss.

It is possible to replace the diagonals in kind without an adverse effect on the historic structure since the steel in the existing bridge is not historically significant. Additionally, bolting

supplemental steel on existing members is considered an acceptable treatment to historic bridges because the process is reversible.

Both approach spans can be widened, preferably to one side only, by adding one beam line and an additional 6-feet of deck width. The existing beams in both spans have been analyzed and can carry HS-20 truck loading with ample reserve capacity for any additional deck thickness. Refer to Appendix D for the analysis results.

Both abutments and both piers require modification (augmentation) to accommodate the widened portion of the structure. The anticipated substructure modifications include several new steel H-piles at the abutments and one new drilled shaft at each pier. The substructure work should be designed and constructed to closely match the look of the existing abutments and piers. Nevertheless, these modifications may be deemed an adverse effect.

Additional recommended bridge work to be performed includes the following:

- Replacement of the truss bearings
- Extension of both pier beams (with new bearings)
- Upgrading the roadway barriers and pedestrian railings to meet current criteria. The new railings should be designed to be attached to the new stringers, new floorbeams, or new deck and have a similar open look to the original railing. AASHTO LRFD Design Specifications includes a discussion of the types of loads that such a railing should be designed to. Crash tested and approved railing types and configurations can be found on the FHWA Safety website for bridge railings: http://safety.fhwa.dot.gov/roadway_dept/policy_guide/road_hardware/barriers/bridge railings/
- Clean and paint all existing structural steel that is to remain. It is likely that the bridge has lead-based paint and that special containment (Class 1A) will be required. The existing paint system should be tested to determine the presence of hazardous metals. A coatings specialist (NACE Level III or BCI Level II Certified) should be retained to perform the tests and make recommendations for the work required. In order to ensure the best quality paint application, the existing steel should be cleaned to bare metal per Structural Steel Painting Council (SSPC) Standard SP10, Near White Blast Cleaning. It should be noted that, even if the bridge was to be demolished, the presence of hazardous metals in the paint system should be verified and appropriate steps taken to ensure a safe environment for workers during removal.
- Substructure repairs

- Replacement of both approach slabs
- Installation of rubble riprap to protect both abutments

Following is a possible sequence to perform the work:

1. Close roadway and remove truss span from supports after flooring system is removed. Provide level truss lay-down area adjacent to bridge or transport to steel fabrication facility. Make necessary modifications to trusses and gusset plates.
2. Install piles and drilled shafts for widened abutments and intermediate piers
3. Widen abutments and piers by splicing into existing structure
4. Place new riprap
5. Install new bearings
6. Reinstall trusses on new supports
7. Install new flooring system (stringers and floorbeams)
8. Install new bearings, beams and diaphragms for approach spans
9. Place new deck, approach slabs and traffic rails
10. Reopen bridge to traffic

Crane access appears to be available at the northwest or southeast quadrants of the bridge with appropriate clearing, grubbing and leveling of the area. Some additional fill and/or stabilization may be required to support the crane.

The anticipated effect of this alternative on several key bridge ratings/indicators is as follows:

NBI Item #	NBI Item Description	March 2016 Rating	Anticipated Rating
58	Deck	7 - Good	8 - Very Good
59	Superstructure	4 - Poor	5 – Fair or 6 - Satisfactory
60	Substructure	4 – Poor	6 – Satisfactory
NA	Status	Structurally Deficient	Not Deficient
NA	Sufficiency Rating	30.3	85 to 95

This alternative has the following advantages:

- Bridge is no longer structurally deficient
- Bridge is no longer functionally obsolete

- Bridge no longer requires load posting
- Historic integrity of bridge is maintained, with few adverse effects
- Reduced maintenance costs

This alternative has the following disadvantages:

- Some environmental impacts, including possible lead paint mitigation
- Bridge remains fracture critical
- Traffic impacted during construction of new bridge and approach roadway

The preliminary construction cost estimate for this alternative (refer to Appendix A) is approximately $1.8 million. This cost does not include any bridge approach roadway work. The estimated 20-year cost for maintenance and inspection of the bridge for this alternative is approximately $170 thousand in 2016 dollars.

Alternative 2(b) – Rehabilitation and widening of existing bridge, eliminating fracture critical designation

This alternative is similar to Alternative 2(a), except as described below:

In order to make the bridge non-fracture critical, it is necessary to provide load path redundancy to the pony truss main span, which is an inherently non-redundant structure. To that end, concepts that retain the truss lines in some fashion, while providing redundant load paths, were considered. The most viable option appears to be replacement of the truss span (as the primary load carrying element) with a new multi-beam steel superstructure with a concrete deck, to which the existing trusses would be re-attached using diaphragms at the lower chord panel points. In order to maintain the historic integrity of the original bridge, it is important that the trusses appear functional, so they will continue to support their own weight.

To support the new multi-beam main span and facilitate the removal of the fracture critical pier beams, the intermediate piers require complete reconstruction. The new piers will support the new beams for the main span, the existing and new beams for the approach spans, and the existing trusses. These changes will have an effect on the appearance of the bridge, and will likely be considered an adverse effect.

The possible sequence of construction, the anticipated effect of this alternative on several key bridge ratings/indicators, and the advantages and disadvantages of this alternative are the same as that of Alternative 2(a), with one exception; a significant advantage is gained in no longer having the bridge classified as fracture critical. Therefore the annual inspection costs are reduced by approximately 80 percent.

The preliminary construction cost estimate (refer to Appendix A) for this alternative is approximately $2.0 million. This cost does not include any bridge approach roadway work. The estimated 20-year cost for maintenance and inspection of the bridge for this alternative is approximately $90 thousand in 2016 dollars.

Alternative 2(c) – Rehabilitation of existing bridge, bridge remains fracture critical; design exception to keep existing bridge width

With this alternative, the bridge would continue to have substandard shoulder widths; thus the bridge remains functionally obsolete. A design exception would be required.

The current inventory load rating (performed with this analysis and included in Appendix C) indicates the existing flooring system (floorbeams and stringers) is deficient. The current load posting of the bridge is a result of this deficiency. Inventory Rating, as defined by the AASHTO Manual for Bridge Evaluation, is that load, including loads in multiple lanes, which can safely utilize the bridge for an indefinite period of time. In order to correct this deficiency, it is necessary to replace the stringers and floorbeams with new members using steel with higher strengths than the existing, which will also require replacement of the deck (deck replacement also recommended at approach spans). Preliminary analysis indicates that use of 50 ksi yield strength steel will allow the floorbeams and stringers to be replaced with members of comparable depth, thus retaining the visual appearance of the truss span. These members can be replaced with no adverse effect on the truss span, as discussed in Alternative 2(a). The truss members are not deficient in this regard, although an in-depth analysis of the gusset plates should be undertaken during the design phase to evaluate whether replacement or strengthening of the plates is needed.

The existing substructures require widespread concrete remediation and holes for new adhesive or mechanical anchor bolts must be drilled as part of the bearing replacement.

Jacking the trusses will be required to install new bearings. This can be done either from locations on the piers or abutments, or using temporary supports braced to the existing piers. Analysis will be required to determine the suitability of either method, or if a different method will be required.

Additional recommended bridge work to be performed includes the following:

- Upgrading the roadway barriers and pedestrian railings to meet current criteria. The new railings should be designed to be attached to the new stringers, new floorbeams, or new deck and have a similar open look to the original railing. AASHTO LRFD Design Specifications includes a discussion of the types of loads that such a railing should be

designed to. Crash tested and approved railing types and configurations can be found on the FHWA Safety website for bridge railings: http://safety.fhwa.dot.gov/roadway_dept/policy_guide/road_hardware/barriers/bridge_railings/

- Clean and paint all existing structural steel that is to remain. It is likely that the bridge has lead-based paint and that special containment (Class 1A) will be required. The existing paint system should be tested to determine the presence of hazardous metals. A coatings specialist (NACE Level III or BCI Level II Certified) should be retained to perform the tests and make recommendations for the precautions and work required. In order to ensure the best quality paint application, the existing steel should be cleaned to bare metal per Structural Steel Painting Council (SSPC) Standard SP10, Near White Blast Cleaning. It should be noted that, even if the bridge was to be demolished, the presence of hazardous metals in the paint system should be verified and appropriate steps taken to ensure a safe environment for workers during removal.
- Substructure repairs
- Replacement of both approach slabs
- Installation of riprap to protect both abutments

Following is a possible sequence to perform the work:

1. Close bridge; remove existing flooring system
2. Replace or strengthen gusset plates if needed
3. Jack trusses and install new bearings
4. Erect new flooring system (stringers and floorbeams)
5. Place new riprap
6. Clean and paint bridge
7. Place new deck, approach slabs and traffic rails
8. Reopen bridge to traffic

As noted in Alternative 2(a), crane access appears to be available at the northwest or southeast quadrants of the bridge.

The anticipated effect of this alternative on several key bridge ratings/indicators is as follows:

NBI Item #	NBI Item Description	March 2016 Rating	Anticipated Rating
58	Deck	7 - Good	8 - Very Good
59	Superstructure	4 - Poor	5 – Fair or 6 - Satisfactory
60	Substructure	4 – Poor	6 – Satisfactory
NA	Status	Structurally Deficient	Functionally Obsolete
NA	Sufficiency Rating	30.3	70 to 80

This alternative has the following advantages:

- Bridge is no longer structurally deficient
- Bridge no longer requires load posting
- Historic integrity of bridge is maintained, with little or no adverse effects
- Reduced maintenance costs

This alternative has the following disadvantages:

- Some environmental impacts, including possible lead paint mitigation
- Bridge remains fracture critical
- Bridge remains functionally obsolete
- Some traffic interruptions

The preliminary construction cost estimate for this alternative (refer to Appendix A) is approximately $1.1 million. This cost does not include any bridge approach roadway work. The estimated 20-year cost for maintenance and inspection of the bridge for this alternative is approximately $150 thousand in 2016 dollars.

Alternative 2(d): Rehabilitation of existing bridge, eliminating fracture critical designation; design exception to keep existing bridge width

This alternative is similar to Alternative 2(c), except as described below:

In order to make the bridge non-fracture critical, it is necessary to provide load path redundancy to the pony truss main span, which is an inherently non-redundant structure. To that end, concepts that retain the truss lines in some fashion, while providing redundant load paths, were considered. The most viable option appears to be replacement of the truss span (as the primary load carrying element) with a new multi-beam steel superstructure with a concrete deck, to which the existing trusses would be re-attached using diaphragms at the lower chord panel points. In order to maintain the historic integrity of the original bridge, it is important that the trusses appear functional, so they will continue to support their own weight.

To support the new multi-beam main span and facilitate the removal of the fracture critical pier beams, the intermediate piers require complete reconstruction. The new piers will support the new beams for the main span, the existing beams for the approach spans, and the existing trusses. These changes will have an effect on the appearance of the bridge, and will likely be considered an adverse effect.

The possible sequence of construction, the anticipated effect of this alternative on several key bridge ratings/indicators, and the advantages and disadvantages of this alternative are the same as that of Alternative 2(c), with one exception; a significant advantage is gained in no longer having the bridge classified as fracture critical. Therefore the annual inspection costs are reduced by approximately 80 percent.

The preliminary construction cost estimate (refer to Appendix A) for this alternative is approximately $1.4 million. This cost does not include any bridge approach roadway work. The estimated 20-year cost for maintenance and inspection of the bridge for this alternative is approximately $70 thousand in 2016 dollars.

Alternative 3 - Build on New Location

The options considered within this alternative are threefold:

- 3(a): Retain existing bridge in vehicular service as part of a one-way couplet, bridge remains fracture critical
- 3(b): Retain existing bridge in vehicular service as part of a one-way couplet, eliminating fracture critical designation
- 3(c): Retain the bridge in place, either as a non-functional “monument” or as a non-vehicular pedestrian or bicycle facility

The scope of work for this project does not include assessment of any new build alignments.

Alternative 3(a) - Retain existing bridge in vehicular service as part of a one-way couplet, bridge remains fracture critical

In order to modify the bridge for one-way traffic, it can be striped for one 12-feet wide travel lane with an 8-feet wide outside shoulder and a 2-feet wide inside shoulder in order to provide a means to pass should a vehicle break down in the travel lane. This will require work to the approach roadway, such as new pavement markings and signage.

The current inventory load rating (performed with this analysis and included in Appendix C) indicates the existing flooring system (floorbeams and stringers) is deficient. The current load posting of the bridge is a result of this deficiency. Inventory Rating, as defined by the current AASHTO Manual for Bridge Evaluation, is that load, including loads in multiple lanes, which can safely utilize the bridge for an indefinite period of time. In order to correct this deficiency, it is necessary to replace the stringers and floorbeams with new members using modern steel with higher strengths, which will also require replacement of the deck (deck replacement also recommended at approach spans). Preliminary analysis indicates that use of modern 50 ksi yield strength steel will allow the floorbeams and stringers to be replaced with members of comparable depth, thus retaining the visual appearance of the truss span. These members can be replaced with no adverse effect on the truss span, as discussed in Alternative 2(a). The truss members are not deficient in this regard, although an in-depth analysis of the gusset plates should be undertaken during the design phase to evaluate whether replacement or strengthening of the plates is needed.

The existing substructures require concrete remediation and holes for new adhesive or mechanical anchor bolts must be drilled as part of the bearing replacement. Jacking the trusses will be required to install new bearings. This can be done either from locations on the piers or abutments, or using temporary supports braced to the existing piers. Analysis will be required to determine the suitability of either method, or if a different method will be required.

Additional recommended bridge work to be performed includes the following:

- Upgrading the roadway barriers and pedestrian railings to meet current criteria. The new railings should be designed to be attached to the new stringers, new floorbeams, or new deck and have a similar open look to the original railing. AASHTO LRFD Design Specifications includes a discussion of the types of loads that such a railing should be designed to. Crash tested and approved railing types and configurations can be found on the FHWA Safety website for bridge railings: http://safety.fhwa.dot.gov/roadway_dept/policy_guide/road_hardware/barriers/bridge railings/
- Clean and paint all existing structural steel that is to remain. It is likely that the bridge has lead-based paint and that special containment (Class 1A) will be required. The existing paint system should be tested to determine the presence of hazardous metals. A coatings specialist (NACE Level III or BCI Level II Certified) should be retained to perform the tests and make recommendations for the precautions and work required. In order to ensure the best quality paint application, the existing steel should be cleaned to bare metal per Structural Steel Painting Council (SSPC) Standard SP10, Near White Blast Cleaning. It should be noted that, even if the bridge was to be demolished, the presence of hazardous metals in the paint system should be verified and appropriate steps taken to ensure a safe environment for workers during removal.
- Substructure repairs
- Replacement of both approach slabs
- Installation of riprap to protect both abutments

Following is a possible sequence to perform the work after the construction of the one-way couplet bridge is completed:

1. Close bridge; remove deck and Span 2 flooring system
2. Make necessary modifications to trusses and gusset plates
3. Jack trusses and install new bearings
4. Erect new flooring system
5. Place new riprap
6. Clean and paint bridge
7. Place new deck, approach slabs and traffic rails
8. Reopen bridge to traffic

As noted in Alternative 2(a), crane access appears to be available at the northwest or southeast quadrants of the bridge.

The anticipated effect of this alternative on several key bridge ratings/indicators is as follows:

NBI Item #	NBI Item Description	March 2016 Rating	Anticipated Rating
58	Deck	7 - Good	8 - Very Good
59	Superstructure	4 - Poor	5 – Fair or 6 - Satisfactory
60	Substructure	4 – Poor	6 – Satisfactory
NA	Status	Structurally Deficient	Not Deficient
NA	Sufficiency Rating	30.3	85 to 95

This alternative has the following advantages:

- Bridge is no longer deficient
- Bridge no longer requires load posting
- Historic integrity of bridge is maintained, with little or no adverse effects
- Reduced maintenance costs

This alternative has the following disadvantages:

- Some environmental impacts, including possible lead paint mitigation
- Bridge remains fracture critical
- Some traffic interuptions

The preliminary construction cost estimate for this alternative (refer to Appendix A) is approximately $1.1 million. This cost does not include any bridge approach roadway work. The estimated 20-year cost for maintenance and inspection of the bridge for this alternative is approximately $150 thousand in 2016 dollars.

Alternative 3(b) - Retain existing bridge in vehicular service as part of a one-way couplet, eliminating fracture critical designation

This alternative is similar to Alternative 3(a), except as described below:

In order to make the bridge non-fracture critical, it is necessary to provide load path redundancy to the pony truss main span, which is an inherently non-redundant structure. To that end, concepts that retain the truss lines in some fashion, while providing redundant load

paths, were considered. The most viable option appears to be replacement of the truss span (as the primary load carrying element) with a new multi-beam steel superstructure with a concrete deck, to which the existing trusses would be re-attached using diaphragms at the lower chord panel points. In order to maintain the historic integrity of the original bridge, it is important that the trusses appear functional, so they will continue to support their own weight.

To support the new multi-beam main span and facilitate the removal of the fracture critical pier beams, the intermediate piers require complete reconstruction. The new piers will support the new beams for the main span, the existing beams for the approach spans, and the existing trusses. These changes will have an effect on the appearance of the bridge, and will likely be considered an adverse effect.

The possible sequence of construction, the anticipated effect of this alternative on several key bridge ratings/indicators, and the advantages and disadvantages of this alternative are the same as that of Alternative 3(a), with one exception; a significant advantage is gained in no longer having the bridge classified as fracture critical. Therefore the annual inspection costs are reduced by approximately 80 percent.

The preliminary construction cost estimate (refer to Appendix A) for this alternative is approximately $1.4 million. This cost does not include any bridge approach roadway work. The estimated 20-year cost for maintenance and inspection of the bridge for this alternative is approximately $70 thousand in 2016 dollars.

Alternative 3(c) – Retain the bridge in place, either as a non-functional "monument" or as a non-vehicular pedestrian or bicycle facility

Retaining the bridge for a non-vehicle use, such as a dedicated bridge for pedestrians and bicyclists (shared-use path), was evaluated using the AASHTO pedestrian bridge guidance. The existing bridge was analyzed using a pedestrian load of 90 pounds per square foot.[8] The evaluation of the existing structure showed that the existing truss in its existing configuration and condition will function adequately as a pedestrian bridge (refer to Appendix F). No improvements or strengthening are required, with the exception of some minor repairs to the existing floorbeams and stringers due to section loss. Minor substructure repairs are also recommended, along with painting the entire structure. An in-depth analysis of the gusset plates should be undertaken during the design phase in order to evaluate whether replacement or strengthening of the plates is warranted.

[8] LRFD Guide Specifications for the Design of Pedestrian Bridges, AASHTO, December 2009.

Replacement of the existing steel traffic railings with appropriate pedestrian railings and the installation of lighting, while not included in this cost estimate, should be considered. Transfer of the bridge to a local municipality or other public agency should be arranged prior to any work, in order to ensure that the bridge continues to be cared for after the initial repairs are completed. Routine maintenance should be continued, including periodic cleaning and painting of the structure. As the truss span deteriorates, it may be feasible to consider replacing the flooring system and installing a lighter weight deck, but these actions are not needed at this time.

This alternative has the following advantages:

- Bridge removed from vehicular service
- Historic integrity of bridge is maintained with regard to character defining features

This alternative has the following disadvantages:

- Some environmental impacts, including possible lead paint mitigation
- Historic integrity of bridge is compromised as the bridge is no longer carrying traffic on Route 66B
- Transfer of bridge ownership may be a challenge
- Bridge still requires routine maintenance

The preliminary cost estimate (refer to Appendix A) to complete the work required to convert the bridge to a pedestrian use is approximately $420 thousand. This cost does not include any work to the roadway approaches to the bridge. The estimated 20-year cost for maintenance and inspection of the bridge is $40 thousand in 2015 dollars.

For use as a monument, steps need to be taken to prevent public access to the bridge. The cost to secure the bridge from the public using fencing and barricades or guardrail, and related activities, is considered to be very minor in nature and has not been prepared as part of this study. However, the bridge will continue to deteriorate and some maintenance will be required. If simple maintenance is not performed and access to do so is not provided, the structure will become a liability to the owner.

Alternative 4: New bridge with existing trusses added as an architectural/historic feature (new or existing alignment)

For this alternative a new bridge will be constructed on the existing or a new alignment, and the existing bridge trusses will be mounted on each side of the new bridge in Span 2. The trusses will be supported by the new bridge piers and attached with diaphragms to the new exterior bridge beams at each truss panel point.

One option for the new bridge is a 3-span (70'-100'-70' span configuration) with a 32-feet clear roadway width and an approximately 30 degree skew. Type IV PC Beams can be utilized for both approach spans and either Type IV PC Beams (with exterior beams painted to match the truss) or steel I-beams can be used for the main span. For the purpose of estimating the cost of this alternative Type IV PC Beams are used in all spans. ODOT Standards should be utilized in the design to the extent possible.

Handling and storage of the existing bridge trusses and during construction of the new bridge and crane access can be managed as described in the previously discussed alternatives.

This alternative has the following advantages:

- New bridge that fulfills the purpose and need of the project
- Elimination of a structurally deficient, load posted and fracture critical bridge
- Character defining features of the existing bridge are showcased in the new bridge
- Reduced maintenance costs

This alternative has the following disadvantages:

- Some environmental impacts, including possible lead paint mitigation
- This is not an "Avoidance Alternative"
- Traffic impacted during construction of new bridge and approach roadway

The preliminary cost estimate (refer to Appendix A) for this alternative is $1.1 million (including an estimated $125 thousand to remove and mount the existing bridge trusses to the new bridge). This cost does not include any work to the roadway approaches to the bridge. The estimated 20-year cost for maintenance and inspection of the bridge is $30 thousand in 2016 dollars.

Summary of Findings

Category	Avoidance Alternatives								Mitigation Alternatives
		#2: Rehabilitation of Existing Bridge				#3: Build on New Location			4: New Bridge with Trusses Mounted as an Architectural Feature
	#1: Do Nothing	#2(a): Widen; Remains Fracture Critical	#2(b): Widen; No Longer Fracture Critical	#2(c): No Widening; Remains Fracture Critical	#2(d): No Widening; No Longer Fracture Critical	#3(a): Bridge Remains Fracture Critical	#3(b): Eliminate Fracture Critical Elements	#3(c): Existing Bridge as Pedestrian Bridge/Monument	
Maintenance and Inspection	• Increased inspection frequency • Increased frequency of repairs to address section loss in steel, particularly stringers and floorbeams • Increased frequency of maintenance, including spot painting, required	• Minimal maintenance required for first 20-25 years, after which spot painting will be required • Structural repairs should not be required if regular program of cleaning the trusses and spot painting areas of corrosion is initiated	• Minimal maintenance required for first 20-25 years, after which spot painting required for the truss and the continuous steel beams • Structural repairs should not be required if regular program of cleaning the trusses and spot painting areas of corrosion is initiated • Inspection effort significantly reduced since bridge is no longer fracture critical	• Minimal maintenance required for first 20-25 years, after which spot painting will be required • Structural repairs should not be required if regular program of cleaning the trusses and spot painting areas of corrosion is initiated	• Minimal maintenance required for first 20-25 years, after which spot painting required for the truss and the continuous steel beams • Structural repairs should not be required if regular program of cleaning the trusses and spot painting areas of corrosion is initiated • Inspection effort significantly reduced since bridge is no longer fracture critical	• Minimal maintenance required for first 20-25 years, after which spot painting will be required • Structural repairs should not be required if regular program of cleaning the trusses and spot painting areas of corrosion is initiated	• Minimal maintenance required for first 20-25 years, after which spot painting required for the truss and the continuous steel beams • Structural repairs should not be required if regular program of cleaning the trusses and spot painting areas of corrosion is initiated • Inspection effort significantly reduced since bridge is no longer fracture critical	• Likely transfer from ODOT to local agency • Increased inspection frequency • Increased frequency of repairs to address section loss in steel, particularly stringers and floorbeams • Increased frequency of maintenance	• Minimal maintenance required for first 20-30 years • Trusses may require periodic maintenance
Geometric Adequacy	• Roadway width remains substandard • Bridge remains Functionally Obsolete	• Provides 28 feet clear roadway width (AASHTO Minimum) • No longer Functionally Obsolete	• Provides 28 feet clear roadway width (AASHTO Minimum) • No longer Functionally Obsolete	• Roadway width remains substandard • Bridge remains Functionally Obsolete	• Roadway width remains substandard • Bridge remains Functionally Obsolete	• Provides 12 feet wide lane, 8 feet wide outside shoulder and 2 feet wide inside shoulder • No longer Functionally Obsolete	• Provides 12 feet wide lane, 8 feet wide outside shoulder and 2 feet wide inside shoulder • No longer Functionally Obsolete	• Pedestrian use requires new railings to meet current requirements for railing openings • No longer Functionally Obsolete, as it is no longer open to vehicle traffic	• Bridge meets current AASHTO and ODOT geometric standards • Functionally Obsolete bridge removed from service
Structural Adequacy	• Remains load posted • Remains Structurally Deficient • Remains Fractural Critical	• No load posting • No longer Structurally Deficient • Remains Fracture Critical	• No load posting • No longer Structurally Deficient • No longer Fracture Critical	• No load posting • No longer Structurally Deficient • Remains Fracture Critical	• No load posting • No longer Structurally Deficient • No longer Fracture Critical	• No load posting • No longer Structurally Deficient • Remains Fracture Critical	• No load posting • No longer Structurally Deficient • No longer Fracture Critical	• Pedestrian bridge option requires posting for no vehicles • Monument use requires fencing or other means to keep public off bridge, yet allow access for maintenance vehicles • No longer considered Structurally Deficient, as it is no longer carrying vehicles	• Load posted, structurally deficient, and fracture critical bridge removed from service
Environmental Impacts	• Lead paint remediation likely	• Lead paint remediation likely • Marginal habitat for Whooping Crane • Jurisdictional Waters and Wetlands – NWI mapped wetlands (impact minimal)	• Lead paint remediation likely • Marginal habitat for Whooping Crane • Jurisdictional Waters and Wetlands – NWI mapped wetlands (impact minimal)	• Lead paint remediation likely • Marginal habitat for Whooping Crane • Jurisdictional Waters and Wetlands – NWI mapped wetlands (impact minimal)	• Lead paint remediation likely • Marginal habitat for Whooping Crane • Jurisdictional Waters and Wetlands – NWI mapped wetlands (impact minimal)	• Lead paint remediation likely • Marginal habitat for Whooping Crane • Jurisdictional Waters and Wetlands – NWI mapped wetlands (impact minimal)	• Lead paint remediation likely • Marginal habitat for Whooping Crane • Jurisdictional Waters and Wetlands – NWI mapped wetlands (impact minimal)	• Lead paint remediation likely	• Lead paint remediation likely • Marginal habitat for Whooping Crane • Jurisdictional Waters and Wetlands – NWI mapped wetlands (impact minimal)

Category	**Avoidance Alternatives**								**Mitigation Alternatives**
	#1: Do Nothing	**#2: Rehabilitation of Existing Bridge**				**#3: Build on New Location**			**4: New Bridge with Trusses Mounted as an Architectural Feature**
		#2(a): Widen; Remains Fracture Critical	**#2(b): Widen; No Longer Fracture Critical**	**#2(c): No Widening; Remains Fracture Critical**	**#2(d): No Widening; No Longer Fracture Critical**	**#3(a): Remains Fracture Critical**	**#3(b): No Longer Fracture Critical**	**#3(c): Existing Bridge as Pedestrian Bridge/Monument**	
Permits	• None anticipated	• US Army Corps of Engineers – Nationwide 14 • Flood Plain Permit (County) • DEQ OK R10 (Construction Stormwater Permit)	• US Army Corps of Engineers – Nationwide 14 • Flood Plain Permit (County) • DEQ OK R10 (Construction Stormwater Permit)	• US Army Corps of Engineers – Nationwide 14 • Flood Plain Permit (County) • DEQ OK R10 (Construction Stormwater Permit)	• US Army Corps of Engineers – Nationwide 14 • Flood Plain Permit (County) • DEQ OK R10 (Construction Stormwater Permit)	• US Army Corps of Engineers – Nationwide 14 • Flood Plain Permit (County) • DEQ OK R10 (Construction Stormwater Permit)	• US Army Corps of Engineers – Nationwide 14 • Flood Plain Permit (County) • DEQ OK R10 (Construction Stormwater Permit)	• None anticipated	• US Army Corps of Engineers – Nationwide 14 • Flood Plain Permit (County) • DEQ OK R10 (Construction Stormwater Permit
Adverse Effects on Historic Bridge	• None	• None are expected – installing new foundations outboard of existing substructure, "in-kind" replacement of stringers and floorbeams, bolting additional steel to substandard members • Bridge retains appearance and function	• Effect determination will require consultation with SHPO – expected that work will not cause an adverse effect • New and existing clearly delineated	• None are expected – bridge retains appearance and function • Bridge retains appearance and function	• Effect determination will require consultation with SHPO – expected that work will not cause an adverse effect • New and existing clearly delineated	• None are expected – bridge retains appearance and function	• Effect determination will require consultation with SHPO – expected that work will not cause an adverse effect • New and substructure elements	• Effect determination will require consultation with SHPO – expected that work will not cause an adverse effect to the character defining features of the bridge, but change of use may be an adverse effect due to bridge being on historic route	• The trusses will be added to the new bridge to retain some of the historical character of the original bridge
Construction Cost (Bridge Only)	$ 420 thousand	$ 1.8 million	$ 2.0 million	$ 1.1 million	$ 1.4 million	$ 1.1 million (does not include cost for new bridge)	$ 1.4 million (does not include cost for new bridge)	$ 420 thousand (pedestrian use – does not include cost for new bridge)	$ 1.1 million
20-Year Maintenance & Inspection Cost (2016 Dollars)	$ 410 thousand	$ 170 thousand	$ 90 thousand	$ 150 thousand	$ 70 thousand	$ 150 thousand	$ 70 thousand	$ 40 thousand	$ 30 thousand

Works Cited

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APPENDIX A

Preliminary Cost Estimates and Quantity Computations

COST ESTIMATE & QUANTITY COMPUTATIONS

Alternative 1 – Do Nothing

Estimate

Estimated Cost: $380,600.00

Contingency: 10.00%

Estimated Total: $418,660.00

Alternative 1 - Do Nothing

Base Date: 01/29/15

Spec Year: 09

Unit System: E

Work Type: BRIDGE IMPROVEMENTS

Highway Type: ASPHALT

Urban/Rural Type: RURAL

Season: SUMMER

County: LINCOLN

Prepared by System Administrator

Line #	Item Number	Quantity	Units	Unit Price	Extension
	Description				
	Supplemental Description				

Group 0200: BRIDGE

0018	512(A) 1323	1.00	LSUM	$150,000.00000	$150,000.00
	PAINTING EXISTING STRUCTURES				
0019	512(B) 6303	1.00	LSUM	$90,000.00000	$90,000.00
	COLLECTION AND HANDLING OF WASTE				
	LEAD PAINT REMOVAL AND DISPOSAL				
0024	521(A) 6210	50.00	SY	$560.00000	$28,000.00
	PNEUMATICALLY PLACED MORTAR				
0025	535 6130	50.00	SY	$52.00000	$2,600.00
	(SP)CORROSION INHIBITOR(SURFACE APPLIED)				
0027	540 4515	1.00	LSUM	$25,000.00000	$25,000.00
	(PL)REPAIR BRIDGE ITEM (TYPE A)				
	FLOOR BEAM STRENGTHENING				
0031	601(B) 1353	800.00	TON	$45.00000	$36,000.00
	TYPE I-A PLAIN RIPRAP				
0032	601(C) 1355	100.00	TON	$40.00000	$4,000.00
	TYPE I-A FILTER BLANKET				
0033	619(B) 2500	1.00	LSUM	$10,000.00000	$10,000.00
	REMOVAL OF BRIDGE ITEMS				

Total for Group 0200: $345,600.00

Group 0600: CONSTRUCTION

0034	641 1399	1.00	LSUM	$35,000.00000	$35,000.00
	MOBILIZATION				

Group Alternate Code: 501

Total for Group 0600: $35,000.00

Area Calculation for Painting Existing Steel (Spans 1 and 3)(See separate calculations for Span 2)					
Location	Length (ft)	Height/Width (ft)	# Faces	# Members	Total Area (SF)
Beam Web (W36 x 160)	60	3.00	2.0	10	3600
Beam Flange (W36 x 160)	60	1.00	3.0	10	1800
P. Beam Web (W36 x 192)	32	3.00	2.0	2	384
P. Beam Fl. (W36 x 192)	32	1.00	3.0	2	192
Diaph.Web (W10 x 22)	5	0.85	2.0	16	136
Diaph. Flange (W10 x 22)	5	0.48	4.0	16	153
Total Area for Painting of Existing Steel in Spans 1 and 3 (SF)					**6265**

COST ESTIMATE & QUANTITY COMPUTATIONS

Alternative 2(a) – Rehabilitation and widening of bridge, bridge remains fracture critical

Estimate

Estimated Cost: $1,635,762.00

Contingency: 10.00%

Estimated Total: $1,799,338.20

Alternative 2(a) - Rehabilitation and widening of existing bridge, bridge remains fracture critical

Base Date: 01/29/15

Spec Year: 09

Unit System: E

Work Type: BRIDGE IMPROVEMENTS

Highway Type: ASPHALT

Urban/Rural Type: RURAL

Season: SUMMER

County: LINCOLN

Prepared by System Administrator

Line #	Item Number	Quantity	Units	Unit Price	Extension
	Description				
	Supplemental Description				

Group 0200: BRIDGE

0006	501(B) 1307	514.00	CY	$20.00000	$10,280.00
	SUBSTRUCTURE EXCAVATION COMMON				
0007	501(G) 6309	514.00	CY	$120.00000	$61,680.00
	CLSM BACKFILL				
0008	504(B) 1305	729.00	SY	$5.00000	$3,645.00
	SAW-CUT GROOVING				
0009	504(A) 1304	272.00	SY	$180.00000	$48,960.00
	APPROACH SLAB				
0010	504(C) 6250	164.00	LF	$300.00000	$49,200.00
	SEALED EXPANSION JOINT				
0011	506(A) 3050	135,742.00	LB	$2.00000	$271,484.00
	STRUCTURAL STEEL M270 GRADE 50 (PAINTED)				
0012	506(A) 3050	9,666.00	LB	$10.00000	$96,660.00
	STRUCTURAL STEEL M270 GRADE 50 (PAINTED)				
	STRENGTHENING EXISTING MEMBERS				
0013	507(B) 6174	12.00	EA	$1,800.00000	$21,600.00
	STAINLESS STEEL EXPANSION BEARING ASSEMBLY				
0014	509(A) 1326	241.00	CY	$550.00000	$132,550.00
	CLASS AA CONCRETE				
0015	511(B) 6010	45,264.00	LB	$1.25000	$56,580.00
	EPOXY COATED REINFORCING STEEL				
0016	512(A) 1323	1.00	LSUM	$150,000.00000	$150,000.00
	PAINTING EXISTING STRUCTURES				
0017	512(B) 6303	1.00	LSUM	$90,000.00000	$90,000.00
	COLLECTION AND HANDLING OF WASTE				
	LEAD PAINT REMOVAL AND DISPOSAL				
0018	514(A) 6010	450.00	LF	$35.00000	$15,750.00
	PILES, FURNISHED (HP 10X42)				
0019	514(B) 6292	450.00	LF	$18.00000	$8,100.00
	PILES, DRIVEN (HP 10X42)				
0020	515(A) 6013	754.00	SY	$4.50000	$3,393.00
	WATER REPELLENT (VISUALLY INSPECTED)				
0021	516(A) 6098	70.00	LF	$810.00000	$56,700.00
	DRILLED SHAFTS 72" DIAMETER				
0022	516(C) 6200	1.00	EA	$3,000.00000	$3,000.00
	CROSSHOLE SONIC LOGGING				
0023	521(A) 6210	50.00	SY	$560.00000	$28,000.00
	PNEUMATICALLY PLACED MORTAR				
0024	535 6130	50.00	SY	$52.00000	$2,600.00
	(SP)CORROSION INHIBITOR(SURFACE APPLIED)				
0025	540 4515	1.00	EA	$75,000.00000	$75,000.00
	(PL)REPAIR BRIDGE ITEM (TYPE A)				
	REMOVE AND RESET TRUSSES				
0026	540 4525	2.00	EA	$3,000.00000	$6,000.00
	(PL)REPAIR BRIDGE ITEM (TYPE B)				
	FIXED BEARING FOR TRUSS				
0027	540 4535	2.00	EA	$3,500.00000	$7,000.00
	(PL)REPAIR BRIDGE ITEM (TYPE C)				
	EXPANSION BEARING FOR TRUSS				
0028	540 4545	2.00	EA	$1,800.00000	$3,600.00
	(PL)REPAIR BRIDGE ITEM (TYPE D)				
	BEARING ASSEMBLY FOR PIER BEAM EXTENSION				
0029	540 4555	454.00	LF	$120.00000	$54,480.00
	(PL)REPAIR BRIDGE ITEM (TYPE E)				
	SPECIAL BRIDGE RAILS, HISTORICALLY SENSITIVE DESIGN				
0030	601(B) 1353	1,500.00	TON	$45.00000	$67,500.00
	TYPE I-A PLAIN RIPRAP				

Line #	Item Number / Description / *Supplemental Description*	Quantity	Units	Unit Price	Extension
0031	601(C) 1355 TYPE I-A FILTER BLANKET	300.00	TON	$40.00000	$12,000.00
0032	619(B) 2500 REMOVAL OF BRIDGE ITEMS	1.00	LSUM	$150,000.00000	$150,000.00

Total for Group 0200: $1,485,762.00

Group 0600: CONSTRUCTION

0033	641 1399 MOBILIZATION	1.00	LSUM	$150,000.00000	$150,000.00

Group Alternate Code: 501

Total for Group 0600: $150,000.00

Substructure Excavation Common				
Location	Length (ft)	Width (ft)	Thickness (ft)	CY
Approach Slabs (2)	48.00	32.00	2.00	113.8
Abutments (2)	60.00	12.00	15.00	400.0
Total Substructure Excavation (CY)				**514**

CLSM Backfill				
Location	Length (ft)	Width (ft)	Thickness (ft)	CY
Approach Slabs (2)	48.00	32.00	2.00	113.8
Abutments (2)	60.00	12.00	15.00	400.0
Total CLSM Backfill (CY)				**514**

Saw Cut Grooving - Deck				
Span	Length (ft)	Deduction for Joints (ft)	Width (ft)(2-ft from Rails)	Area (SY)
1	64.17	1.00	24.00	168.45
2	102.00	1.00	24.00	269.33
3	64.17	1.00	24.00	168.45
Saw Cut Grooving Sub-Total (Deck)				606

Saw Cut Grooving - Approach Slab					
Phase	Slab	Length (ft)	Deduction for Joints (ft)	Width (ft)(2-ft from Rails)	Area (SY)
1	1	24.00	1.00	24.00	61.33
1	2	24.00	1.00	24.00	61.33
Saw Cut Grooving Sub-Total (Approach Slabs)					123
Total Saw Cut Grooving					**729**

Structural Steel					
Spans 1 and 3 Widening					
Element	Section	Length (ft)	Number	lb/ft	Weight (lb)
Span 1 and 3 Beam	W36 x 160	60.0	2	160	19,200
Span 1 and 3 Diaphragms	W10 x 22	5.2	2	22	227
Span 1 and 3 Pier Beam	W36 x 192	6.0	2	192	2,304
Floor Framing (Span 2)					
Element	Section	Length (ft)	Number	lb/ft	Weight (lb)
Span 2 Stringers	W18 x 65	100.0	7	65	45,500
Span 2 Floor Beams (End)	W33 x 241	39.4	2	241	18,991
Span 2 Floor Beams (Int.)	W33 x 241	33.9	5	241	40,850
Span 2 Lateral Bracing	L3 x 2.5 x 5/16	39.4	10	5.6	2,206
Sub Total Weight of Structural Steel (lb) =					129,278
Weight of Connection Hardware (lb) - Assume 5% of Total Steel Weight					6,464
Total Weight of Structural Steel (lb) =					**135,742**

Truss Strengthening (New Members)						
Element	Designation	Section	Length (in)	Number	lb/ft	Weight (lb)
New Exterior Diagonals	U1-L2	W10 x 22	22.6	2	22.0	994
New Exterior Diagonals	L2-U1	W10 x 22	22.6	2	22.0	994
New Interior Diagonals	L2-U2	L3 x 2.5 x 5/16	23.6	2	5.6	264
New Interior Diagonals	U2-L2	L3 x 2.5 x 5/16	23.6	2	5.6	264

Truss Strengthening (Supplemental Plates at Top Chords)						
Element	Designation	Section	Length (in)	Number	lb/ft	Weight (lb)
Top Chord Plate (1/2" x 1'-6" x L)	L0-U1	PL 1/2" x 1'-6"	22.6	4	30.6	2,769
Top Chord Plate (1/2" x 1'-6" x L)	U1-U2	PL 1/2" x 1'-6"	22	4	30.6	2,695
Top Chord Plate (1/2" x 1'-6" x L)	U2-U2	PL 1/2" x 1'-6"	20	2	30.6	1,225
Sub Total Weight of Structural Steel (lb) for Strengthening =						9,206
Weight of Connection Hardware (lb) - Assume 5% of Total Steel Weight						460
Total Weight of Structural Steel (lb) for Strengthening =						**9,666**

Alternative 2(a)

Class AA Concrete (Deck)				
Item	Length (ft)	Width (ft)	Thickness (ft)	CY
Deck	227.30	31.00	0.67	174.1
Haunch (Spans 1 and 3)	770.00	1.00	0.13	3.6
Haunch (Span 2 - Stringer)	510.00	0.50	0.13	1.2
Haunch (Span 2 - FB)	220.51	0.88	0.13	0.9
Total Class AA Concrete - Deck				179.7

Class AA Concrete (Substructure)						
Item	Length (ft)	Width (ft)	Height (ft)	CY (each unit)	# Units	CY (Total)
Abutments - Caps	6.00	5.33	2.50	2.96	2	5.9
Abutments - Backwalls	6.00	1.00	3.00	0.67	2	1.3
Abutments - Toe Walls	6.00	1.33	8.00	2.36	2	4.7
Abut. Wings - Caps	16.00	4.20	2.50	6.22	2	12.4
Abut. Wings - Backwalls	16.00	1.00	4.60	2.73	2	5.5
Abut. Wings - Toe Walls	16.00	1.33	8.00	6.31	2	12.6
Piers - Columns (4' Diam.)	18.00	Area (SF) =	12.57	8.38	2	16.8
Piers - Caps	1.50	Area (SF) =	17.73	0.98	2	2.0
Total Class AA Concrete - Substructure						61.2
Total Class AA Concrete						**240.9**

Epoxy Coated Reinforcing Steel			
Location	Concrete (CY)	LB/CY	LB Steel
Deck	179.7	205	36,840
Abutments	42.5	135	5,736
Piers	18.7	150	2,810
Total Weight of Epoxy Coated Reinforcing Steel (LB)			**45,386**

Piles - HP10 x 42			
Location	Length/Pile	Number	Total Length
Abutment 1	40.0	5	200
Abutment 2	50.0	5	250
Total Length of Piling (ft)			**450**

Drilled Shafts (6'-0" Diameter)			
Location	Length/Pile	Number	Total Length
Pier 1	30.0	1	30
Pier 2	40.0	1	40
Total Length of Drilled Shafts (ft)			**70**

Area Calculation for Painting Existing Steel (Spans 1 and 3)(See separate calculations for Span 2)

Location	Length (ft)	Height/Width (ft)	# Faces	# Members	Total Area (SF)
Beam Web (W36 x 160)	60	3.00	2.0	10	3600
Beam Flange (W36 x 160)	60	1.00	3.0	10	1800
P. Beam Web (W36 x 192)	32	3.00	2.0	2	384
P. Beam Fl. (W36 x 192)	32	1.00	3.0	2	192
Diaph.Web (W10 x 22)	5	0.85	2.0	16	136
Diaph. Flange (W10 x 22)	5	0.48	4.0	16	153
Total Area for Painting of Existing Steel in Spans 1 and 3 (SF)					**6265**

Water Repellent (Visually Inspected)				
Deck and Rails				
Location	Length (ft)	Width (ft)	# Locations	Total Area (SY)
Deck Soffit	227.33	1.50	2	75.8
Deck Fascia	227.33	0.67	2	33.7
Assumed Area for Rails	227.33	4.00	2	202.1
Total Water Repellent - Deck and Rails				312
Water Repellent (Visually Inspected)				
Substructure				
Location	Length (ft)	Width (ft)	# Locations	Total Area (SY)
Abutment 1:				
Seat Face	67.00	2.50	1	18.6
Seat Ends	5.33	2.50	2	3.0
Seat Top	67.00	3.00	1	22.3
Backwall	67.00	3.00	1	22.3
Subtotal for Abutment 1				66
Abutment 2:				
Seat Face	67.00	2.50	1	18.6
Seat Ends	5.33	2.50	2	3.0
Seat Top	67.00	3.00	1	22.3
Backwall	67.00	3.00	1	22.3
Subtotal for Abutment 2				66
Pier 1:				
Top of Web Wall	28.00	1.50	1	4.7
Face of Web Wall	28.00	12.50	2	77.8
Columns Tops (4.75' diameter)	Area =	17.73	3	5.9
Column Faces (4'-0" diameter)	18.00	11.07	3	66.4
Subtotal for Pier 1				**155**
Pier 2:				
Top of Web Wall	28.00	1.50	1	4.7
Face of Web Wall	28.00	12.50	2	77.8
Columns Tops (4.75' diameter)	Area =	17.73	3	5.9
Column Faces (4'-0" diameter)	18.00	11.07	3	66.4
Subtotal for Pier 2				**155**
Total Water Repellent for Substructure				442
Grand Total for Water Repellent				**754**

Painting Quantity Estimate

Painting estimate based on square footage of painted steel. Perimeters for sections calculated in Microstation.

- perimeter of the outer section of the bottom chord:

$perimeter_1 := 2 \cdot 3.035ft = 6.07 \cdot ft$

- perimeter of the inner section of the bottom chord:

$perimeter_2 := 2 \cdot 3.0521ft = 6.104 \cdot ft$

- perimeter of the verticals:

$perimeter_3 := 4.177ft$

- perimeter of the outer diagonals:

$perimeter_4 := 3.516ft$

- perimeter of the inner diagonals:

$perimeter_5 := 2 \cdot 0.882ft = 1.764 \cdot ft$

- perimeter of the outer section of the top chord:

$perimeter_6 := 7.738ft$

- perimeter of the inner section of the top chord:

$perimeter_7 := perimeter_6 = 7.738 \cdot ft$

- perimeter of the existing end floorbeams (27W91):

$perimeter_8 := 7.635ft$

- perimeter of the existing interior floorbeams (30W116):

$perimeter_9 := 8.296ft$

- perimeter of the existing stringers (18W47):

$perimeter_{10} := 4.878ft$

- perimeter of the new floorbeams (33W241):

$perimeter_{11} := 10.898ft$

- perimeter of the new stringers (18W65):

$perimeter_{12} := 5.415ft$

- perimeter of the lateral bracing (L3x2.5x5/16):

$perimeter_{13} := 0.882ft$

Lengths calculated using existing plans and proposed widening geometry.

- length of the outer section of the bottom chord:

$length_1 := 2 \cdot (4 \cdot 20ft) = 160 \cdot ft$

- length of the inner section of the bottom chord:

$length_2 := 2 \cdot (20ft) = 40 \cdot ft$

- length of the verticals:

$length_3 := 2 \cdot (10.5ft + 12.5ft + 12.5ft + 10.5ft) = 92 \cdot ft$

- length of the outer diagonals:

$length_4 := 2 \cdot 2 \cdot \left(\sqrt{20^2 + 10.5^2}\, ft\right) = 90.355 \cdot ft$

- length of the inner diagonals:

$length_5 := 2 \cdot 2 \cdot \left(\sqrt{20^2 + 12.5^2}\, ft\right) = 94.34 \cdot ft$

- length of the outer section of the top chord:

$length_6 := length_4 = 90.355 \cdot ft$

- length of the inner section of the top chord:

$length_7 := 2 \cdot \left[2 \cdot \left(\sqrt{20^2 + 2^2}\, ft\right) + 20ft\right] = 120.399 \cdot ft$

- length of the existing end floorbeams (27W91):

$length_8 := 2 \cdot \left(\sqrt{24.9167^2 + 20^2}\, ft\right) = 63.901 \cdot ft$

- length of the existing interior floorbeams (30W116):

$length_9 := 5 \cdot (24.9167ft) = 124.584 \cdot ft$

- length of the existing stringers (18W47):

$length_{10} := 5 \cdot 100ft = 500 \cdot ft$

- length of the new floorbeams (33W241):

$length_{11} := 5 \cdot (33.9167ft) + 2 \cdot \left(\sqrt{33.9167^2 + 20^2}\, ft\right) = 248.332 \cdot ft$

- length of the new stringers (18W65):

$length_{12} := 7 \cdot 100ft = 700 \cdot ft$

- length of the lateral bracing (L3x2.5x5/16) (original):

$length_{13} := 6 \cdot \left(\sqrt{24.9167^2 + 20^2}\, ft\right) = 191.704 \cdot ft$

- length of the lateral bracing (L3x2.5x5/16) (widened):

$$length_{14} := 6\cdot\left(\sqrt{33.9167^2 + 20^2}\,ft\right) = 236.246\cdot ft$$

Square footage of truss elements:

- area of the outer section of the bottom chord:

$$area_1 := perimeter_1\cdot length_1 = 971.2\cdot ft^2$$

- area of the inner section of the bottom chord:

$$area_2 := perimeter_2\cdot length_2 = 244.168\cdot ft^2$$

- area of the verticals:

$$area_3 := perimeter_3\cdot length_3 = 384.284\cdot ft^2$$

- area of the outer diagonals:

$$area_4 := perimeter_4\cdot length_4 = 317.688\cdot ft^2$$

- area of the inner diagonals:

$$area_5 := perimeter_5\cdot length_5 = 166.415\cdot ft^2$$

- area of the outer section of the top chord:

$$area_6 := perimeter_6\cdot length_6 = 699.166\cdot ft^2$$

- area of the inner section of the top chord:

$$area_7 := perimeter_7\cdot length_7 = 931.648\cdot ft^2$$

Quantity for both trusses, including **20%** increase for gusset plates and lacing:

$$area_{truss} := 1.2\left(area_1 + area_2 + area_3 + area_4 + area_5 + area_6 + area_7\right)$$

$$\boxed{area_{truss} = 4457\cdot ft^2}$$

Square footage of existing floor system:

- area of the existing end floorbeams (27W91):

$$area_8 := perimeter_8\cdot length_8 = 487.886\cdot ft^2$$

- area of the existing interior floorbeams (30W116):

$$area_9 := perimeter_9\cdot length_9 = 1033.545\cdot ft^2$$

- area of the existing stringers (18W47):

$$area_{10} := perimeter_{10}\cdot length_{10} = 2439\cdot ft^2$$

- area of the lateral bracing:

$area_{13} := perimeter_{13} \cdot length_{13} = 169.083 \cdot ft^2$

Quantity for existing floor system, including 5% increase for connections:

$area_{floor\_original} := 1.05\left(area_8 + area_9 + area_{10} + area_{13}\right)$

$\boxed{area_{floor\_original} = 4336 \cdot ft^2}$

Square footage of widened floor system:

- area of the new floorbeams (33W241):

$area_{11} := perimeter_{11} \cdot length_{11} = 2706.325 \cdot ft^2$

- area of the the new stringers (18W65):

$area_{12} := perimeter_{12} \cdot length_{12} = 3790.5 \cdot ft^2$

- area of the lateral bracing:

$area_{14} := perimeter_{13} \cdot length_{14} = 208.369 \cdot ft^2$

Quantity for existing floor system, including 5% increase for connections:

$area_{floor\_widened} := 1.05\left(area_{11} + area_{12} + area_{14}\right)$

$\boxed{area_{floor\_widened} = 7040 \cdot ft^2}$

COST ESTIMATE & QUANTITY COMPUTATIONS

Alternative 2(b) – Rehabilitation and widening of bridge, eliminating fracture critical designation

Estimate

Estimated Cost: $1,826,097.50

Contingency: 10.00%

Estimated Total: $2,008,707.25

Alternative 2(b) - Rehabilitation and widening of existing bridge, eliminating fracture critical designation

Base Date: 01/29/15

Spec Year: 09

Unit System: E

Work Type: BRIDGE IMPROVEMENTS

Highway Type: ASPHALT

Urban/Rural Type: RURAL

Season: SUMMER

County: LINCOLN

Prepared by System Administrator

Line #	Item Number	Quantity	Units	Unit Price	Extension
	Description				
	Supplemental Description				

Group 0200: BRIDGE

0006	501(B) 1307	514.00	CY	$20.00000	$10,280.00
	SUBSTRUCTURE EXCAVATION COMMON				
0007	501(G) 6309	514.00	CY	$120.00000	$61,680.00
	CLSM BACKFILL				
0008	504(B) 1305	729.00	SY	$5.00000	$3,645.00
	SAW-CUT GROOVING				
0009	504(A) 1304	272.00	SY	$180.00000	$48,960.00
	APPROACH SLAB				
0010	504(C) 6250	164.00	LF	$300.00000	$49,200.00
	SEALED EXPANSION JOINT				
0011	506(A) 3050	167,815.00	LB	$2.00000	$335,630.00
	STRUCTURAL STEEL M270 GRADE 50 (PAINTED)				
0013	507(A) 6170	16.00	EA	$2,200.00000	$35,200.00
	STAINLESS STEEL FIXED BEARING ASSEMBLY				
0014	507(B) 6174	16.00	EA	$1,800.00000	$28,800.00
	STAINLESS STEEL EXPANSION BEARING ASSEMBLY				
0015	509(A) 1326	325.00	CY	$550.00000	$178,750.00
	CLASS AA CONCRETE				
0016	511(B) 6010	63,720.00	LB	$1.25000	$79,650.00
	EPOXY COATED REINFORCING STEEL				
0017	512(A) 1323	1.00	LSUM	$120,000.00000	$120,000.00
	PAINTING EXISTING STRUCTURES				
0018	512(B) 6303	1.00	LSUM	$90,000.00000	$90,000.00
	COLLECTION AND HANDLING OF WASTE				
	LEAD PAINT REMOVAL AND DISPOSAL				
0019	514(A) 6010	450.00	LF	$35.00000	$15,750.00
	PILES, FURNISHED (HP 10X42)				
0020	514(B) 6292	450.00	LF	$18.00000	$8,100.00
	PILES, DRIVEN (HP 10X42)				
0021	515(A) 6013	905.00	SY	$4.50000	$4,072.50
	WATER REPELLENT (VISUALLY INSPECTED)				
0022	516(A) 6098	210.00	LF	$810.00000	$170,100.00
	DRILLED SHAFTS 72" DIAMETER				
0023	516(C) 6200	1.00	EA	$9,000.00000	$9,000.00
	CROSSHOLE SONIC LOGGING				
0024	521(A) 6210	25.00	SY	$560.00000	$14,000.00
	PNEUMATICALLY PLACED MORTAR				
0025	535 6130	25.00	SY	$52.00000	$1,300.00
	(SP)CORROSION INHIBITOR(SURFACE APPLIED)				
0026	540 4515	1.00	EA	$100,000.00000	$100,000.00
	(PL)REPAIR BRIDGE ITEM (TYPE A)				
	REMOVE AND RESET TRUSSES				
0027	540 4525	2.00	EA	$3,000.00000	$6,000.00
	(PL)REPAIR BRIDGE ITEM (TYPE B)				
	FIXED BEARING FOR TRUSS				
0028	540 4535	2.00	EA	$3,500.00000	$7,000.00
	(PL)REPAIR BRIDGE ITEM (TYPE C)				
	EXPANSION BEARING FOR TRUSS				
0030	540 4545	454.00	EA	$120.00000	$54,480.00
	(PL)REPAIR BRIDGE ITEM (TYPE D)				
	SPECIAL BRIDGE RAILS, HISTORICALLY SENSITIVE DESIGN				
0031	601(B) 1353	1,500.00	TON	$45.00000	$67,500.00
	TYPE I-A PLAIN RIPRAP				
0032	601(C) 1355	300.00	TON	$40.00000	$12,000.00
	TYPE I-A FILTER BLANKET				
0033	619(B) 2500	1.00	LSUM	$150,000.00000	$150,000.00
	REMOVAL OF BRIDGE ITEMS				

Line #	Item Number	Quantity	Units	Unit Price	Extension
	Description ***Supplemental Description***				

Total for Group 0200: $1,661,097.50

Group 0600: CONSTRUCTION

0034	641	1399	1.00	LSUM	$165,000.00000	$165,000.00
MOBILIZATION						

Group Alternate Code: 501

Total for Group 0600: $165,000.00

Substructure Excavation Common				
Location	Length (ft)	Width (ft)	Thickness (ft)	CY
Approach Slabs (2)	48.00	32.00	2.00	113.8
Abutments (2)	60.00	12.00	15.00	400.0
Total Substructure Excavation (CY)				**514**

CLSM Backfill				
Location	Length (ft)	Width (ft)	Thickness (ft)	CY
Approach Slabs (2)	48.00	32.00	2.00	113.8
Abutments (2)	60.00	12.00	15.00	400.0
Total CLSM Backfill (CY)				**514**

Saw Cut Grooving - Deck				
Span	Length (ft)	Deduction for Joints (ft)	Width (ft)(2-ft from Rails)	Area (SY)
1	64.17	1.00	24.00	168.45
2	102.00	1.00	24.00	269.33
3	64.17	1.00	24.00	168.45
Saw Cut Grooving Sub-Total (Deck)				606

Saw Cut Grooving - Approach Slab					
Phase	Slab	Length (ft)	Deduction for Joints (ft)	Width (ft)(2-ft from Rails)	Area (SY)
1	1	24.00	1.00	24.00	61.33
1	2	24.00	1.00	24.00	61.33
Saw Cut Grooving Sub-Total (Approach Slabs)					123
Total Saw Cut Grooving					**729**

Structural Steel					
Spans 1 and 3 Widening					
Element	Section	Length (ft)	Number	lb/ft	Weight (lb)
Span 1 and 3 Beam	W36 x 160	60.0	2	160	19,200
Span 1 and 3 Diaphragms	W10 x 22	5.2	8	22	909
Span 2 New Steel Beam Superstructure					
Element	Section	Length (ft)	Number	lb/ft	Weight (lb)
Steel Beams	W40 x 324	101.7	4	324	131,760
End Diaphragms	MC18 x 42.7	9.0	9	42.7	3,459
Intermediate Diaphragms	MC18 x 42.7	12.5	6	42.7	3,203
Element	Quantity	Length (in)	Width (in)	Thickness (in)	Weight (lb)
Bearing Stiffener (Plate)	16	38.0	7	0.75	905
Diaph. Stiffener (Plate)	18	38.0	4	0.5	388
Sub Total Weight of Structural Steel (lb) =					159,824
Weight of Connection Hardware & Shear Studs (lb) - Assume 5% of Total Steel Weight					7,991
Total Weight of Structural Steel (lb) =					**167,815**

Alternative 2(b)

Class AA Concrete (Deck)				
Item	Length (ft)	Width (ft)	Thickness (ft)	CY
Deck	227.30	31.00	0.67	174.1
Haunch (Spans 1 and 3)	770.00	1.00	0.13	3.6
Haunch (Span 2)	408.00	1.33	0.13	2.5
Total Class AA Concrete - Deck				180.1

Class AA Concrete (Substructure)						
Item	Length (ft)	Width (ft)	Height (ft)	CY (each unit)	# Units	CY (Total)
Abutments - Caps	6.00	5.33	2.50	3.0	2	5.9
Abutments - Backwalls	6.00	1.00	3.00	0.7	2	1.3
Abutments - Toe Walls	6.00	1.33	8.00	2.4	2	4.7
Abut. Wings - Caps	16.00	4.20	2.50	6.2	2	12.4
Abut. Wings - Backwalls	16.00	1.00	4.60	2.7	2	5.5
Abut. Wings - Toe Walls	16.00	1.33	8.00	6.3	2	12.6
Piers - Columns (4' Diam.)	18.00	Area (SF) =	12.57	8.4	6	50.3
Piers - Caps	44.00	4.00	4.00	26.1	2	52.1
Web Wall	32.00	1.50	16.00	19.0	2	37.9
Total Class AA Concrete - Substructure						144.9
Total Class AA Concrete						**325.1**

Epoxy Coated Reinforcing Steel			
Location	Concrete (CY)	LB/CY	LB Steel
Deck	180.1	205	36,930
Abutments	42.5	135	5,736
Piers	140.4	150	21,054
Total Weight of Epoxy Coated Reinforcing Steel (LB)			**63,720**

Piles - HP10 x 42			
Location	Length/Pile	Number	Total Length
Abutment 1	40.0	5	200
Abutment 2	50.0	5	250
Total Length of Piling (ft)			**450**

Drilled Shafts (5'-0" Diameter)			
Location	Length/Pile	Number	Total Length
Pier 1	30.0	3	90
Pier 2	40.0	3	120
Total Length of Drilled Shafts (ft)			**210**

Water Repellent (Visually Inspected)				
Deck and Rails				
Location	Length (ft)	Width (ft)	# Locations	Total Area (SY)
Deck Soffit	227.33	1.50	2	75.8
Deck Fascia	227.33	0.67	2	33.7
Assumed Area for Rails	227.33	4.00	2	202.1
Total Water Repellent - Deck and Rails				312
Water Repellent (Visually Inspected)				
Substructure				
Location	Length (ft)	Width (ft)	# Locations	Total Area (SY)
Abutment 1:				
Seat Face	67.00	2.50	1	18.6
Seat Ends	5.33	2.50	2	3.0
Seat Top	67.00	3.00	1	22.3
Backwall	67.00	3.00	1	22.3
Subtotal for Abutment 1				66
Abutment 2:				
Seat Face	67.00	2.50	1	18.6
Seat Ends	5.33	2.50	2	3.0
Seat Top	67.00	3.00	1	22.3
Backwall	67.00	3.00	1	22.3
Subtotal for Abutment 2				66
Pier 1:				
Top of Web Wall	28.00	1.50	1	4.7
Face of Web Wall	28.00	12.50	2	77.8
Cap Faces (top, bot., and sides)	44.00	4.00	4	78.2
Cap Ends	4.00	4.00	2	3.6
Column Faces (4'-0" diameter)	18.00	11.07	3	66.4
Subtotal for Pier 1				231
Pier 2:				
Top of Web Wall	28.00	1.50	1	4.7
Face of Web Wall	28.00	12.50	2	77.8
Cap Faces (top, bot., and sides)	44.00	4.00	4	78.2
Cap Ends	4.00	4.00	2	3.6
Column Faces (4'-0" diameter)	18.00	11.07	3	66.4
Subtotal for Pier 2				231
Total Water Repellent for Substructure				594
Grand Total for Water Repellent				**905**

Area Calculation for Painting Existing Steel (Spans 1 and 3)(See separate calculations for Span 2)					
Location	Length (ft)	Height/Width (ft)	# Faces	# Members	Total Area (SF)
Beam Web (W36 x 160)	60	3.00	2.0	10	3600
Beam Flange (W36 x 160)	60	1.00	3.0	10	1800
P. Beam Web (W36 x 192)	32	3.00	2.0	2	384
P. Beam Fl. (W36 x 192)	32	1.00	3.0	2	192
Diaph.Web (W10 x 22)	5	0.85	2.0	16	136
Diaph. Flange (W10 x 22)	5	0.48	4.0	16	153
Total Area for Painting of Existing Steel in Spans 1 and 3 (SF)					**6265**

COST ESTIMATE & QUANTITY COMPUTATIONS

Alternative 2(c): Rehabilitation of existing bridge, bridge remains fracture critical; design exception to keep existing bridge width

Estimate

Estimated Cost: $1,025,642.00

Contingency: 10.00%

Estimated Total: $1,128,206.20

Alternative 2(c) - Rehabilitation of existing bridge; bridge remains fracture critical and design exception to keep current bridge width

Base Date: 01/29/15

Spec Year: 09

Unit System: E

Work Type: BRIDGE IMPROVEMENTS

Highway Type: ASPHALT

Urban/Rural Type: RURAL

Season: SUMMER

County: LINCOLN

Prepared by System Administrator

Line #	Item Number	Quantity	Units	Unit Price	Extension
	Description				
	Supplemental Description				

Group 0200: BRIDGE

0006	501(B) 1307	114.00	CY	$20.00000	$2,280.00
	SUBSTRUCTURE EXCAVATION COMMON				
0007	501(G) 6309	114.00	CY	$120.00000	$13,680.00
	CLSM BACKFILL				
0008	504(B) 1305	547.00	SY	$5.00000	$2,735.00
	SAW-CUT GROOVING				
0009	504(A) 1304	203.00	SY	$180.00000	$36,540.00
	APPROACH SLAB				
0010	504(C) 6250	130.00	LF	$300.00000	$39,000.00
	SEALED EXPANSION JOINT				
0011	506(A) 3050	83,833.00	LB	$2.00000	$167,666.00
	STRUCTURAL STEEL M270 GRADE 50 (PAINTED)				
0014	507(B) 6174	10.00	EA	$1,800.00000	$18,000.00
	STAINLESS STEEL EXPANSION BEARING ASSEMBLY				
0015	509(A) 1326	146.00	CY	$550.00000	$80,300.00
	CLASS AA CONCRETE				
0016	511(B) 6010	29,812.00	LB	$1.25000	$37,265.00
	EPOXY COATED REINFORCING STEEL				
0017	512(A) 1323	1.00	LSUM	$150,000.00000	$150,000.00
	PAINTING EXISTING STRUCTURES				
0018	512(B) 6303	1.00	LSUM	$90,000.00000	$90,000.00
	COLLECTION AND HANDLING OF WASTE				
	LEAD PAINT REMOVAL AND DISPOSAL				
0021	515(A) 6013	688.00	SY	$4.50000	$3,096.00
	WATER REPELLENT (VISUALLY INSPECTED)				
0024	521(A) 6210	50.00	SY	$560.00000	$28,000.00
	PNEUMATICALLY PLACED MORTAR				
0025	535 6130	50.00	SY	$52.00000	$2,600.00
	(SP)CORROSION INHIBITOR(SURFACE APPLIED)				
0027	540 4515	2.00	EA	$3,000.00000	$6,000.00
	(PL)REPAIR BRIDGE ITEM (TYPE A)				
	FIXED BEARING FOR TRUSS				
0028	540 4525	2.00	EA	$3,500.00000	$7,000.00
	(PL)REPAIR BRIDGE ITEM (TYPE B)				
	EXPANSION BEARING FOR TRUSS				
0030	540 4535	454.00	EA	$120.00000	$54,480.00
	(PL)REPAIR BRIDGE ITEM (TYPE C)				
	SPECIAL BRIDGE RAILS, HISTORICALLY SENSITIVE DESIGN				
0031	601(B) 1353	1,200.00	TON	$45.00000	$54,000.00
	TYPE I-A PLAIN RIPRAP				
0032	601(C) 1355	250.00	TON	$40.00000	$10,000.00
	TYPE I-A FILTER BLANKET				
0033	619(B) 2500	1.00	LSUM	$130,000.00000	$130,000.00
	REMOVAL OF BRIDGE ITEMS				

Total for Group 0200: $932,642.00

Group 0600: CONSTRUCTION

0034	641 1399	1.00	LSUM	$93,000.00000	$93,000.00
	MOBILIZATION				

Group Alternate Code: 501

Total for Group 0600: $93,000.00

Alternative 2(c)

Substructure Excavation Common				
Location	Length (ft)	Width (ft)	Thickness (ft)	CY
Approach Slabs (2)	48.00	32.00	2.00	113.8
Total Substructure Excavation (CY)				**114**

CLSM Backfill				
Location	Length (ft)	Width (ft)	Thickness (ft)	CY
Approach Slabs (2)	48.00	32.00	2.00	113.8
Total CLSM Backfill (CY)				**114**

Saw Cut Grooving - Deck				
Span	Length (ft)	Deduction for Joints (ft)	Width (ft)(2-ft from Rails)	Area (SY)
1	64.17	1.00	18.00	126.33
2	102.00	1.00	18.00	202.00
3	64.17	1.00	18.00	126.34
Saw Cut Grooving Sub-Total (Deck)				455

Saw Cut Grooving - Approach Slab					
Phase	Slab	Length (ft)	Deduction for Joints (ft)	Width (ft)(2-ft from Rails)	Area (SY)
1	1	24.00	1.00	18.00	46.00
1	2	24.00	1.00	18.00	46.00
Saw Cut Grooving Sub-Total (Approach Slabs)					92
Total Saw Cut Grooving					**547**

Structural Steel					
Floor Framing (Span 2)					
Element	Section	Length (ft)	Number	lb/ft	Weight (lb)
Span 2 Stringers	W18 x 65	100.0	5	65	32,500
Span 2 Floor Beams (End)	W33 x 241	32.0	2	241	15,424
Span 2 Floor Beams (Int.)	W33 x 241	25.0	5	241	30,125
Span 2 Lateral Bracing	L3 x 2.5 x 5/16	32.0	10	5.6	1,792
Sub Total Weight of Structural Steel (lb) =					79,841
Weight of Connection Hardware (lb) - Assume 5% of Total Steel Weight					3,992
Total Weight of Structural Steel (lb) =					**83,833**

Class AA Concrete (Deck)				
Item	Length (ft)	Width (ft)	Thickness (ft)	CY
Deck	227.30	25.00	0.67	140.4
Haunch (Spans 1 and 3)	641.67	1.00	0.13	3.0
Haunch (Span 2 - Stringer)	510.00	0.50	0.13	1.2
Haunch (Span 2 - FB)	220.51	0.88	0.13	0.9
Total Class AA Concrete - Deck				**145.4**

Epoxy Coated Reinforcing Steel			
Location	Concrete (CY)	LB/CY	LB Steel
Deck	145.4	205	29,812
Total Weight of Epoxy Coated Reinforcing Steel (LB)			**29,812**

Water Repellent (Visually Inspected)				
Deck and Rails				
Location	Length (ft)	Width (ft)	# Locations	Total Area (SY)
Deck Soffit	227.33	1.50	2	75.8
Deck Fascia	227.33	0.67	2	33.7
Assumed Area for Rails	227.33	4.00	2	202.1
Total Water Repellent - Deck and Rails				312
Water Repellent (Visually Inspected)				
Substructure				
Location	Length (ft)	Width (ft)	# Locations	Total Area (SY)
Abutment 1:				
Seat Face	58.00	2.50	1	16.1
Seat Ends	5.33	2.50	2	3.0
Seat Top	58.00	3.00	1	19.3
Backwall	58.00	3.00	1	19.3
Subtotal for Abutment 1				58
Abutment 2:				
Seat Face	58.00	2.50	1	16.1
Seat Ends	5.33	2.50	2	3.0
Seat Top	58.00	3.00	1	19.3
Backwall	58.00	3.00	1	19.3
Subtotal for Abutment 2				58
Pier 1:				
Top of Web Wall	28.00	1.50	1	4.7
Face of Web Wall	28.00	12.50	2	77.8
Columns Tops (4.75' diameter)	Area =	17.73	2	3.9
Column Faces (4'-0" diameter)	18.00	11.07	2	44.3
Subtotal for Pier 1				**131**
Pier 2:				
Top of Web Wall	28.00	1.50	1	4.7
Face of Web Wall	28.00	12.50	2	77.8
Columns Tops (4.75' diameter)	Area =	17.73	2	3.9
Column Faces (4'-0" diameter)	18.00	11.07	2	44.3
Subtotal for Pier 2				**131**
Total Water Repellent for Substructure				377
Grand Total for Water Repellent				**688**

Area Calculation for Painting Existing Steel (Spans 1 and 3)(See separate calculations for Span 2)					
Location	Length (ft)	Height/Width (ft)	# Faces	# Members	Total Area (SF)
Beam Web (W36 x 160)	60	3.00	2.0	10	3600
Beam Flange (W36 x 160)	60	1.00	3.0	10	1800
P. Beam Web (W36 x 192)	32	3.00	2.0	2	384
P. Beam Fl. (W36 x 192)	32	1.00	3.0	2	192
Diaph.Web (W10 x 22)	5	0.85	2.0	16	136
Diaph. Flange (W10 x 22)	5	0.48	4.0	16	153
Total Area for Painting of Existing Steel in Spans 1 and 3 (SF)					**6265**

COST ESTIMATE & QUANTITY COMPUTATIONS

Alternative 2(d): Rehabilitation of existing bridge, eliminating fracture critical designation; design exception to keep existing bridge width

Estimate

Estimated Cost: $1,243,447.25

Contingency: 10.00%

Estimated Total: $1,367,791.98

Alternative 2(d) - Rehabilitation of existing bridge, elminating fracture critical designation; design exception to keep current bridge width

Base Date: 01/29/15

Spec Year: 09

Unit System: E

Work Type: BRIDGE IMPROVEMENTS

Highway Type: ASPHALT

Urban/Rural Type: RURAL

Season: SUMMER

County: LINCOLN

Prepared by System Administrator

Line #	Item Number / Description / *Supplemental Description*	Quantity	Units	Unit Price	Extension

Group 0200: BRIDGE

0006	501(B) 1307 SUBSTRUCTURE EXCAVATION COMMON	114.00	CY	$20.00000	$2,280.00
0007	501(G) 6309 CLSM BACKFILL	114.00	CY	$120.00000	$13,680.00
0008	504(B) 1305 SAW-CUT GROOVING	547.00	SY	$5.00000	$2,735.00
0009	504(A) 1304 APPROACH SLAB	203.00	SY	$180.00000	$36,540.00
0010	504(C) 6250 SEALED EXPANSION JOINT	130.00	LF	$300.00000	$39,000.00
0011	506(A) 3050 STRUCTURAL STEEL M270 GRADE 50 (PAINTED)	145,557.00	LB	$2.00000	$291,114.00
0013	507(A) 6170 STAINLESS STEEL FIXED BEARING ASSEMBLY	14.00	EA	$2,200.00000	$30,800.00
0015	507(B) 6174 STAINLESS STEEL EXPANSION BEARING ASSEMBLY	14.00	EA	$1,800.00000	$25,200.00
0016	509(A) 1326 CLASS AA CONCRETE	239.00	CY	$550.00000	$131,450.00
0017	511(B) 6010 EPOXY COATED REINFORCING STEEL	43,845.00	LB	$1.25000	$54,806.25
0018	512(A) 1323 PAINTING EXISTING STRUCTURES	1.00	LSUM	$120,000.00000	$120,000.00
0019	512(B) 6303 COLLECTION AND HANDLING OF WASTE *LEAD PAINT REMOVAL AND DISPOSAL*	1.00	LSUM	$90,000.00000	$90,000.00
0021	515(A) 6013 WATER REPELLENT (VISUALLY INSPECTED)	836.00	SY	$4.50000	$3,762.00
0024	521(A) 6210 PNEUMATICALLY PLACED MORTAR	50.00	SY	$560.00000	$28,000.00
0025	535 6130 (SP)CORROSION INHIBITOR(SURFACE APPLIED)	50.00	SY	$52.00000	$2,600.00
0027	540 4515 (PL)REPAIR BRIDGE ITEM (TYPE A) *FIXED BEARING FOR TRUSS*	2.00	EA	$3,000.00000	$6,000.00
0028	540 4525 (PL)REPAIR BRIDGE ITEM (TYPE B) *EXPANSION BEARING FOR TRUSS*	2.00	EA	$3,500.00000	$7,000.00
0030	540 4535 (PL)REPAIR BRIDGE ITEM (TYPE C) *SPECIAL BRIDGE RAILS, HISTORICALLY SENSITIVE DESIGN*	454.00	EA	$120.00000	$54,480.00
0031	601(B) 1353 TYPE I-A PLAIN RIPRAP	1,200.00	TON	$45.00000	$54,000.00
0032	601(C) 1355 TYPE I-A FILTER BLANKET	250.00	TON	$40.00000	$10,000.00
0033	619(B) 2500 REMOVAL OF BRIDGE ITEMS	1.00	LSUM	$130,000.00000	$130,000.00

Total for Group 0200: $1,133,447.25

Group 0600: CONSTRUCTION

0034	641 1399 MOBILIZATION	1.00	LSUM	$110,000.00000	$110,000.00

Group Alternate Code: 501

Total for Group 0600: $110,000.00

Substructure Excavation Common				
Location	Length (ft)	Width (ft)	Thickness (ft)	CY
Approach Slabs (2)	48.00	32.00	2.00	113.8
Total Substructure Excavation (CY)				**114**

CLSM Backfill				
Location	Length (ft)	Width (ft)	Thickness (ft)	CY
Approach Slabs (2)	48.00	32.00	2.00	113.8
Total CLSM Backfill (CY)				**114**

Saw Cut Grooving - Deck				
Span	Length (ft)	Deduction for Joints (ft)	Width (ft)(2-ft from Rails)	Area (SY)
1	64.17	1.00	18.00	126.33
2	102.00	1.00	18.00	202.00
3	64.17	1.00	18.00	126.34
Saw Cut Grooving Sub-Total (Deck)				455

Saw Cut Grooving - Approach Slab					
Phase	Slab	Length (ft)	Deduction for Joints (ft)	Width (ft)(2-ft from Rails)	Area (SY)
1	1	24.00	1.00	18.00	46.00
1	2	24.00	1.00	18.00	46.00
Saw Cut Grooving Sub-Total (Approach Slabs)					92
Total Saw Cut Grooving					**547**

Structural Steel - Span 2 Superstructure					
Element	Section	Length (ft)	Number	lb/ft	Weight (lb)
Steel Beams	W40 x 324	101.7	4	324	131,760
End Diaphragms	MC18 x 42.7	7.5	9	42.7	2,882
Intermediate Diaphragms	MC18 x 42.7	10.5	6	42.7	2,690
Element	Quantity	Length (in)	Width (in)	Thickness (in)	Weight (lb)
Bearing Stiffener (Plate)	16	38.0	7	0.75	905
Diaph. Stiffener (Plate)	18	38.0	4	0.5	388
Sub Total Weight of Structural Steel (lb) =					138,626
Weight of Connection Hardware (lb) - Assume 5% of Total Steel Weight					6,931
Total Weight of Structural Steel (lb) =					**145,557**

Class AA Concrete (Deck)				
Item	Length (ft)	Width (ft)	Thickness (ft)	CY
Deck	227.30	25.00	0.67	140.4
Haunch (Spans 1 and 3)	641.67	1.00	0.13	3.0
Haunch (Span 2)	408.00	1.33	0.13	2.5
Total Class AA Concrete - Deck				145.9

Class AA Concrete (Substructure) - Pier Reconstruction for New Span 2 Superstruture						
Item	Length (ft)	Width (ft)	Height (ft)	CY (each unit)	# Units	CY (Total)
Piers - Columns (4' Diam.)	18.00	Area (SF) =	12.57	8.4	6	50.3
Piers - Caps	36.00	4.00	4.00	21.3	2	42.7
Web Wall	24.00	1.50	16.00	14.2	2	28.4
Total Class AA Concrete - Substructure						93.0
Total Class AA Concrete						**238.8**

Epoxy Coated Reinforcing Steel			
Location	Concrete (CY)	LB/CY	LB Steel
Deck	145.9	205	29,902
Piers	93.0	150	13,943
Total Weight of Epoxy Coated Reinforcing Steel (LB)			**43,845**

Water Repellent (Visually Inspected)				
Deck and Rails				
Location	Length (ft)	Width (ft)	# Locations	Total Area (SY)
Deck Soffit	227.33	1.50	2	75.8
Deck Fascia	227.33	0.67	2	33.7
Assumed Area for Rails	227.33	4.00	2	202.1
Total Water Repellent - Deck and Rails				312
Water Repellent (Visually Inspected)				
Substructure				
Location	Length (ft)	Width (ft)	# Locations	Total Area (SY)
Abutment 1:				
Seat Face	58.00	2.50	1	16.1
Seat Ends	5.33	2.50	2	3.0
Seat Top	58.00	3.00	1	19.3
Backwall	58.00	3.00	1	19.3
Subtotal for Abutment 1				58
Abutment 2:				
Seat Face	58.00	2.50	1	16.1
Seat Ends	5.33	2.50	2	3.0
Seat Top	58.00	3.00	1	19.3
Backwall	58.00	3.00	1	19.3
Subtotal for Abutment 2				58
Pier 1:				
Top of Web Wall	24.00	1.50	1	4.0
Face of Web Wall	24.00	12.50	2	66.7
Cap Faces (top, bot., and sides)	36.00	4.00	4	64.0
Cap Ends	4.00	4.00	2	3.6
Column Faces (4'-0" diameter)	18.00	11.07	3	66.4
Subtotal for Pier 1				205
Pier 2:				
Top of Web Wall	24.00	1.50	1	4.0
Face of Web Wall	24.00	12.50	2	66.7
Cap Faces (top, bot., and sides)	36.00	4.00	4	64.0
Cap Ends	4.00	4.00	2	3.6
Column Faces (4'-0" diameter)	18.00	11.07	3	66.4
Subtotal for Pier 2				205
Total Water Repellent for Substructure				525
Grand Total for Water Repellent				**836**

Area Calculation for Painting Existing Steel (Spans 1 and 3)(See separate calculations for Span 2)					
Location	Length (ft)	Height/Width (ft)	# Faces	# Members	Total Area (SF)
Beam Web (W36 x 160)	60	3.00	2.0	10	3600
Beam Flange (W36 x 160)	60	1.00	3.0	10	1800
P. Beam Web (W36 x 192)	32	3.00	2.0	2	384
P. Beam Fl. (W36 x 192)	32	1.00	3.0	2	192
Diaph.Web (W10 x 22)	5	0.85	2.0	16	136
Diaph. Flange (W10 x 22)	5	0.48	4.0	16	153
Total Area for Painting of Existing Steel in Spans 1 and 3 (SF)					**6265**

COST ESTIMATE & QUANTITY COMPUTATIONS

Alternative 3(a) – Retain existing bridge in vehicular service as part of a one-way couplet, bridge remains fracture critical

Estimate

Estimated Cost: $1,025,642.00

Contingency: 10.00%

Estimated Total: $1,128,206.20

Alternative 3(a) - Retain existing bridge in vehicular service as part of a one-way couplet, bridge remains fracture critical

Base Date: 01/29/15

Spec Year: 09

Unit System: E

Work Type: BRIDGE IMPROVEMENTS

Highway Type: ASPHALT

Urban/Rural Type: RURAL

Season: SUMMER

County: LINCOLN

Prepared by System Administrator

Line #	Item Number	Quantity	Units	Unit Price	Extension
	Description				
	Supplemental Description				

Group 0200: BRIDGE

0006	501(B) 1307	114.00	CY	$20.00000	$2,280.00
	SUBSTRUCTURE EXCAVATION COMMON				
0007	501(G) 6309	114.00	CY	$120.00000	$13,680.00
	CLSM BACKFILL				
0008	504(B) 1305	547.00	SY	$5.00000	$2,735.00
	SAW-CUT GROOVING				
0009	504(A) 1304	203.00	SY	$180.00000	$36,540.00
	APPROACH SLAB				
0010	504(C) 6250	130.00	LF	$300.00000	$39,000.00
	SEALED EXPANSION JOINT				
0011	506(A) 3050	83,833.00	LB	$2.00000	$167,666.00
	STRUCTURAL STEEL M270 GRADE 50 (PAINTED)				
0014	507(B) 6174	10.00	EA	$1,800.00000	$18,000.00
	STAINLESS STEEL EXPANSION BEARING ASSEMBLY				
0015	509(A) 1326	146.00	CY	$550.00000	$80,300.00
	CLASS AA CONCRETE				
0016	511(B) 6010	29,812.00	LB	$1.25000	$37,265.00
	EPOXY COATED REINFORCING STEEL				
0017	512(A) 1323	1.00	LSUM	$150,000.00000	$150,000.00
	PAINTING EXISTING STRUCTURES				
0018	512(B) 6303	1.00	LSUM	$90,000.00000	$90,000.00
	COLLECTION AND HANDLING OF WASTE				
	LEAD PAINT REMOVAL AND DISPOSAL				
0021	515(A) 6013	688.00	SY	$4.50000	$3,096.00
	WATER REPELLENT (VISUALLY INSPECTED)				
0024	521(A) 6210	50.00	SY	$560.00000	$28,000.00
	PNEUMATICALLY PLACED MORTAR				
0025	535 6130	50.00	SY	$52.00000	$2,600.00
	(SP)CORROSION INHIBITOR(SURFACE APPLIED)				
0027	540 4515	2.00	EA	$3,000.00000	$6,000.00
	(PL)REPAIR BRIDGE ITEM (TYPE A)				
	FIXED BEARING FOR TRUSS				
0028	540 4525	2.00	EA	$3,500.00000	$7,000.00
	(PL)REPAIR BRIDGE ITEM (TYPE B)				
	EXPANSION BEARING FOR TRUSS				
0030	540 4535	454.00	EA	$120.00000	$54,480.00
	(PL)REPAIR BRIDGE ITEM (TYPE C)				
	SPECIAL BRIDGE RAILS, HISTORICALLY SENSITIVE DESIGN				
0031	601(B) 1353	1,200.00	TON	$45.00000	$54,000.00
	TYPE I-A PLAIN RIPRAP				
0032	601(C) 1355	250.00	TON	$40.00000	$10,000.00
	TYPE I-A FILTER BLANKET				
0033	619(B) 2500	1.00	LSUM	$130,000.00000	$130,000.00
	REMOVAL OF BRIDGE ITEMS				

Total for Group 0200: $932,642.00

Group 0600: CONSTRUCTION

0034	641 1399	1.00	LSUM	$93,000.00000	$93,000.00
	MOBILIZATION				

Group Alternate Code: 501

Total for Group 0600: $93,000.00

Substructure Excavation Common				
Location	Length (ft)	Width (ft)	Thickness (ft)	CY
Approach Slabs (2)	48.00	32.00	2.00	113.8
Total Substructure Excavation (CY)				**114**

CLSM Backfill				
Location	Length (ft)	Width (ft)	Thickness (ft)	CY
Approach Slabs (2)	48.00	32.00	2.00	113.8
Total CLSM Backfill (CY)				**114**

Saw Cut Grooving - Deck				
Span	Length (ft)	Deduction for Joints (ft)	Width (ft)(2-ft from Rails)	Area (SY)
1	64.17	1.00	18.00	126.33
2	102.00	1.00	18.00	202.00
3	64.17	1.00	18.00	126.34
Saw Cut Grooving Sub-Total (Deck)				455

Saw Cut Grooving - Approach Slab					
Phase	Slab	Length (ft)	Deduction for Joints (ft)	Width (ft)(2-ft from Rails)	Area (SY)
1	1	24.00	1.00	18.00	46.00
1	2	24.00	1.00	18.00	46.00
Saw Cut Grooving Sub-Total (Approach Slabs)					92
Total Saw Cut Grooving					**547**

Structural Steel					
Floor Framing (Span 2)					
Element	Section	Length (ft)	Number	lb/ft	Weight (lb)
Span 2 Stringers	W18 x 65	100.0	5	65	32,500
Span 2 Floor Beams (End)	W33 x 241	32.0	2	241	15,424
Span 2 Floor Beams (Int.)	W33 x 241	25.0	5	241	30,125
Span 2 Lateral Bracing	L3 x 2.5 x 5/16	32.0	10	5.6	1,792
Sub Total Weight of Structural Steel (lb) =					79,841
Weight of Connection Hardware (lb) - Assume 5% of Total Steel Weight					3,992
Total Weight of Structural Steel (lb) =					**83,833**

Class AA Concrete (Deck)				
Item	Length (ft)	Width (ft)	Thickness (ft)	CY
Deck	227.30	25.00	0.67	140.4
Haunch (Spans 1 and 3)	641.67	1.00	0.13	3.0
Haunch (Span 2 - Stringer)	510.00	0.50	0.13	1.2
Haunch (Span 2 - FB)	220.51	0.88	0.13	0.9
Total Class AA Concrete - Deck				**145.4**

Epoxy Coated Reinforcing Steel			
Location	Concrete (CY)	LB/CY	LB Steel
Deck	145.4	205	29,812
Total Weight of Epoxy Coated Reinforcing Steel (LB)			**29,812**

Water Repellent (Visually Inspected)				
Deck and Rails				
Location	Length (ft)	Width (ft)	# Locations	Total Area (SY)
Deck Soffit	227.33	1.50	2	75.8
Deck Fascia	227.33	0.67	2	33.7
Assumed Area for Rails	227.33	4.00	2	202.1
Total Water Repellent - Deck and Rails				312
Water Repellent (Visually Inspected)				
Substructure				
Location	Length (ft)	Width (ft)	# Locations	Total Area (SY)
Abutment 1:				
Seat Face	58.00	2.50	1	16.1
Seat Ends	5.33	2.50	2	3.0
Seat Top	58.00	3.00	1	19.3
Backwall	58.00	3.00	1	19.3
Subtotal for Abutment 1				58
Abutment 2:				
Seat Face	58.00	2.50	1	16.1
Seat Ends	5.33	2.50	2	3.0
Seat Top	58.00	3.00	1	19.3
Backwall	58.00	3.00	1	19.3
Subtotal for Abutment 2				58
Pier 1:				
Top of Web Wall	28.00	1.50	1	4.7
Face of Web Wall	28.00	12.50	2	77.8
Columns Tops (4.75' diameter)	Area =	17.73	2	3.9
Column Faces (4'-0" diameter)	18.00	11.07	2	44.3
Subtotal for Pier 1				**131**
Pier 2:				
Top of Web Wall	28.00	1.50	1	4.7
Face of Web Wall	28.00	12.50	2	77.8
Columns Tops (4.75' diameter)	Area =	17.73	2	3.9
Column Faces (4'-0" diameter)	18.00	11.07	2	44.3
Subtotal for Pier 2				**131**
Total Water Repellent for Substructure				377
Grand Total for Water Repellent				**688**

Area Calculation for Painting Existing Steel (Spans 1 and 3)(See separate calculations for Span 2)					
Location	Length (ft)	Height/Width (ft)	# Faces	# Members	Total Area (SF)
Beam Web (W36 x 160)	60	3.00	2.0	10	3600
Beam Flange (W36 x 160)	60	1.00	3.0	10	1800
P. Beam Web (W36 x 192)	32	3.00	2.0	2	384
P. Beam Fl. (W36 x 192)	32	1.00	3.0	2	192
Diaph.Web (W10 x 22)	5	0.85	2.0	16	136
Diaph. Flange (W10 x 22)	5	0.48	4.0	16	153
Total Area for Painting of Existing Steel in Spans 1 and 3 (SF)					**6265**

COST ESTIMATE & QUANTITY COMPUTATIONS

Alternative 3(b) – Retain existing bridge in vehicular service as part of a one-way couplet, eliminating fracture critical designation

Estimate

Estimated Cost: $1,243,447.25

Contingency: 10.00%

Estimated Total: $1,367,791.98

Alternative 3(b) - Retain existing bridge in vehicular service as part of a one-way couplet, eliminating fracture critical designation

Base Date: 01/29/15

Spec Year: 09

Unit System: E

Work Type: BRIDGE IMPROVEMENTS

Highway Type: ASPHALT

Urban/Rural Type: RURAL

Season: SUMMER

County: LINCOLN

Prepared by System Administrator

Line #	Item Number / Description / *Supplemental Description*	Quantity	Units	Unit Price	Extension
Group 0200: BRIDGE					
0006	501(B) 1307 SUBSTRUCTURE EXCAVATION COMMON	114.00	CY	$20.00000	$2,280.00
0007	501(G) 6309 CLSM BACKFILL	114.00	CY	$120.00000	$13,680.00
0008	504(B) 1305 SAW-CUT GROOVING	547.00	SY	$5.00000	$2,735.00
0009	504(A) 1304 APPROACH SLAB	203.00	SY	$180.00000	$36,540.00
0010	504(C) 6250 SEALED EXPANSION JOINT	130.00	LF	$300.00000	$39,000.00
0011	506(A) 3050 STRUCTURAL STEEL M270 GRADE 50 (PAINTED)	145,557.00	LB	$2.00000	$291,114.00
0013	507(A) 6170 STAINLESS STEEL FIXED BEARING ASSEMBLY	14.00	EA	$2,200.00000	$30,800.00
0015	507(B) 6174 STAINLESS STEEL EXPANSION BEARING ASSEMBLY	14.00	EA	$1,800.00000	$25,200.00
0016	509(A) 1326 CLASS AA CONCRETE	239.00	CY	$550.00000	$131,450.00
0017	511(B) 6010 EPOXY COATED REINFORCING STEEL	43,845.00	LB	$1.25000	$54,806.25
0018	512(A) 1323 PAINTING EXISTING STRUCTURES	1.00	LSUM	$120,000.00000	$120,000.00
0019	512(B) 6303 COLLECTION AND HANDLING OF WASTE *LEAD PAINT REMOVAL AND DISPOSAL*	1.00	LSUM	$90,000.00000	$90,000.00
0021	515(A) 6013 WATER REPELLENT (VISUALLY INSPECTED)	836.00	SY	$4.50000	$3,762.00
0024	521(A) 6210 PNEUMATICALLY PLACED MORTAR	50.00	SY	$560.00000	$28,000.00
0025	535 6130 (SP)CORROSION INHIBITOR(SURFACE APPLIED)	50.00	SY	$52.00000	$2,600.00
0027	540 4515 (PL)REPAIR BRIDGE ITEM (TYPE A) *FIXED BEARING FOR TRUSS*	2.00	EA	$3,000.00000	$6,000.00
0028	540 4525 (PL)REPAIR BRIDGE ITEM (TYPE B) *EXPANSION BEARING FOR TRUSS*	2.00	EA	$3,500.00000	$7,000.00
0030	540 4535 (PL)REPAIR BRIDGE ITEM (TYPE C) *SPECIAL BRIDGE RAILS, HISTORICALLY SENSITIVE DESIGN*	454.00	EA	$120.00000	$54,480.00
0031	601(B) 1353 TYPE I-A PLAIN RIPRAP	1,200.00	TON	$45.00000	$54,000.00
0032	601(C) 1355 TYPE I-A FILTER BLANKET	250.00	TON	$40.00000	$10,000.00
0033	619(B) 2500 REMOVAL OF BRIDGE ITEMS	1.00	LSUM	$130,000.00000	$130,000.00

Total for Group 0200: $1,133,447.25

Group 0600: CONSTRUCTION

0034	641 1399 MOBILIZATION	1.00	LSUM	$110,000.00000	$110,000.00

Group Alternate Code: 501

Total for Group 0600: $110,000.00

Alternative 3(b)

Substructure Excavation Common				
Location	Length (ft)	Width (ft)	Thickness (ft)	CY
Approach Slabs (2)	48.00	32.00	2.00	113.8
Total Substructure Excavation (CY)				**114**

CLSM Backfill				
Location	Length (ft)	Width (ft)	Thickness (ft)	CY
Approach Slabs (2)	48.00	32.00	2.00	113.8
Total CLSM Backfill (CY)				**114**

Saw Cut Grooving - Deck				
Span	Length (ft)	Deduction for Joints (ft)	Width (ft)(2-ft from Rails)	Area (SY)
1	64.17	1.00	18.00	126.33
2	102.00	1.00	18.00	202.00
3	64.17	1.00	18.00	126.34
Saw Cut Grooving Sub-Total (Deck)				455

Saw Cut Grooving - Approach Slab					
Phase	Slab	Length (ft)	Deduction for Joints (ft)	Width (ft)(2-ft from Rails)	Area (SY)
1	1	24.00	1.00	18.00	46.00
1	2	24.00	1.00	18.00	46.00
Saw Cut Grooving Sub-Total (Approach Slabs)					92
Total Saw Cut Grooving					**547**

Structural Steel - Span 2 Superstructure					
Element	Section	Length (ft)	Number	lb/ft	Weight (lb)
Steel Beams	W40 x 324	101.7	4	324	131,760
End Diaphragms	MC18 x 42.7	7.5	9	42.7	2,882
Intermediate Diaphragms	MC18 x 42.7	10.5	6	42.7	2,690
Element	Quantity	Length (in)	Width (in)	Thickness (in)	Weight (lb)
Bearing Stiffener (Plate)	16	38.0	7	0.75	905
Diaph. Stiffener (Plate)	18	38.0	4	0.5	388
Sub Total Weight of Structural Steel (lb) =					138,626
Weight of Connection Hardware (lb) - Assume 5% of Total Steel Weight					6,931
Total Weight of Structural Steel (lb) =					**145,557**

Class AA Concrete (Deck)				
Item	Length (ft)	Width (ft)	Thickness (ft)	CY
Deck	227.30	25.00	0.67	140.4
Haunch (Spans 1 and 3)	641.67	1.00	0.13	3.0
Haunch (Span 2)	408.00	1.33	0.13	2.5
Total Class AA Concrete - Deck				145.9

Class AA Concrete (Substructure) - Pier Reconstruction for New Span 2 Superstruture						
Item	Length (ft)	Width (ft)	Height (ft)	CY (each unit)	# Units	CY (Total)
Piers - Columns (4' Diam.)	18.00	Area (SF) =	12.57	8.4	6	50.3
Piers - Caps	36.00	4.00	4.00	21.3	2	42.7
Web Wall	24.00	1.50	16.00	14.2	2	28.4
Total Class AA Concrete - Substructure						93.0
Total Class AA Concrete						**238.8**

Epoxy Coated Reinforcing Steel			
Location	Concrete (CY)	LB/CY	LB Steel
Deck	145.9	205	29,902
Piers	93.0	150	13,943
Total Weight of Epoxy Coated Reinforcing Steel (LB)			**43,845**

Water Repellent (Visually Inspected)				
Deck and Rails				
Location	Length (ft)	Width (ft)	# Locations	Total Area (SY)
Deck Soffit	227.33	1.50	2	75.8
Deck Fascia	227.33	0.67	2	33.7
Assumed Area for Rails	227.33	4.00	2	202.1
Total Water Repellent - Deck and Rails				312

Water Repellent (Visually Inspected)				
Substructure				
Location	Length (ft)	Width (ft)	# Locations	Total Area (SY)
Abutment 1:				
Seat Face	58.00	2.50	1	16.1
Seat Ends	5.33	2.50	2	3.0
Seat Top	58.00	3.00	1	19.3
Backwall	58.00	3.00	1	19.3
Subtotal for Abutment 1				58
Abutment 2:				
Seat Face	58.00	2.50	1	16.1
Seat Ends	5.33	2.50	2	3.0
Seat Top	58.00	3.00	1	19.3
Backwall	58.00	3.00	1	19.3
Subtotal for Abutment 2				58
Pier 1:				
Top of Web Wall	24.00	1.50	1	4.0
Face of Web Wall	24.00	12.50	2	66.7
Cap Faces (top, bot., and sides)	36.00	4.00	4	64.0
Cap Ends	4.00	4.00	2	3.6
Column Faces (4'-0" diameter)	18.00	11.07	3	66.4
Subtotal for Pier 1				205
Pier 2:				
Top of Web Wall	24.00	1.50	1	4.0
Face of Web Wall	24.00	12.50	2	66.7
Cap Faces (top, bot., and sides)	36.00	4.00	4	64.0
Cap Ends	4.00	4.00	2	3.6
Column Faces (4'-0" diameter)	18.00	11.07	3	66.4
Subtotal for Pier 2				205
Total Water Repellent for Substructure				525
Grand Total for Water Repellent				**836**

Area Calculation for Painting Existing Steel (Spans 1 and 3)(See separate calculations for Span 2)					
Location	Length (ft)	Height/Width (ft)	# Faces	# Members	Total Area (SF)
Beam Web (W36 x 160)	60	3.00	2.0	10	3600
Beam Flange (W36 x 160)	60	1.00	3.0	10	1800
P. Beam Web (W36 x 192)	32	3.00	2.0	2	384
P. Beam Fl. (W36 x 192)	32	1.00	3.0	2	192
Diaph.Web (W10 x 22)	5	0.85	2.0	16	136
Diaph. Flange (W10 x 22)	5	0.48	4.0	16	153
Total Area for Painting of Existing Steel in Spans 1 and 3 (SF)					**6265**

COST ESTIMATE & QUANTITY COMPUTATIONS

Alternative 3(c) – Retain bridge in place, either as a non-functional “monument” or as a non-vehicular pedestrian or bicycle facility

Estimate

Estimated Cost: $380,600.00

Contingency: 10.00%

Estimated Total: $418,660.00

Alternative 3(c) - Retain the bridge in place, either as a non-functional "monument" or as a non-vehicular pedestrian or bicycle facility

Base Date: 01/29/15

Spec Year: 09

Unit System: E

Work Type: BRIDGE IMPROVEMENTS

Highway Type: ASPHALT

Urban/Rural Type: RURAL

Season: SUMMER

County: LINCOLN

Prepared by System Administrator

Line #	Item Number	Quantity	Units	Unit Price	Extension
	Description				
	Supplemental Description				

Group 0200: BRIDGE

0018	512(A) 1323	1.00	LSUM	$150,000.00000	$150,000.00
	PAINTING EXISTING STRUCTURES				
0019	512(B) 6303	1.00	LSUM	$90,000.00000	$90,000.00
	COLLECTION AND HANDLING OF WASTE				
	LEAD PAINT REMOVAL AND DISPOSAL				
0024	521(A) 6210	50.00	SY	$560.00000	$28,000.00
	PNEUMATICALLY PLACED MORTAR				
0025	535 6130	50.00	SY	$52.00000	$2,600.00
	(SP)CORROSION INHIBITOR(SURFACE APPLIED)				
0027	540 4515	1.00	LSUM	$25,000.00000	$25,000.00
	(PL)REPAIR BRIDGE ITEM (TYPE A)				
	FLOOR BEAM STRENGTHENING				
0031	601(B) 1353	800.00	TON	$45.00000	$36,000.00
	TYPE I-A PLAIN RIPRAP				
0032	601(C) 1355	100.00	TON	$40.00000	$4,000.00
	TYPE I-A FILTER BLANKET				
0033	619(B) 2500	1.00	LSUM	$10,000.00000	$10,000.00
	REMOVAL OF BRIDGE ITEMS				

Total for Group 0200: $345,600.00

Group 0600: CONSTRUCTION

0034	641 1399	1.00	LSUM	$35,000.00000	$35,000.00
	MOBILIZATION				

Group Alternate Code: 501

Total for Group 0600: $35,000.00

Area Calculation for Painting Existing Steel (Spans 1 and 3)(See separate calculations for Span 2)					
Location	Length (ft)	Height/Width (ft)	# Faces	# Members	Total Area (SF)
Beam Web (W36 x 160)	60	3.00	2.0	10	3600
Beam Flange (W36 x 160)	60	1.00	3.0	10	1800
P. Beam Web (W36 x 192)	32	3.00	2.0	2	384
P. Beam Fl. (W36 x 192)	32	1.00	3.0	2	192
Diaph.Web (W10 x 22)	5	0.85	2.0	16	136
Diaph. Flange (W10 x 22)	5	0.48	4.0	16	153
Total Area for Painting of Existing Steel in Spans 1 and 3 (SF)					**6265**

COST ESTIMATE & QUANTITY COMPUTATIONS

Alternative 4 – New bridge with existing trusses added as an architectural/historic feature (new or existing alignment)

Estimate

Estimated Cost: $1,079,090.09

Contingency: 0.00%

Estimated Total: $1,079,090.09

Alternative 4 - Construct new bridge on existing or new alignment and attach existing bridge trusses to Span 2 of new bridge as an architectural/historic feature

Base Date: 02/04/15

Spec Year: 09

Unit System: E

Work Type: BRIDGE AND APPROACHES

Highway Type: ASPHALT

Urban/Rural Type: RURAL

Season: SUMMER

County: LINCOLN

Prepared by System Administrator

Line #	Item Number / Description / *Supplemental Description*	Quantity	Units	Unit Price	Extension

Group 0200: BRIDGE

0000	501(B) 1307 SUBSTRUCTURE EXCAVATION COMMON	83.00	CY	$20.00000	$1,660.00
0005	501(G) 6309 CLSM BACKFILL	184.00	CY	$135.00000	$24,840.00
0006	503(A) 1312 PRESTRESSED CONCRETE BEAMS (TYPE III)	957.00	LF	$220.00000	$210,540.00
0007	504(A) 1304 APPROACH SLAB	254.00	SY	$180.00000	$45,720.00
0008	504(B) 1305 SAW-CUT GROOVING	1,102.00	SY	$4.50000	$4,959.00
0009	504(D) 6245 CONCRETE RAIL (TR4)	617.00	LF	$85.00000	$52,445.00
0010	506(A) 6005 STRUCTURAL STEEL A36	1,050.00	LB	$3.00000	$3,150.00
0011	507(A) 6170 STAINLESS STEEL FIXED BEARING ASSEMBLY	8.00	EA	$2,300.00000	$18,400.00
0012	507(B) 6174 STAINLESS STEEL EXPANSION BEARING ASSEMBLY	16.00	EA	$1,400.00000	$22,400.00
0013	507(C) 6282 ELASTOMERIC BEARING PADS	16.00	EA	$510.00000	$8,160.00
0014	509(A) 1326 CLASS AA CONCRETE	361.00	CY	$510.00000	$184,110.00
0015	511(B) 6010 EPOXY COATED REINFORCING STEEL	73,586.00	LB	$1.15000	$84,623.90
0016	514(A) 6010 PILES, FURNISHED (HP 10X42)	765.00	LF	$32.00000	$24,480.00
0017	514(B) 6292 PILES, DRIVEN (HP 10X42)	765.00	LF	$14.23358	$10,888.69
0018	515(A) 6013 WATER REPELLENT (VISUALLY INSPECTED)	1,046.00	SY	$4.00000	$4,184.00
0019	516(A) 6096 DRILLED SHAFTS 60" DIAMETER	160.00	LF	$760.00000	$121,600.00
0020	523(A) 6550 SEALER CRACK PREPARATION	150.00	LF	$4.70000	$705.00
0021	523(B) 6560 SEALER RESIN	1.70	GAL	$135.00000	$229.50
0022	613(H) 6204 6" PERFORATED PIPE UNDERDRAIN ROUND	77.00	LF	$35.00000	$2,695.00
0023	613(I) 6207 6" NON-PERF.PIPE UNDERDRAIN RND.	150.00	LF	$22.00000	$3,300.00
0025	516(C) 6200 CROSSHOLE SONIC LOGGING	4.00	EA	$3,000.00000	$12,000.00
0027	540 4515 (PL)REPAIR BRIDGE ITEM (TYPE A) *REMOVE AND REATTACH TRUSSES TO NEW BRIDGE*	1.00	EA	$125,000.00000	$125,000.00
0028	540 4525 (PL)REPAIR BRIDGE ITEM (TYPE B) *FIXED BEARING FOR TRUSS*	2.00	EA	$3,000.00000	$6,000.00
0029	540 4535 (PL)REPAIR BRIDGE ITEM (TYPE C) *EXPANSION BEARING FOR TRUSS*	2.00	EA	$3,500.00000	$7,000.00

Total for Group 0200: $979,090.09

Group 0600: CONSTRUCTION

0026	641 1399	1.00	LSUM	$100,000.00000	$100,000.00

Line #	Item Number / Description / *Supplemental Description*	Quantity	Units	Unit Price	Extension
	MOBILIZATION				

Total for Group 0600: $100,000.00

BRIDGE 03800	BRIDGE PAY QUANTITIES								
SH-66B OVER CAPTAIN CREEK 3-SIMPLE 70'-100'-70' SPAN PC BEAM (TYPE IV BEAMS)									
ITEM NO.	**ITEM**	**UNIT**	**SPAN 1**	**SPAN 2**	**SPAN 3**	**ABUT-MENTS**	**PIERS**	**APP. SLABS**	**TOTAL**
501 (B) 1307	SUBSTRUCTURE EXCAVATION COMMON	CY	-	-	-	82.8	-	-	83
501 (G) 6309	CLSM BACKFILL	SY	-	-	-	184.0	-	-	184
503 (A) 1312	PRESTRESSED CONCRETE BEAMS (TYPE IV)	LF	279.0	399.0	279.0	-	-	-	957
504 (A) 1304	APPROACH SLAB	SY	-	-	-	-	-	254.4	254
504 (B) 1305	SAW CUT GROOVING	SY	253.4	355.5	253.4	-	-	239.4	1,102
504 (D) 6245	CONCRETE RAIL (TR4)	LF	140.5	200.0	140.5	-	-	136.0	617
506 (A) 6005	STRUCTURAL STEEL A36	LF	300.0	450.0	300.0	-	-	-	1,050
507 (A) 6170	STAINLESS STEEL FIXED BEARING ASSEMBLY	EA	4.0	-	4.0	-	-	-	8
507 (B) 6174	STAINLESS STEEL EXPANSION BEARING ASSEMBLY	EA	4.0	8.0	4.0	-	-	-	16
507 (C) 6282	ELASTOMERIC BEARING PADS	EA	4.0	8.0	4.0	-	-	-	16
509 (A) 1326	CLASS AA CONCRETE	CY	83.1	93.3	83.1	57.2	43.9	-	360
511 (B) 6010	EPOXY COATED REINFORCING STEEL	LB	16,675.5	22,193.5	16,675.5	9,271.0	8,770.4	-	73,586
514 (A) 6010	PILES, FURNISHED (HP 10X42)	LF	-	-	-	765.0	-	-	765
514 (B) 6292	PILES, FURNISHED (HP 10X42)	LF	-	-	-	765.0	-	-	765
515 (A) 6013	WATER REPELLENT (VISUALLY INSPECTED)	SY	268.0	353.0	268.0	22.0	69.3	66.0	1,046
516 (A) 6096	DRILLED SHAFTS 60" DIAMETER	LF	-	-	-	-	160.0	-	160
516 (C) 6200	CROSSHOLE SONIC LOGGING	EA	-	-	-	-	4.0	-	4
523 (A) 6550	SEALER CRACK PREPARATION	LF	-	-	-	-	150.0	-	150
523 (B) 6560	SEALER RESIN	GAL	-	-	-	-	1.7	-	2
613 (H) 6204	6" PERFORATED PIPE UNDERDRAIN ROUND	LF	-	-	-	77.3	-	-	77
613 (I) 6207	6" NON-PERF. PIPE UNDERDRAIN RND.	LF	-	-	-	150.0	-	-	150

APPENDIX B

Alternative 2(a) Analysis Results (Pony Truss Main Span)

TRUSS SPAN: 28'-0" CURB-TO-CURB WIDTH (Widened)

				CAPACITY			DEMAND					
Section	A (gross)	A (net)	**Ref. Sect.**	Yielding (kip)	Fracture (kip)	Buckling (kip)	DL Effects (T)	LL Effects (T)	DL Effects (C)	LL Effects (C)	**Inventory Rating Factor**	**Operating Rating Factor**
(2) 12C30	17.58	15.8	**1**	527.4	948	-	165.130	103.640	-	-	**1.138**	**1.899**
(2) 12C35	20.52	18.34	**2**	615.6	1100.4	-	205.130	117.270	-	-	**1.122**	**1.873**
(1) 10W37	10.88	9.14	**3**	326.4	548.4	-	40.890	51.180	-	-	**2.013**	**3.360**
(1) 10W21	6.19	5.06	**4**	185.7	303.6	149.559	47.750	59.270	-	28.550	**0.786**	**1.313**
(2) L3x2.5x5/16	3.24	2.69	**5**	97.2	-	**51.42**	-	23.970	2.540	22.400	**0.810**	**1.352**
(2) 12C25, (1) PL 18 x 3/8	21.39	21.39	**6**	641.7	-	**519.67**	-	-	185.710	125.680	**0.835**	**1.393**
(2) 12C25, (1) PL 18 x 7/16	22.515	22.515	**7**	675.45	-	**552.93**	-	-	209.280	137.850	**0.768**	**1.282**

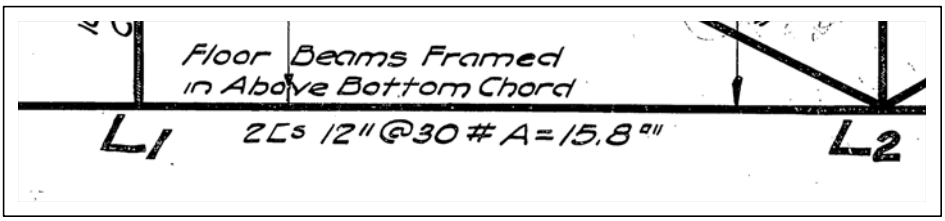
IMPACT FACTOR 0.222 for Trusses
0.300 for Stringers and Floor Beams

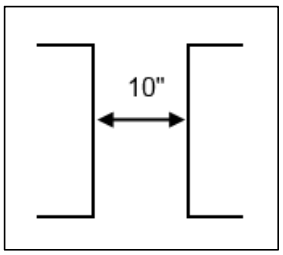
For Reference:
Prismatic Section 1 = Bottom Chord (outer)
Prismatic Section 2 = Bottom Chord (center)
Prismatic Section 3 = Verticals
Prismatic Section 4 = Diagonals (outer)
Prismatic Section 5 = Diagonals (center)
Prismatic Section 6 = Top Chord (outer)
Prismatic Section 7 = Top Chord (center)

MEMBER SECTION PROPERTIES

(Organized by STAAD Prismatic General Reference Number)

Section 1 - Bottom Chord, Outer Section





$Area_1 := 2 \cdot 8.79in^2 = 17.58 \cdot in^2$

$I_{z1} := 2 \cdot 161.2in^4 = 322.4 \cdot in^4$

$I_{y1} := 2 \cdot \left[5.2in^4 + 8.79in^2 \cdot (5in + 0.68in)^2\right] = 577.57 \cdot in^4$

$I_{x1} := \dfrac{4 \cdot 3.17in \cdot (0.5in)^3 + 2 \cdot 12in \cdot (0.51in)^3}{3} = 1.59 \cdot in^4$

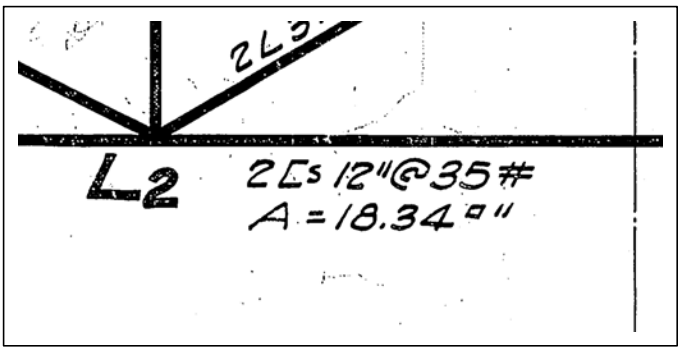
$Area_1 = 0.12208 \cdot ft^2$

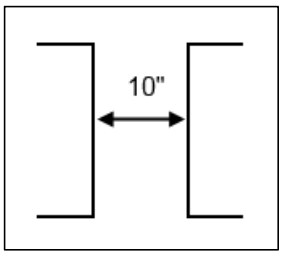
$I_{z1} = 0.01555 \cdot ft^4$

$I_{y1} = 0.02785 \cdot ft^4$

$I_{x1} = 0.00008 \cdot ft^4$

Section 2 - Bottom Chord, Inner Section





$Area_2 := 2 \cdot 10.26in^2 = 20.52 \cdot in^2$

$I_{z2} := 2 \cdot 178.8in^4 = 357.6 \cdot in^4$

$I_{y2} := 2 \cdot \left[5.9in^4 + 10.26in^2 \cdot (5in + 0.69in)^2\right] = 676.16 \cdot in^4$

$I_{x2} := \dfrac{4 \cdot 3.292in \cdot (0.5in)^3 + 2 \cdot 12in \cdot (0.632in)^3}{3} = 2.57 \cdot in^4$

$Area_2 = 0.14250 \cdot ft^2$

$I_{z2} = 0.01725 \cdot ft^4$

$I_{y2} = 0.03261 \cdot ft^4$

$I_{x2} = 0.00012 \cdot ft^4$

Section 3 - Verticals

$Area_3 := 10.88in^2 = 10.88 \cdot in^2$

$I_{z3} := 196.9in^4 = 196.9 \cdot in^4$

$I_{y3} := 42.2in^4 = 42.2 \cdot in^4$

$I_{x3} := \frac{2 \cdot 7.978in \cdot (0.498in)^3 + 9.88in \cdot (0.306in)^3}{3} = 0.75 \cdot in^4$

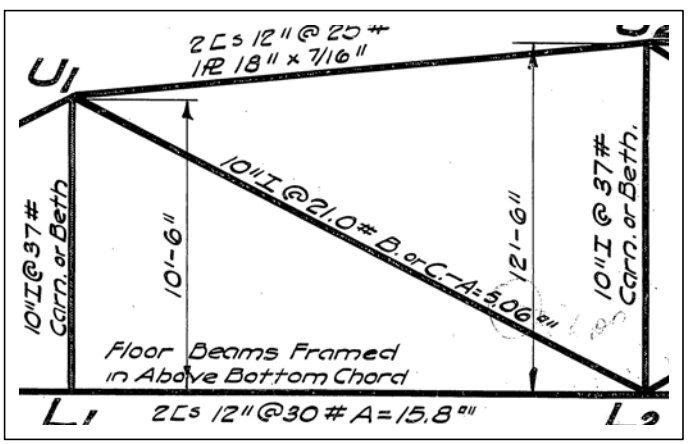
$Area_3 = 0.07556 \cdot ft^2$

$I_{z3} = 0.0095 \cdot ft^4$

$I_{y3} = 0.00204 \cdot ft^4$

$I_{x3} = 0.00004 \cdot ft^4$

Section 4 - Diagonals, Outer



$Area_4 := 6.19in^2 = 6.19 \cdot in^2$

$I_{z4} := 106.3in^4 = 106.3 \cdot in^4$

$I_{y4} := 9.7in^4 = 9.7 \cdot in^4$

$I_{x4} := \frac{2 \cdot 5.75in \cdot (0.34in)^3 + 9.90in \cdot (0.24in)^3}{3} = 0.2 \cdot in^4$

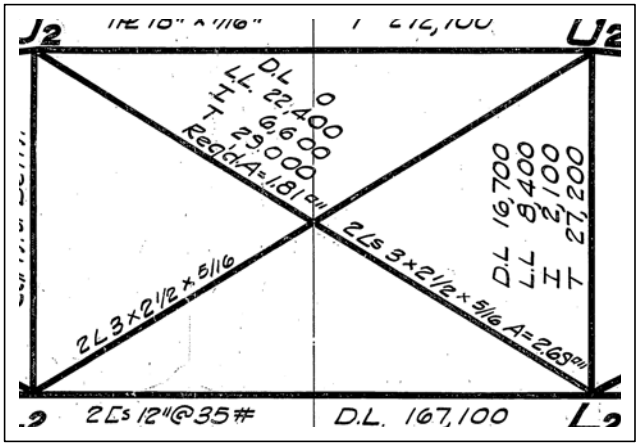
$Area_4 = 0.04299 \cdot ft^2$

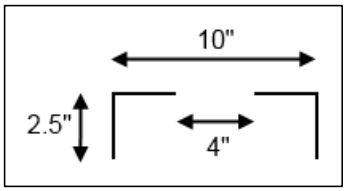
$I_{z4} = 0.00513 \cdot ft^4$

$I_{y4} = 0.00047 \cdot ft^4$

$I_{x4} = 0.00001 \cdot ft^4$

Section 5 - Diagonals, Inner





$$\text{Area}_5 := 2\cdot 1.62\text{in}^2 = 3.24\cdot\text{in}^2$$

$$I_{z5} := 2\cdot 1.4\text{in}^4 = 2.8\cdot\text{in}^4$$

$$I_{y5} := 0.9\text{in}^4 + \left[0.9\text{in}^4 + 1.62\text{in}^2\cdot[10\text{in} - (2\cdot 0.93\text{in})]^2\right] = 109.14\cdot\text{in}^4$$

$$I_{x5} := \frac{2\cdot 3\text{in}\cdot(0.3125\text{in})^3 + 2\cdot 2.5\text{in}\cdot(0.3125\text{in})^3}{3} = 0.11\cdot\text{in}^4$$

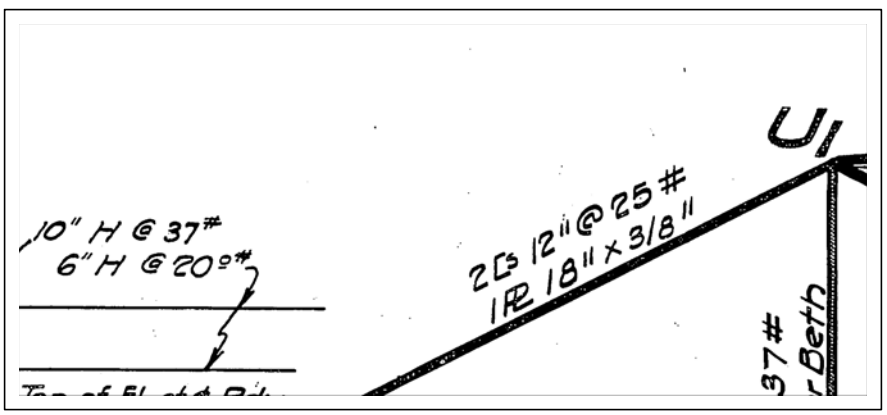
$$\text{Area}_5 = 0.02250\cdot\text{ft}^2$$

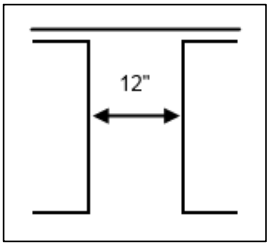
$$I_{z5} = 0.00014\cdot\text{ft}^4$$

$$I_{y5} = 0.00526\cdot\text{ft}^4$$

$$I_{x5} = 0.00001\cdot\text{ft}^4$$

Section 6 - Top Chord, Outer Section:





$$\text{Area}_6 := 6.75\text{in}^2 + (2)\cdot 7.32\text{in}^2 = 21.39\cdot\text{in}^2$$

$$y_6 := \frac{6\text{in}\cdot(2)\cdot 7.32\text{in}^2 + \left(12\text{in} + \frac{3\text{in}}{16}\right)\cdot 6.75\text{in}^2}{7.32\text{in}^2 + 7.32\text{in}^2 + 6.75\text{in}^2} = 7.953\cdot\text{in}$$

$$I_{z6} := 2\cdot\left[143.5\text{in}^4 + 7.32\text{in}^2\cdot\left(y_6 - 6\text{in}\right)^2\right] + \left[0.1\text{in}^4 + 6.75\text{in}^2\cdot\left(12.1875\text{in} - y_6\right)^2\right] = 463.97\cdot\text{in}^4$$

$$I_{y6} := 182.3\text{in}^4 + 2\cdot\left[4.5\text{in}^4 + 7.32\text{in}^2\cdot(6\text{in} + 0.68\text{in})^2\right] = 844.57\cdot\text{in}^4$$

$$I_{x6} := \frac{4\cdot 3\text{in}\cdot(0.5\text{in})^3 + 18\text{in}\cdot\left(\frac{3}{8}\text{in}\right)^3 + 2\cdot 12\text{in}\cdot(0.387\text{in})^3}{3} = 1.28\cdot\text{in}^4$$

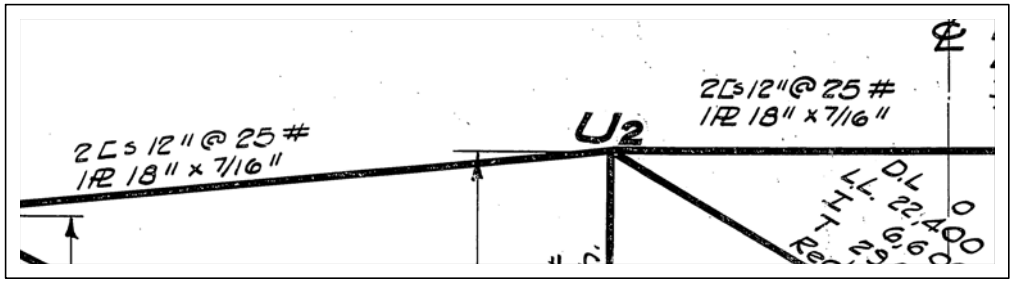
$$\text{Area}_6 = 0.14854\cdot\text{ft}^2$$

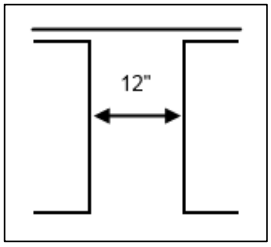
$$I_{z6} = 0.02238\cdot\text{ft}^4$$

$$I_{y6} = 0.04073\cdot\text{ft}^4$$

$$I_{x6} = 0.00006\cdot\text{ft}^4$$

Section 7 - Top Chord, Inner Section:





$$Area_7 := 7.875in^2 + (2)\cdot 7.32in^2 = 22.515\cdot in^2$$

$$y_7 := \frac{6in\cdot(2)\cdot 7.32in^2 + \left(12in + \frac{7in}{32}\right)\cdot 7.875in^2}{7.32in^2 + 7.32in^2 + 7.875in^2} = 8.175\cdot in$$

$$I_{z7} := 2\cdot\left[143.5in^4 + 7.32in^2\cdot\left(y_7 - 6in\right)^2\right] + \left[0.1in^4 + 7.875in^2\cdot\left(12.21875in - y_7\right)^2\right] = 485.13\cdot in^4$$

$$I_{y7} := 212.625in^4 + 2\cdot\left[4.5in^4 + 7.32in^2\cdot(6in + 0.68in)^2\right] = 874.9\cdot in^4$$

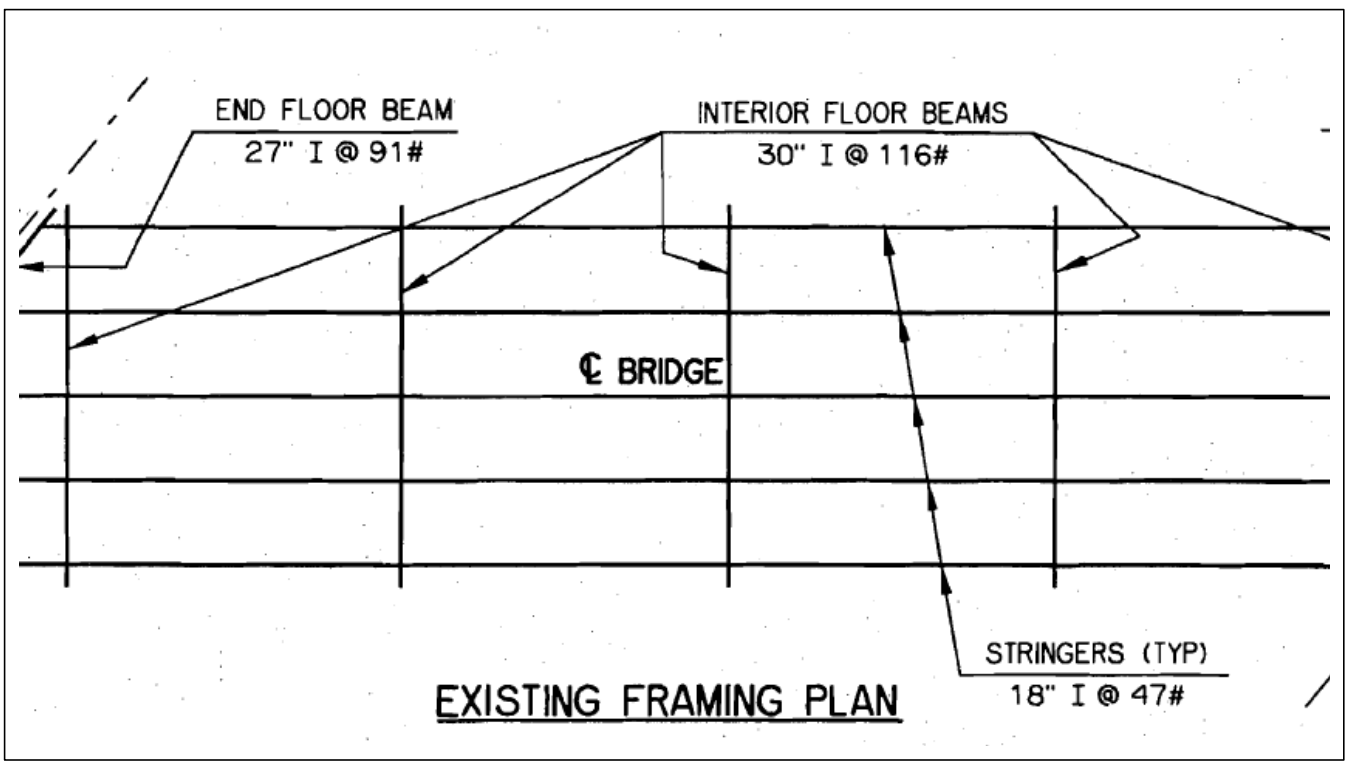
$$I_{x7} := \frac{4\cdot 3in\cdot(0.5in)^3 + 18in\cdot\left(\frac{7}{16}in\right)^3 + 2\cdot 12in\cdot(0.387in)^3}{3} = 1.47\cdot in^4$$

$$Area_7 = 0.15635\cdot ft^2$$

$$I_{z7} = 0.0234\cdot ft^4$$

$$I_{y7} = 0.04219\cdot ft^4$$

$$I_{x7} = 0.00007\cdot ft^4$$



Section 8 - End Floorbeams - 27W91

$Area_8 := 26.77in^2 = 26.77 \cdot in^2$ $\qquad Area_8 = 0.18590 \cdot ft^2$

$I_{z8} := 3129.2in^4 = 3129.2 \cdot in^4$ $\qquad I_{z8} = 0.15091 \cdot ft^4$

$I_{y8} := 109.0in^4 = 109 \cdot in^4$ $\qquad I_{y8} = 0.00526 \cdot ft^4$

$I_{x8} := \frac{2 \cdot 9.983in \cdot (0.712in)^3 + 26.77in \cdot (0.483in)^3}{3} = 3.41 \cdot in^4$ $\qquad I_{x8} = 0.00016 \cdot ft^4$

Section 9 - Interior Floorbeams - 30W116

$Area_9 := 34.13in^2 = 34.13 \cdot in^2$ $\qquad Area_9 = 0.23701 \cdot ft^2$

$I_{z9} := 4919.1in^4 = 4919.1 \cdot in^4$ $\qquad I_{z9} = 0.23723 \cdot ft^4$

$I_{y9} := 153.2in^4 = 153.2 \cdot in^4$ $\qquad I_{y9} = 0.00739 \cdot ft^4$

$I_{x9} := \frac{2 \cdot 10.5in \cdot (0.850in)^3 + 30in \cdot (0.564in)^3}{3} = 6.09 \cdot in^4$ $\qquad I_{x9} = 0.00029 \cdot ft^4$

Section 10 - Stringers - 18W47

$Area_{10} := 13.81in^2 = 13.81 \cdot in^2$ $\qquad Area_{10} = 0.09590 \cdot ft^2$

$I_{z10} := 736.4in^4 = 736.4 \cdot in^4$ $\qquad I_{z10} = 0.03551 \cdot ft^4$

$I_{y10} := 33.5in^4 = 33.5 \cdot in^4$ $\qquad I_{y10} = 0.00162 \cdot ft^4$

$I_{x10} := \frac{2 \cdot 7.492in \cdot (0.52in)^3 + 17.90in \cdot (0.35in)^3}{3} = 0.96 \cdot in^4$ $\qquad I_{x10} = 0.00005 \cdot ft^4$

Inputs

$F_y := 30000 \frac{lb}{in^2}$ Yield stress of the steel

$E := 29000000 \frac{lb}{in^2}$ Modulus of elasticity

AASHTO 10.54.1.2 - Effective Length

$K_f := 0.75$ The effective Length factor, K_f, for riveted, bolted, or welded end connections

The length of the member between points of support, *L* (inches), and the radius of gyration, *r*, are from design plans

For the <u>outer top chord</u> members, use the following variables:

$L\_by\_r_1 := 58.2$

$A_{s.1} := 21.45 in^2$

For the <u>inner top chord</u> members, use the following variables:

$L\_by\_r_2 := 51.9$

$A_{s.2} := 22.58 in^2$

Compressive Capacity of Outer Top Chord Members:

F_{cr} is determined by one of the following two formulas:

$$F_{cr.1} := \begin{cases} F_y \cdot \left[1 - \frac{F_y}{4\pi^2 E} \cdot \left(K_f \cdot L\_by\_r_1\right)^2 \right] & \text{if } K_f \cdot L\_by\_r_1 \le \sqrt{\frac{2\pi^2 E}{F_y}} \\ \frac{\pi^2 E}{\left(K_f \cdot L\_by\_r_1\right)^2} & \text{if } K_f \cdot L\_by\_r_1 > \sqrt{\frac{2\pi^2 E}{F_y}} \end{cases} = 28502.202 \cdot \frac{lb}{in^2}$$

AASHTO Equations (10-151), (10-152) (10-153), and (10-154)

AASHTO 10.54.1.1 - Maximum Capacity

The maximum strength of concentrically loaded columns shall be computed as:

$P_{u.1} := 0.85 \cdot A_{s.1} \cdot F_{cr.1} = 519666 \cdot lb$

A_s is the gross effective area of the column cross section

Compressive Capacity of Inner Top Chord Members:

F_{cr} is determined by one of the following two formulas:

$$F_{cr.2} := \begin{cases} F_y \cdot \left[1 - \frac{F_y}{4\pi^2 E} \cdot \left(K_f \cdot L\_by\_r_2\right)^2\right] & \text{if } K_f \cdot L\_by\_r_2 \le \sqrt{\frac{2\pi^2 E}{F_y}} \\ \frac{\pi^2 E}{\left(K_f \cdot L\_by\_r_2\right)^2} & \text{if } K_f \cdot L\_by\_r_2 > \sqrt{\frac{2\pi^2 E}{F_y}} \end{cases} = 28808.917 \cdot \frac{lb}{in^2}$$

AASHTO Equations (10-151), (10-152) (10-153), and (10-154)

AASHTO 10.54.1.1 - Maximum Capacity

The maximum strength of concentrically loaded columns shall be computed as:

$$P_{u.2} := 0.85 \cdot A_{s.2} \cdot F_{cr.2} = 552930 \cdot lb$$

A_s is the gross effective area of the column cross section

Compressive Capacity of Outer Diagonal Members:

$$L_3 := \left(\sqrt{20^2 + 10.5^2}\right) ft - 2ft = 247.065 \cdot in$$

$$r_3 := 4.14in$$

$$L\_by\_r_3 := \frac{L_3}{r_3} = 59.677$$

$$A_{s.3} := 6.19in^2$$

F_{cr} is determined by one of the following two formulas:

$$F_{cr.3} := \begin{cases} F_y \cdot \left[1 - \frac{F_y}{4\pi^2 E} \cdot \left(K_f \cdot L\_by\_r_3\right)^2\right] & \text{if } K_f \cdot L\_by\_r_3 \le \sqrt{\frac{2\pi^2 E}{F_y}} \\ \frac{\pi^2 E}{\left(K_f \cdot L\_by\_r_3\right)^2} & \text{if } K_f \cdot L\_by\_r_3 > \sqrt{\frac{2\pi^2 E}{F_y}} \end{cases} = 28425.192 \cdot \frac{lb}{in^2}$$

AASHTO Equations (10-151), (10-152) (10-153), and (10-154)

AASHTO 10.54.1.1 - Maximum Capacity

The maximum strength of concentrically loaded columns shall be computed as:

$$P_{u.3} := 0.85 \cdot A_{s.3} \cdot F_{cr.3} = 149559 \cdot lb$$

A_s is the gross effective area of the column cross section

Compressive Capacity of Inner Diagonal Members:

$$L_4 := \frac{\left(\sqrt{20^2 + 12.5^2}\right)}{2} ft - 2ft = 117.51 \cdot in$$

$$r_4 := 0.94in$$

$$L\_by\_r_4 := \frac{L_4}{r_4} = 125.01$$

$$A_{s.4} := 1.31in^2 \cdot 2 = 2.62 \cdot in^2$$

F_{cr} is determined by one of the following two formulas:

$$F_{cr.4} := \begin{cases} F_y \cdot \left[1 - \frac{F_y}{4\pi^2 E} \cdot \left(K_f \cdot L\_by\_r_4\right)^2\right] & \text{if } K_f \cdot L\_by\_r_4 \le \sqrt{\frac{2\pi^2 E}{F_y}} \\ \frac{\pi^2 E}{\left(K_f \cdot L\_by\_r_4\right)^2} & \text{if } K_f \cdot L\_by\_r_4 > \sqrt{\frac{2\pi^2 E}{F_y}} \end{cases} = 23089.664 \cdot \frac{lb}{in^2}$$

AASHTO Equations (10-151), (10-152) (10-153), and (10-154)

AASHTO 10.54.1.1 - Maximum Capacity

The maximum strength of concentrically loaded columns shall be computed as:

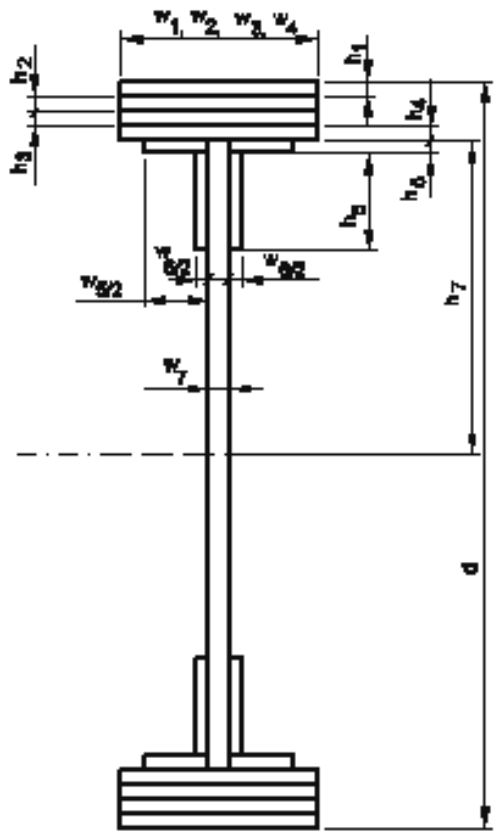
$$P_{u.4} := 0.85 \cdot A_{s.4} \cdot F_{cr.4} = 51421 \cdot lb$$

A_s is the gross effective area of the column cross section

Moment and Shear Capacities of Symmetrical Steel Girders

Using AASHTO "Standard Specifications for Highway Bridges," 16th Edition, 1996 and Interims through 1999.

INPUT DATA: Stringer (18W47)



Section Descriptions:

ORIGIN := 1 i := 1 .. 7

	Width (*in*)	Height (*in*)
Top Cover Plate 1:	0	0
Top Cover Plate 2:	0	0
Top Cover Plate 3:	0	0
Top Cover Plate 4:	7.492	0.52
H. Legs of Angles:	0	0
V. Legs of Angles:	0	0
1/2 Web Plate:	0.35	8.43

$w := \begin{pmatrix} 0 \\ 0 \\ 0 \\ 7.492 \\ 0 \\ 0 \\ 0.35 \end{pmatrix}$ $h := \begin{pmatrix} 0 \\ 0 \\ 0 \\ 0.52 \\ 0 \\ 0 \\ 8.43 \end{pmatrix}$

Bracing/Stiffeners Information:

Spacing of Lateral Bracing: $L_b := 20$ *ft*

Spacing of Transverse Stiffeners: $d_o := 20$ *ft*

Longitudinal Stiffeners: $LS := 0$

Note: "1": With Longitudinal Stiffeners "0": Without Longitudinal Stiffeners

Materials Properties:

Steel Yield Strength: $F_y := 30000$ *psi* $F_{yf} := 30000$ *psi*

Smaller End Moment of Unbraced length: $M_1 := 0$ *kft*

Larger End Moment of Unbraced length: $M_2 := 0$ *kft*

Note: M_1 and M_2 are moments at ends of the unbraced segment obtained through structural analysis. M_2 is positive when bent in single curvature.

========== *END OF DATA INPUT* ==========

Data Calculated from Input Data:

Clear distance between flanges: $D := 2\cdot\left[h_7 - \left(h_6 + h_5\right)\right]$ $D = 16.86$ *in*

Depth of web in compression: $D_c := \frac{D}{2}$ $D_c = 8.43$ *in*

Thickness of flange: $t := \sum_{i=1}^{4} h_i$ $t = 0.52$ *in*

Thickness of web: $t_w := w_7$ $t_w = 0.35$ *in*

Width of projecting flange element: $b' := \frac{max(w) - w_7 - w_6}{2}$ $b' = 3.571$ *in*

Depth of Girder: $d := 2\cdot\left[\left(\sum_{i=1}^{4} h_i\right) + h_7\right]$ $d = 17.9$ *in*

Area of Elements: $A_i := \left(w_i\right)\cdot\left(h_i\right)$ I_{ox} of Elements: $I_{ox_i} := \left(w_i\right)\cdot\frac{\left(h_i\right)^3}{12}$ I_{oy} of Elements: $I_{oy_i} := \left(h_i\right)\cdot\frac{\left(w_i\right)^3}{12}$

Distance from the center of element to the neutral axis:

$y_{c_1} := \frac{d}{2} - h_1\cdot\frac{1}{2}$ $y_{c_7} := \frac{h_7}{2}$ $i := 2..6$ $y_{c_i} := y_{c_{i-1}} - \left(h_{i-1} + h_i\right)\cdot\frac{1}{2}$

Spacing of lateral bracing: $L_b := L_b\cdot 12$ $L_b = 240$ *in*

Spacing of Transverse Stiffeners: $d_o := d_o\cdot 12$ $d_o = 240$ *in*

Calculated Section Properties

Area of Section: $A_g := 2 \cdot \sum_{i=1}^{7} A_i$ $\quad A_g = 13.693 \quad in^2$

Moment of inertia of section about horizontal axis: $I_x := 2 \cdot \sum_{i=1}^{7} \left[\left(I_{ox_i} \right) + \left(y_{c_i} \right)^2 \cdot A_i \right]$ $\quad I_x = 728.358 \quad in^4$

Moment of inertia of section about vertical axis: $I_y := 2 \cdot \sum_{i=1}^{7} I_{oy_i}$ $\quad I_y = 36.506 \quad in^4$

St. Venant constant: $J := 2 \cdot \sum_{i=1}^{7} \left[\frac{1}{3} \cdot if\left(w_i > h_i, w_i, h_i\right) \cdot \left(if\left(w_i < h_i, w_i, h_i\right) \right)^3 \right]$ $\quad J = 0.943 \quad in^4$

Moment of inertia of compression flange about vertical axis: $I_{yc} := \sum_{i=1}^{5} I_{oy_i}$ $\quad I_{yc} = 18.223 \quad in^4$

Area of compression flange: $A_{fc} := \sum_{i=1}^{5} A_i$ $\quad A_{fc} = 3.896 \quad in^2$

$A_f := A_{fc}$ $\quad A_f = 3.896 \quad in^2$

Section modulus: $S := I_x \div \left(\frac{d}{2} \right)$ $\quad S = 81.381 \quad in^3$

Section modulus with respect to compression flange: $S_{xc} := S$ $\quad S_{xc} = 81.381 \quad in^3$

Radius of gyration of compression flange about vertical axis: $r' := \sqrt{\left(\frac{I_{yc}}{A_{fc}} \right)}$ $\quad r' = 2.163 \quad in$

Radius of gyration of section about vertical axis: $r_y := \sqrt{\left(\frac{I_y}{A_g} \right)}$ $\quad r_y = 1.633 \quad in$

Determine Plastic Section Modulus (Z) (AASHTO Appendix D):

Distance from the centroid of compression or tension areas to the neutral axis of the section:

$$y_c := \frac{\sum_{i=1}^{7} \left(y_{c_i} \cdot A_i\right)}{\sum_{i=1}^{7} \left(A_i\right)} \qquad y_c = 6.761 \quad in$$

Distance between the centroids of compression and tension areas: $a := 2 \cdot y_c$ $\quad a = 13.523 \quad in$

Plastic Section Modulus Z: $Z := \frac{A_g}{2} \cdot a$ $\quad Z = 92.582 \quad in^3$

Moment Capacity

AASHTO (10-92): $M_u := F_y \cdot Z$ $\quad M_u := \frac{M_u}{1000 \cdot 12}$ $\quad M_u = 231.456 \quad ft - kip$

AASHTO (10-98): $M_y := F_y \cdot S$ $\quad M_y := \frac{M_y}{1000 \cdot 12}$ $\quad M_y = 203.452 \quad ft - kip$

Notes:

NA := "Not Applicable" ***TEXT1*** := "Compact Section" ***TEXT3*** := "Braced Non-Compact"

TEXT2 := "Non-Compact Section" ***TEXT4*** := "Unbraced Section"

Case 1 *Check for Compact Section – AASHTO 10.48.1*

(*a*) *AASHTO (10-93):* $\frac{b'}{t} = 6.867$ $\frac{2055}{\sqrt{F_y}} = 11.865$

(*b*) *AASHTO (10-94):* $\frac{D}{t_w} = 48.171$ $\frac{19230}{\sqrt{F_y}} = 111.024$

$$z_4 := if\left(\frac{b'}{t} > 0.75\cdot\frac{2055}{\sqrt{F_y}}, if\left(\frac{D}{t_w} > 0.75\cdot\frac{19230}{\sqrt{F_y}}, 1, 0\right), 0\right)$$

AASHTO (10-95): $\frac{D}{t_w} + 9.35\cdot\left(\frac{b'}{t}\right) = 112.381$ $\frac{33650}{\sqrt{F_{yf}}} = 194.278$

(*c*) *AASHTO (10-96):* $\frac{L_b}{r_y} = 146.985$ $\frac{\left[3.6 - 2.2\cdot\left(\frac{M_l}{M_u}\right)\right]\cdot 10^6}{F_y} = 120$

$$z_1 := if\left(\frac{2055}{\sqrt{F_y}} \ge \frac{b'}{t}, 1, 0\right) \qquad z_2 := if\left(\frac{19230}{\sqrt{F_y}} \ge \frac{D}{t_w}, 1, 0\right)$$

$$z_3 := if\left[\frac{\left[3.6 - 2.2\cdot\left(\frac{M_l}{M_u}\right)\right]\cdot 10^6}{F_y} \ge \frac{L_b}{r_y}, 1, 0\right] \qquad z_4 := if\left[z_4 = 1, if\left[\frac{D}{t_w} + 4.6\cdot\left(\frac{b'}{t}\right) \le \frac{33650}{\sqrt{F_{yf}}}, 0, -1\right], 0\right]$$

$$Comp := if\left(\sum z = 3, 1, 0\right)$$

$$if(Comp = 1, TEXT1, TEXT2) = \text{"Non-Compact Section"}$$

$$M_u := if\left(Comp = 1, M_u, NA\right)$$

M_u = "Not Applicable" *ft – kip*

Case 2 *Check for Braced Non-Compact Section -- AASHTO 10.48.2*

(a) *AASHTO (10-99):* $\frac{b'}{t} = 6.867$ $\frac{2200}{\sqrt{F_y}} = 12.702$

(b) *AASHTO (10-100):* $\frac{D_c}{t_w} = 24.086$ $\frac{15400}{\sqrt{F_y}} = 88.912$

(c) *AASHTO (10-101):* $L_b = 240$ $\frac{20 \cdot 10^6 \cdot A_f}{F_y \cdot d} = 145.096$

$s_1 := if\left(\frac{2200}{\sqrt{F_y}} \geq \frac{b'}{t}, 1, 0\right)$ $s_2 := if\left(\frac{15400}{\sqrt{F_y}} \geq \frac{D_c}{t_w}, 1, 0\right)$ $s_3 := if\left(\frac{20 \cdot 10^6 \cdot A_f}{F_y \cdot d} \geq L_b, 1, 0\right)$

$B\_NC := if\left(\sum s = 3, 1, 0\right)$

$M_u := if\left(Comp = 1, \text{"See Case 1: Compact Section"}, if\left(B\_NC = 1, M_y, \text{"Not Applicable"}\right)\right)$

$if(Comp = 1, TEXT1, if(B\_NC = 1, TEXT3, TEXT4)) = \text{"Unbraced Section"}$

$M_u = \text{"Not Applicable"}$ $ft - kip$

Case 3 *Capacity of Unbraced Section -- AASHTO 10.48.4*

$if\left(0.1 \leq \frac{I_{yc}}{I_y} \leq 0.9, \text{"Case 3 Applies."}, \text{"Case 3 Does Not Apply."}\right) = \text{"Case 3 Applies."}$

$\lambda := 15400$ for all members with a compression flange area equal to or greater than the tension flange area

$C_b := 1.75 + 1.05 \cdot \left(\frac{-M_1}{M_2}\right) + 0.3 \cdot \left(\frac{-M_1}{M_2}\right)^2$ $if\left(C_b \leq 2.3, C_b, 2.3\right) = 1.75$

Note: C_b= 1.0 for unbraced cantilevers and for members where the moment within a significant portion of the unbraced segment is greater than or equal to the larger of the segment end moments.

$L_p := \frac{9500 \cdot r'}{\sqrt{F_y}}$ $L_p = 118.623$ in

AASHTO (10-103f): $L_r := \sqrt{\dfrac{572 \cdot 10^6 \cdot I_{yc} \cdot d}{F_y \cdot S_{xc}}}$ $\qquad L_r = 276.446 \quad in$

AASHTO (10-103c): $M_r := 91 \cdot 10^6 \cdot (C_b) \cdot \left(\dfrac{I_{yc}}{L_b}\right) \cdot \sqrt{0.772 \cdot \dfrac{J}{I_{yc}} + 9.87 \cdot \left(\dfrac{d}{L_b}\right)^2}$

AASHTO (10-103e): $M_{r1} := C_b \cdot F_y \cdot S_{xc} \cdot \left[1 - 0.5 \cdot \dfrac{(L_b - L_p)}{L_r - L_p}\right]$

AASHTO (10-103g): $M_{r2} := C_b \cdot F_y \cdot \dfrac{S_{xc}}{2} \cdot \left(\dfrac{L_r}{L_b}\right)^2$

$u_1 := if\left(\dfrac{D_c}{t_w} \le \dfrac{\lambda}{\sqrt{F_y}}, 1, if(LS = 1, 1, 0)\right)$ $\qquad u_2 := if\left(\dfrac{\lambda}{\sqrt{F_y}} < \dfrac{D_c}{t_w} \le \dfrac{18250}{\sqrt{F_y}}, 1, 0\right)$

$u_3 := if(L_b \le L_p, 1, 0)$ $\qquad u_4 := if(L_r \ge L_b > L_p, 1, 0)$ $\qquad u_5 := if(L_b \ge L_r, 1, 0)$

$M_r := if(u_1 = 1, M_r, if(u_2 = 1, if(u_3 = 1, M_y \cdot 12 \cdot 1000, if(u_4 = 1, M_{r1}, if(u_5 = 1, M_{r2}, NA)))), NA))$

$M_r := if(M_r \le M_y \cdot 12 \cdot 1000, M_r, M_y \cdot 12 \cdot 1000)$

$\dfrac{M_r}{12 \cdot 1000} = 203.452 \quad ft - kip$

AASHTO (10-103b): $R_b := 1 - 0.002 \cdot \left(D_c \cdot \dfrac{t_w}{A_{fc}}\right) \cdot \left(\dfrac{D_c}{t_w} - \dfrac{\lambda}{\sqrt{\dfrac{M_r}{S_{xc}}}}\right)$ $\qquad R_b := if(R_b \le 1.0, R_b, 1.0)$ $\qquad R_b = 1$

$M_u := \dfrac{M_r \cdot R_b}{12 \cdot 1000}$ $\qquad M_u := if(Comp = 1, NA, if(B\_NC = 1, NA, M_u))$

$M_u = 203.452 \quad ft - kip$

Shear Capacity

Plastic or Buckling Shear Strength:

AASHTO (10-115):

$$V_p := 0.58 \cdot F_y \cdot D \cdot t_w$$

Determine the constant *C*:

$$k := 5 + \frac{5}{\left(\frac{d_o}{D}\right)^2} \qquad k = 5.025$$

$$C_1 := if\left(\frac{D}{t_w} < 6000 \cdot \frac{\sqrt{k}}{\sqrt{F_y}}, 1.0, 0.0\right)$$

AASHTO (10-116):

$$C_2 := if\left(6000 \cdot \frac{\sqrt{k}}{\sqrt{F_y}} \le \frac{D}{t_w} \le 7500 \cdot \frac{\sqrt{k}}{\sqrt{F_y}}, \frac{6000 \cdot \sqrt{k}}{\frac{D}{t_w} \cdot \sqrt{F_y}}, 0.0\right)$$

AASHTO (10-117):

$$C_3 := if\left[\frac{D}{t_w} > 7500 \cdot \frac{\sqrt{k}}{\sqrt{F_y}}, \frac{4.5 \cdot 10^7 \cdot k}{\left(\frac{D}{t_w}\right)^2 \cdot F_y}, 0.0\right]$$

$$C := \sum C \qquad C = 1$$

AASHTO (10-113) and (10-114):

$$V_u := if\left[\frac{d_o}{D} \le 3, V_p \cdot \left[C + \frac{0.87 \cdot (1 - C)}{\sqrt{1 + \left(\frac{d_o}{D}\right)^2}}\right], C \cdot V_p\right] \qquad V_{kips} := \frac{V_u}{1000}$$

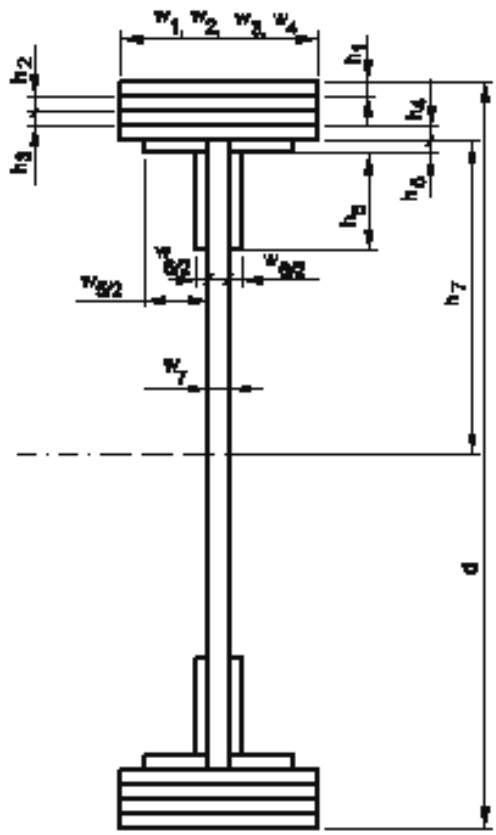
AASHTO EQS
(10-113) AND (10-114):

$$V_u = 102.677 \quad kips$$

Moment and Shear Capacities of Symmetrical Steel Girders

Using AASHTO "Standard Specifications for Highway Bridges," 16th Edition, 1996 and Interims through 1999.

INPUT DATA: End Floorbeam (27W91)



Section Descriptions:

ORIGIN := 1 i := 1 .. 7

	Width (*in*)	Height (*in*)
Top Cover Plate 1:	0	0
Top Cover Plate 2:	0	0
Top Cover Plate 3:	0	0
Top Cover Plate 4:	9.983	0.712
H. Legs of Angles:	0	0
V. Legs of Angles:	0	0
1/2 Web Plate:	0.483	12.708

Bracing/Stiffeners Information:

Spacing of Lateral Bracing: $L_b := 31.95$ *ft*

Spacing of Transverse Stiffeners: $d_o := 31.95$ *ft*

Longitudinal Stiffeners: $LS := 0$

Note: "1": With Longitudinal Stiffeners "0": Without Longitudinal Stiffeners

Materials Properties:

Steel Yield Strength: $F_y := 30000$ *psi* $F_{yf} := 30000$ *psi*

Smaller End Moment of Unbraced length: $M_1 := 0$ *kft*

Larger End Moment of Unbraced length: $M_2 := 0$ *kft*

Note: M_1 and M_2 are moments at ends of the unbraced segment obtained through structural analysis. M_2 is positive when bent in single curvature.

========== *END OF DATA INPUT* ==========

Data Calculated from Input Data:

Clear distance between flanges: $D := 2\cdot\left[h_7 - \left(h_6 + h_5\right)\right]$ $D = 25.416$ *in*

Depth of web in compression: $D_c := \frac{D}{2}$ $D_c = 12.708$ *in*

Thickness of flange: $t := \sum_{i=1}^{4} h_i$ $t = 0.712$ *in*

Thickness of web: $t_w := w_7$ $t_w = 0.483$ *in*

Width of projecting flange element: $b' := \frac{max(w) - w_7 - w_6}{2}$ $b' = 4.75$ *in*

Depth of Girder: $d := 2\cdot\left[\left(\sum_{i=1}^{4} h_i\right) + h_7\right]$ $d = 26.84$ *in*

Area of Elements: $A_i := \left(w_i\right)\cdot\left(h_i\right)$ I_{ox} of Elements: $I_{ox_i} := \left(w_i\right)\cdot\frac{\left(h_i\right)^3}{12}$ I_{oy} of Elements: $I_{oy_i} := \left(h_i\right)\cdot\frac{\left(w_i\right)^3}{12}$

Distance from the center of element to the neutral axis:

$y_{c_1} := \frac{d}{2} - h_1\cdot\frac{1}{2}$ $y_{c_7} := \frac{h_7}{2}$ $i := 2..6$ $y_{c_i} := y_{c_{i-1}} - \left(h_{i-1} + h_i\right)\cdot\frac{1}{2}$

Spacing of lateral bracing: $L_b := L_b\cdot 12$ $L_b = 383.4$ *in*

Spacing of Transverse Stiffeners: $d_o := d_o\cdot 12$ $d_o = 383.4$ *in*

Calculated Section Properties

Area of Section: $A_g := 2 \cdot \sum_{i=1}^{7} A_i$ $\quad A_g = 26.492 \quad in^2$

Moment of inertia of section about horizontal axis: $I_x := 2 \cdot \sum_{i=1}^{7} \left[\left(I_{ox_i} \right) + \left(y_{c_i} \right)^2 \cdot A_i \right]$ $\quad I_x = 3.088 \times 10^3 \; in^4$

Moment of inertia of section about vertical axis: $I_y := 2 \cdot \sum_{i=1}^{7} I_{oy_i}$ $\quad I_y = 118.301 \quad in^4$

St. Venant constant: $J := 2 \cdot \sum_{i=1}^{7} \left[\frac{1}{3} \cdot if\left(w_i > h_i, w_i, h_i\right) \cdot \left(if\left(w_i < h_i, w_i, h_i\right) \right)^3 \right]$ $\quad J = 3.357 \quad in^4$

Moment of inertia of compression flange about vertical axis: $I_{yc} := \sum_{i=1}^{5} I_{oy_i}$ $\quad I_{yc} = 59.031 \quad in^4$

Area of compression flange: $A_{fc} := \sum_{i=1}^{5} A_i$ $\quad A_{fc} = 7.108 \quad in^2$

$A_f := A_{fc}$ $\quad A_f = 7.108 \quad in^2$

Section modulus: $S := I_x \div \left(\frac{d}{2} \right)$ $\quad S = 230.075 \quad in^3$

Section modulus with respect to compression flange: $S_{xc} := S$ $\quad S_{xc} = 230.075 \quad in^3$

Radius of gyration of compression flange about vertical axis: $r' := \sqrt{\left(\frac{I_{yc}}{A_{fc}} \right)}$ $\quad r' = 2.882 \quad in$

Radius of gyration of section about vertical axis: $r_y := \sqrt{\left(\frac{I_y}{A_g} \right)}$ $\quad r_y = 2.113 \quad in$

Determine Plastic Section Modulus (Z) (AASHTO Appendix D):

Distance from the centroid of compression or tension areas to the neutral axis of the section:

$$y_c := \frac{\sum_{i=1}^{7} \left(y_{c_i} \cdot A_i\right)}{\sum_{i=1}^{7} \left(A_i\right)} \qquad y_c = 9.955 \quad in$$

Distance between the centroids of compression and tension areas: $a := 2 \cdot y_c$ $\quad a = 19.909 \quad in$

Plastic Section Modulus Z: $Z := \frac{A_g}{2} \cdot a$ $\quad Z = 263.716 \quad in^3$

Moment Capacity

AASHTO (10-92): $M_u := F_y \cdot Z$ $\quad M_u := \frac{M_u}{1000 \cdot 12}$ $\quad M_u = 659.291 \quad ft - kip$

AASHTO (10-98): $M_y := F_y \cdot S$ $\quad M_y := \frac{M_y}{1000 \cdot 12}$ $\quad M_y = 575.188 \quad ft - kip$

Notes:

NA := "Not Applicable"

TEXT1 := "Compact Section"

TEXT2 := "Non-Compact Section"

TEXT3 := "Braced Non-Compact"

TEXT4 := "Unbraced Section"

Case 1 *Check for Compact Section – AASHTO 10.48.1*

(*a*) *AASHTO (10-93):* $\frac{b'}{t} = 6.671$ $\frac{2055}{\sqrt{F_y}} = 11.865$

(*b*) *AASHTO (10-94):* $\frac{D}{t_w} = 52.621$ $\frac{19230}{\sqrt{F_y}} = 111.024$

$$z_4 := if\left(\frac{b'}{t} > 0.75\cdot\frac{2055}{\sqrt{F_y}}, if\left(\frac{D}{t_w} > 0.75\cdot\frac{19230}{\sqrt{F_y}}, 1, 0\right), 0\right)$$

AASHTO (10-95): $\frac{D}{t_w} + 9.35\cdot\left(\frac{b'}{t}\right) = 114.998$ $\frac{33650}{\sqrt{F_{yf}}} = 194.278$

(*c*) *AASHTO (10-96):* $\frac{L_b}{r_y} = 181.432$ $\frac{\left[3.6 - 2.2\cdot\left(\frac{M_l}{M_u}\right)\right]\cdot 10^6}{F_y} = 120$

$$z_1 := if\left(\frac{2055}{\sqrt{F_y}} \ge \frac{b'}{t}, 1, 0\right) \qquad z_2 := if\left(\frac{19230}{\sqrt{F_y}} \ge \frac{D}{t_w}, 1, 0\right)$$

$$z_3 := if\left[\frac{\left[3.6 - 2.2\cdot\left(\frac{M_l}{M_u}\right)\right]\cdot 10^6}{F_y} \ge \frac{L_b}{r_y}, 1, 0\right] \qquad z_4 := if\left[z_4 = 1, if\left[\frac{D}{t_w} + 4.6\cdot\left(\frac{b'}{t}\right) \le \frac{33650}{\sqrt{F_{yf}}}, 0, -1\right], 0\right]$$

$$Comp := if\left(\sum z = 3, 1, 0\right)$$

$$if(Comp = 1, TEXT1, TEXT2) = \text{"Non-Compact Section"}$$

$$M_u := if\left(Comp = 1, M_u, NA\right)$$

M_u = "Not Applicable" *ft – kip*

Case 2 *Check for Braced Non-Compact Section -- AASHTO 10.48.2*

(a) *AASHTO (10-99):* $\frac{b'}{t} = 6.671$ $\frac{2200}{\sqrt{F_y}} = 12.702$

(b) *AASHTO (10-100):* $\frac{D_c}{t_w} = 26.311$ $\frac{15400}{\sqrt{F_y}} = 88.912$

(c) *AASHTO (10-101):* $L_b = 383.4$ $\frac{20 \cdot 10^6 \cdot A_f}{F_y \cdot d} = 176.55$

$$s_1 := if\left(\frac{2200}{\sqrt{F_y}} \ge \frac{b'}{t}, 1, 0\right) \quad s_2 := if\left(\frac{15400}{\sqrt{F_y}} \ge \frac{D_c}{t_w}, 1, 0\right) \quad s_3 := if\left(\frac{20 \cdot 10^6 \cdot A_f}{F_y \cdot d} \ge L_b, 1, 0\right)$$

$$B\_NC := if\left(\sum s = 3, 1, 0\right)$$

$$M_u := if\left(Comp = 1, \text{"See Case 1: Compact Section"}, if\left(B\_NC = 1, M_y, \text{"Not Applicable"}\right)\right)$$

$$if(Comp = 1, TEXT1, if(B\_NC = 1, TEXT3, TEXT4)) = \text{"Unbraced Section"}$$

M_u = "Not Applicable" $ft - kip$

Case 3 *Capacity of Unbraced Section -- AASHTO 10.48.4*

$$if\left(0.1 \le \frac{I_{yc}}{I_y} \le 0.9, \text{"Case 3 Applies."}, \text{"Case 3 Does Not Apply."}\right) = \text{"Case 3 Applies."}$$

$\lambda := 15400$ for all members with a compression flange area equal to or greater than the tension flange area

$$C_b := 1.75 + 1.05 \cdot \left(\frac{-M_1}{M_2}\right) + 0.3 \cdot \left(\frac{-M_1}{M_2}\right)^2 \qquad if\left(C_b \le 2.3, C_b, 2.3\right) = 1.75$$

Note: C_b= 1.0 for unbraced cantilevers and for members where the moment within a significant portion of the unbraced segment is greater than or equal to the larger of the segment end moments.

$$L_p := \frac{9500 \cdot r'}{\sqrt{F_y}} \qquad L_p = 158.064 \quad in$$

AASHTO (10-103f): $L_r := \sqrt{\dfrac{572 \cdot 10^6 \cdot I_{yc} \cdot d}{F_y \cdot S_{xc}}}$ $\qquad L_r = 362.355 \quad in$

AASHTO (10-103c): $M_r := 91 \cdot 10^6 \cdot (C_b) \cdot \left(\dfrac{I_{yc}}{L_b}\right) \cdot \sqrt{0.772 \cdot \dfrac{J}{I_{yc}} + 9.87 \cdot \left(\dfrac{d}{L_b}\right)^2}$

AASHTO (10-103e): $M_{r1} := C_b \cdot F_y \cdot S_{xc} \cdot \left[1 - 0.5 \cdot \dfrac{(L_b - L_p)}{L_r - L_p}\right]$

AASHTO (10-103g): $M_{r2} := C_b \cdot F_y \cdot \dfrac{S_{xc}}{2} \cdot \left(\dfrac{L_r}{L_b}\right)^2$

$u_1 := if\left(\dfrac{D_c}{t_w} \le \dfrac{\lambda}{\sqrt{F_y}}, 1, if(LS = 1, 1, 0)\right)$ $\qquad u_2 := if\left(\dfrac{\lambda}{\sqrt{F_y}} < \dfrac{D_c}{t_w} \le \dfrac{18250}{\sqrt{F_y}}, 1, 0\right)$

$u_3 := if(L_b \le L_p, 1, 0)$ $\qquad u_4 := if(L_r \ge L_b > L_p, 1, 0)$ $\qquad u_5 := if(L_b \ge L_r, 1, 0)$

$M_r := if(u_1 = 1, M_r, if(u_2 = 1, if(u_3 = 1, M_y \cdot 12 \cdot 1000, if(u_4 = 1, M_{r1}, if(u_5 = 1, M_{r2}, NA))), NA))$

$M_r := if(M_r \le M_y \cdot 12 \cdot 1000, M_r, M_y \cdot 12 \cdot 1000)$

$\dfrac{M_r}{12 \cdot 1000} = 575.188 \quad ft - kip$

AASHTO (10-103b): $R_b := 1 - 0.002 \cdot \left(D_c \cdot \dfrac{t_w}{A_{fc}}\right) \cdot \left(\dfrac{D_c}{t_w} - \dfrac{\lambda}{\sqrt{\dfrac{M_r}{S_{xc}}}}\right)$ $\qquad R_b := if(R_b \le 1.0, R_b, 1.0)$ $\qquad R_b = 1$

$M_u := \dfrac{M_r \cdot R_b}{12 \cdot 1000}$ $\qquad M_u := if(Comp = 1, NA, if(B\_NC = 1, NA, M_u))$

$M_u = 575.188 \quad ft - kip$

Shear Capacity

Plastic or Buckling Shear Strength:

AASHTO (10-115):

$$V_p := 0.58 \cdot F_y \cdot D \cdot t_w$$

Determine the constant *C*:

$$k := 5 + \frac{5}{\left(\frac{d_o}{D}\right)^2} \qquad k = 5.022$$

$$C_1 := if\left(\frac{D}{t_w} < 6000 \cdot \frac{\sqrt{k}}{\sqrt{F_y}}, 1.0, 0.0\right)$$

AASHTO (10-116):

$$C_2 := if\left(6000 \cdot \frac{\sqrt{k}}{\sqrt{F_y}} \le \frac{D}{t_w} \le 7500 \cdot \frac{\sqrt{k}}{\sqrt{F_y}}, \frac{6000 \cdot \sqrt{k}}{\frac{D}{t_w} \cdot \sqrt{F_y}}, 0.0\right)$$

AASHTO (10-117):

$$C_3 := if\left[\frac{D}{t_w} > 7500 \cdot \frac{\sqrt{k}}{\sqrt{F_y}}, \frac{4.5 \cdot 10^7 \cdot k}{\left(\frac{D}{t_w}\right)^2 \cdot F_y}, 0.0\right]$$

$$C := \sum C \qquad C = 1$$

AASHTO (10-113) and (10-114):

$$V_u := if\left[\frac{d_o}{D} \le 3, V_p \cdot \left[C + \frac{0.87 \cdot (1 - C)}{\sqrt{1 + \left(\frac{d_o}{D}\right)^2}}\right], C \cdot V_p\right] \qquad V_{kips} := \frac{V_u}{1000}$$

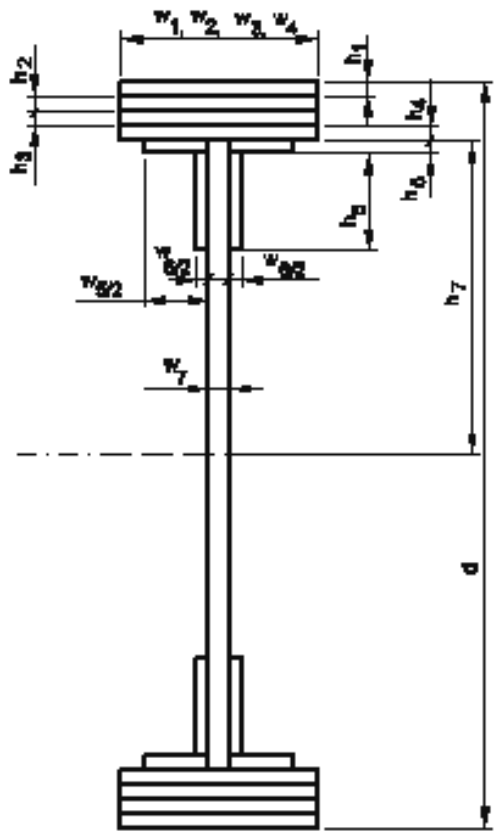
AASHTO EQS
(10-113) AND (10-114):

$$V_u = 213.601 \quad kips$$

Moment and Shear Capacities of Symmetrical Steel Girders

Using AASHTO "Standard Specifications for Highway Bridges," 16th Edition, 1996 and Interims through 1999.

INPUT DATA: Interior Floorbeam (30W116)



Section Descriptions:

ORIGIN := 1 i := 1 .. 7

		Width (*in*)	***Height*** (*in*)
Top Cover Plate 1:		0	0
Top Cover Plate 2:		0	0
Top Cover Plate 3:		0	0
Top Cover Plate 4:	w :=	10.50	h := 0.85
H. Legs of Angles:		0	0
V. Legs of Angles:		0	0
1/2 Web Plate:		0.564	14.15

Bracing/Stiffeners Information:

Spacing of Lateral Bracing: L_b := 24.92 *ft*

Spacing of Transverse Stiffeners: d_o := 24.92 *ft*

Longitudinal Stiffeners: LS := 0

Note: "1": With Longitudinal Stiffeners "0": Without Longitudinal Stiffeners

Materials Properties:

Steel Yield Strength: F_y := 30000 *psi* F_{yf} := 30000 *psi*

Smaller End Moment of Unbraced length: M_1 := 0 *kft*

Larger End Moment of Unbraced length: M_2 := 0 *kft*

Note: M_1 and M_2 are moments at ends of the unbraced segment obtained through structural analysis.
M_2 is positive when bent in single curvature.

========== *END OF DATA INPUT* ==========

Data Calculated from Input Data:

Clear distance between flanges: $D := 2\cdot\left[h_7 - \left(h_6 + h_5\right)\right]$ $D = 28.3$ *in*

Depth of web in compression: $D_c := \frac{D}{2}$ $D_c = 14.15$ *in*

Thickness of flange: $t := \sum_{i=1}^{4} h_i$ $t = 0.85$ *in*

Thickness of web: $t_w := w_7$ $t_w = 0.564$ *in*

Width of projecting flange element: $b' := \frac{max(w) - w_7 - w_6}{2}$ $b' = 4.968$ *in*

Depth of Girder: $d := 2\cdot\left[\left(\sum_{i=1}^{4} h_i\right) + h_7\right]$ $d = 30$ *in*

Area of Elements: $A_i := \left(w_i\right)\cdot\left(h_i\right)$ I_{ox} of Elements: $I_{ox_i} := \left(w_i\right)\cdot\frac{\left(h_i\right)^3}{12}$ I_{oy} of Elements: $I_{oy_i} := \left(h_i\right)\cdot\frac{\left(w_i\right)^3}{12}$

Distance from the center of element to the neutral axis:

$y_{c_1} := \frac{d}{2} - h_1\cdot\frac{1}{2}$ $y_{c_7} := \frac{h_7}{2}$ $i := 2..6$ $y_{c_i} := y_{c_{i-1}} - \left(h_{i-1} + h_i\right)\cdot\frac{1}{2}$

Spacing of lateral bracing: $L_b := L_b\cdot 12$ $L_b = 299.04$ *in*

Spacing of Transverse Stiffeners: $d_o := d_o\cdot 12$ $d_o = 299.04$ *in*

Calculated Section Properties

Area of Section: $A_g := 2 \cdot \sum_{i=1}^{7} A_i$ $\quad A_g = 33.811 \quad in^2$

Moment of inertia of section about horizontal axis: $I_x := 2 \cdot \sum_{i=1}^{7} \left[\left(I_{ox_i} \right) + \left(y_{c_i} \right)^2 \cdot A_i \right]$ $\quad I_x = 4.858 \times 10^3 \; in^4$

Moment of inertia of section about vertical axis: $I_y := 2 \cdot \sum_{i=1}^{7} I_{oy_i}$ $\quad I_y = 164.42 \quad in^4$

St. Venant constant: $J := 2 \cdot \sum_{i=1}^{7} \left[\frac{1}{3} \cdot if\left(w_i > h_i, w_i, h_i\right) \cdot \left(if\left(w_i < h_i, w_i, h_i\right) \right)^3 \right]$ $\quad J = 5.991 \quad in^4$

Moment of inertia of compression flange about vertical axis: $I_{yc} := \sum_{i=1}^{5} I_{oy_i}$ $\quad I_{yc} = 81.998 \quad in^4$

Area of compression flange: $A_{fc} := \sum_{i=1}^{5} A_i$ $\quad A_{fc} = 8.925 \quad in^2$

$A_f := A_{fc}$ $\quad A_f = 8.925 \quad in^2$

Section modulus: $S := I_x \div \left(\frac{d}{2} \right)$ $\quad S = 323.882 \quad in^3$

Section modulus with respect to compression flange: $S_{xc} := S$ $\quad S_{xc} = 323.882 \quad in^3$

Radius of gyration of compression flange about vertical axis: $r' := \sqrt{\left(\frac{I_{yc}}{A_{fc}} \right)}$ $\quad r' = 3.031 \quad in$

Radius of gyration of section about vertical axis: $r_y := \sqrt{\left(\frac{I_y}{A_g} \right)}$ $\quad r_y = 2.205 \quad in$

Determine Plastic Section Modulus (Z) (AASHTO Appendix D):

Distance from the centroid of compression or tension areas to the neutral axis of the section:

$$y_c := \frac{\sum_{i=1}^{7} \left(y_{c_i} \cdot A_i\right)}{\sum_{i=1}^{7} \left(A_i\right)} \qquad y_c = 11.034 \quad in$$

Distance between the centroids of compression and tension areas: $a := 2 \cdot y_c$ $\quad a = 22.069 \quad in$

Plastic Section Modulus Z: $Z := \frac{A_g}{2} \cdot a$ $\quad Z = 373.089 \quad in^3$

Moment Capacity

AASHTO (10-92): $M_u := F_y \cdot Z$ $\quad M_u := \frac{M_u}{1000 \cdot 12}$ $\quad M_u = 932.723 \quad ft - kip$

AASHTO (10-98): $M_y := F_y \cdot S$ $\quad M_y := \frac{M_y}{1000 \cdot 12}$ $\quad M_y = 809.704 \quad ft - kip$

Notes:

NA := "Not Applicable" ***TEXT1*** := "Compact Section" ***TEXT3*** := "Braced Non-Compact"

TEXT2 := "Non-Compact Section" ***TEXT4*** := "Unbraced Section"

Case 1 *Check for Compact Section – AASHTO 10.48.1*

(*a*) *AASHTO (10-93):* $\frac{b'}{t} = 5.845$ $\frac{2055}{\sqrt{F_y}} = 11.865$

(*b*) *AASHTO (10-94):* $\frac{D}{t_w} = 50.177$ $\frac{19230}{\sqrt{F_y}} = 111.024$

$$z_4 := if\left(\frac{b'}{t} > 0.75\cdot\frac{2055}{\sqrt{F_y}}, if\left(\frac{D}{t_w} > 0.75\cdot\frac{19230}{\sqrt{F_y}}, 1, 0\right), 0\right)$$

AASHTO (10-95): $\frac{D}{t_w} + 9.35\cdot\left(\frac{b'}{t}\right) = 104.825$ $\frac{33650}{\sqrt{F_{yf}}} = 194.278$

(*c*) *AASHTO (10-96):* $\frac{L_b}{r_y} = 135.607$ $\frac{\left[3.6 - 2.2\cdot\left(\frac{M_l}{M_u}\right)\right]\cdot 10^6}{F_y} = 120$

$$z_1 := if\left(\frac{2055}{\sqrt{F_y}} \ge \frac{b'}{t}, 1, 0\right) \qquad z_2 := if\left(\frac{19230}{\sqrt{F_y}} \ge \frac{D}{t_w}, 1, 0\right)$$

$$z_3 := if\left[\frac{\left[3.6 - 2.2\cdot\left(\frac{M_l}{M_u}\right)\right]\cdot 10^6}{F_y} \ge \frac{L_b}{r_y}, 1, 0\right] \qquad z_4 := if\left[z_4 = 1, if\left[\frac{D}{t_w} + 4.6\cdot\left(\frac{b'}{t}\right) \le \frac{33650}{\sqrt{F_{yf}}}, 0, -1\right], 0\right]$$

$$Comp := if\left(\sum z = 3, 1, 0\right)$$

$$if(Comp = 1, TEXT1, TEXT2) = \text{"Non-Compact Section"}$$

$$M_u := if\left(Comp = 1, M_u, NA\right)$$

M_u = "Not Applicable" $ft - kip$

Case 2 *Check for Braced Non-Compact Section -- AASHTO 10.48.2*

(*a*) *AASHTO (10-99):* $\frac{b'}{t} = 5.845$ $\frac{2200}{\sqrt{F_y}} = 12.702$

(*b*) *AASHTO (10-100):* $\frac{D_c}{t_w} = 25.089$ $\frac{15400}{\sqrt{F_y}} = 88.912$

(*c*) *AASHTO (10-101):* $L_b = 299.04$ $\frac{20 \cdot 10^6 \cdot A_f}{F_y \cdot d} = 198.333$

$$s_1 := if\left(\frac{2200}{\sqrt{F_y}} \geq \frac{b'}{t}, 1, 0\right) \quad s_2 := if\left(\frac{15400}{\sqrt{F_y}} \geq \frac{D_c}{t_w}, 1, 0\right) \quad s_3 := if\left(\frac{20 \cdot 10^6 \cdot A_f}{F_y \cdot d} \geq L_b, 1, 0\right)$$

$$B\_NC := if\left(\sum s = 3, 1, 0\right)$$

$$M_u := if\left(Comp = 1, \text{"See Case 1: Compact Section"}, if\left(B\_NC = 1, M_y, \text{"Not Applicable"}\right)\right)$$

$$if(Comp = 1, TEXT1, if(B\_NC = 1, TEXT3, TEXT4)) = \text{"Unbraced Section"}$$

M_u = "Not Applicable" $ft - kip$

Case 3 *Capacity of Unbraced Section -- AASHTO 10.48.4*

$$if\left(0.1 \leq \frac{I_{yc}}{I_y} \leq 0.9, \text{"Case 3 Applies."}, \text{"Case 3 Does Not Apply."}\right) = \text{"Case 3 Applies."}$$

$\lambda := 15400$ for all members with a compression flange area equal to or greater than the tension flange area

$$C_b := 1.75 + 1.05 \cdot \left(\frac{-M_1}{M_2}\right) + 0.3 \cdot \left(\frac{-M_1}{M_2}\right)^2 \qquad if\left(C_b \leq 2.3, C_b, 2.3\right) = 1.75$$

Note: C_b= 1.0 for unbraced cantilevers and for members where the moment within a significant portion of the unbraced segment is greater than or equal to the larger of the segment end moments.

$$L_p := \frac{9500 \cdot r'}{\sqrt{F_y}} \qquad L_p = 166.25 \quad in$$

AASHTO (10-103f): $L_r := \sqrt{\dfrac{572 \cdot 10^6 \cdot I_{yc} \cdot d}{F_y \cdot S_{xc}}}$ $\qquad L_r = 380.546 \quad in$

AASHTO (10-103c): $M_r := 91 \cdot 10^6 \cdot (C_b) \cdot \left(\dfrac{I_{yc}}{L_b}\right) \cdot \sqrt{0.772 \cdot \dfrac{J}{I_{yc}} + 9.87 \cdot \left(\dfrac{d}{L_b}\right)^2}$

AASHTO (10-103e): $M_{r1} := C_b \cdot F_y \cdot S_{xc} \cdot \left[1 - 0.5 \cdot \dfrac{(L_b - L_p)}{L_r - L_p}\right]$

AASHTO (10-103g): $M_{r2} := C_b \cdot F_y \cdot \dfrac{S_{xc}}{2} \cdot \left(\dfrac{L_r}{L_b}\right)^2$

$u_1 := if\left(\dfrac{D_c}{t_w} \le \dfrac{\lambda}{\sqrt{F_y}}, 1, if(LS = 1, 1, 0)\right)$ $\qquad u_2 := if\left(\dfrac{\lambda}{\sqrt{F_y}} < \dfrac{D_c}{t_w} \le \dfrac{18250}{\sqrt{F_y}}, 1, 0\right)$

$u_3 := if(L_b \le L_p, 1, 0)$ $\qquad u_4 := if(L_r \ge L_b > L_p, 1, 0)$ $\qquad u_5 := if(L_b \ge L_r, 1, 0)$

$M_r := if(u_1 = 1, M_r, if(u_2 = 1, if(u_3 = 1, M_y \cdot 12 \cdot 1000, if(u_4 = 1, M_{r1}, if(u_5 = 1, M_{r2}, NA)))), NA))$

$M_r := if(M_r \le M_y \cdot 12 \cdot 1000, M_r, M_y \cdot 12 \cdot 1000)$

$\dfrac{M_r}{12 \cdot 1000} = 809.704 \quad ft - kip$

AASHTO (10-103b): $R_b := 1 - 0.002 \cdot \left(D_c \cdot \dfrac{t_w}{A_{fc}}\right) \cdot \left(\dfrac{D_c}{t_w} - \dfrac{\lambda}{\sqrt{\dfrac{M_r}{S_{xc}}}}\right)$ $\qquad R_b := if(R_b \le 1.0, R_b, 1.0)$ $\qquad R_b = 1$

$M_u := \dfrac{M_r \cdot R_b}{12 \cdot 1000}$ $\qquad M_u := if(Comp = 1, NA, if(B\_NC = 1, NA, M_u))$

$M_u = 809.704 \quad ft - kip$

Shear Capacity

Plastic or Buckling Shear Strength:

AASHTO (10-115):

$$V_p := 0.58 \cdot F_y \cdot D \cdot t_w$$

Determine the constant *C*:

$$k := 5 + \frac{5}{\left(\frac{d_o}{D}\right)^2} \qquad k = 5.045$$

$$C_1 := if\left(\frac{D}{t_w} < 6000 \cdot \frac{\sqrt{k}}{\sqrt{F_y}}, 1.0, 0.0\right)$$

AASHTO (10-116):

$$C_2 := if\left(6000 \cdot \frac{\sqrt{k}}{\sqrt{F_y}} \le \frac{D}{t_w} \le 7500 \cdot \frac{\sqrt{k}}{\sqrt{F_y}}, \frac{6000 \cdot \sqrt{k}}{\frac{D}{t_w} \cdot \sqrt{F_y}}, 0.0\right)$$

AASHTO (10-117):

$$C_3 := if\left[\frac{D}{t_w} > 7500 \cdot \frac{\sqrt{k}}{\sqrt{F_y}}, \frac{4.5 \cdot 10^7 \cdot k}{\left(\frac{D}{t_w}\right)^2 \cdot F_y}, 0.0\right]$$

$$C := \sum C \qquad C = 1$$

AASHTO (10-113) and (10-114):

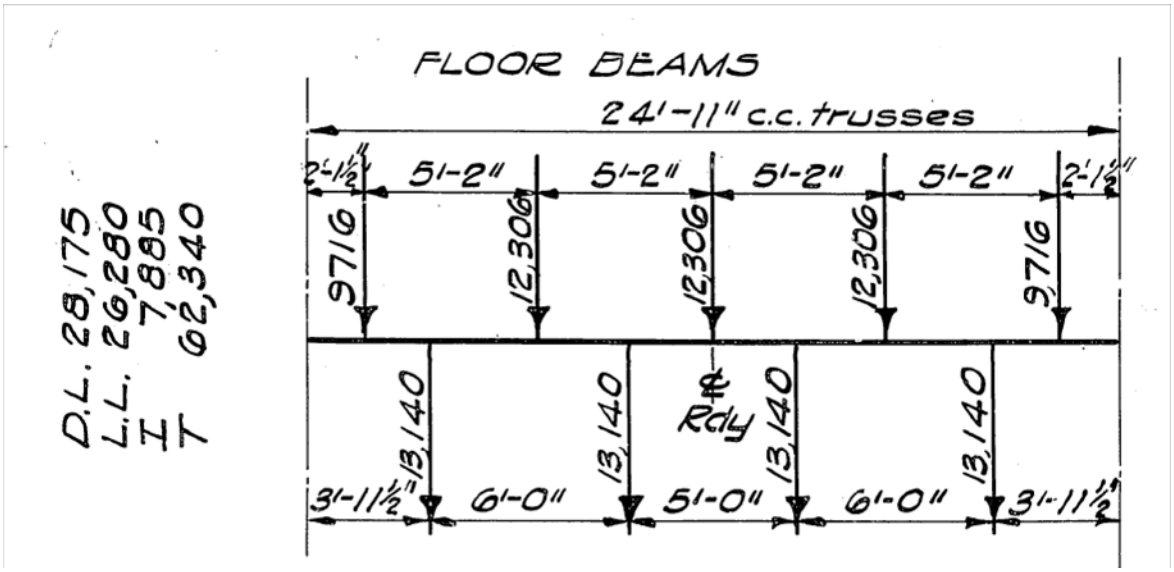
$$V_u := if\left[\frac{d_o}{D} \le 3, V_p \cdot \left[C + \frac{0.87 \cdot (1 - C)}{\sqrt{1 + \left(\frac{d_o}{D}\right)^2}}\right], C \cdot V_p\right] \qquad V_{kips} := \frac{V_u}{1000}$$

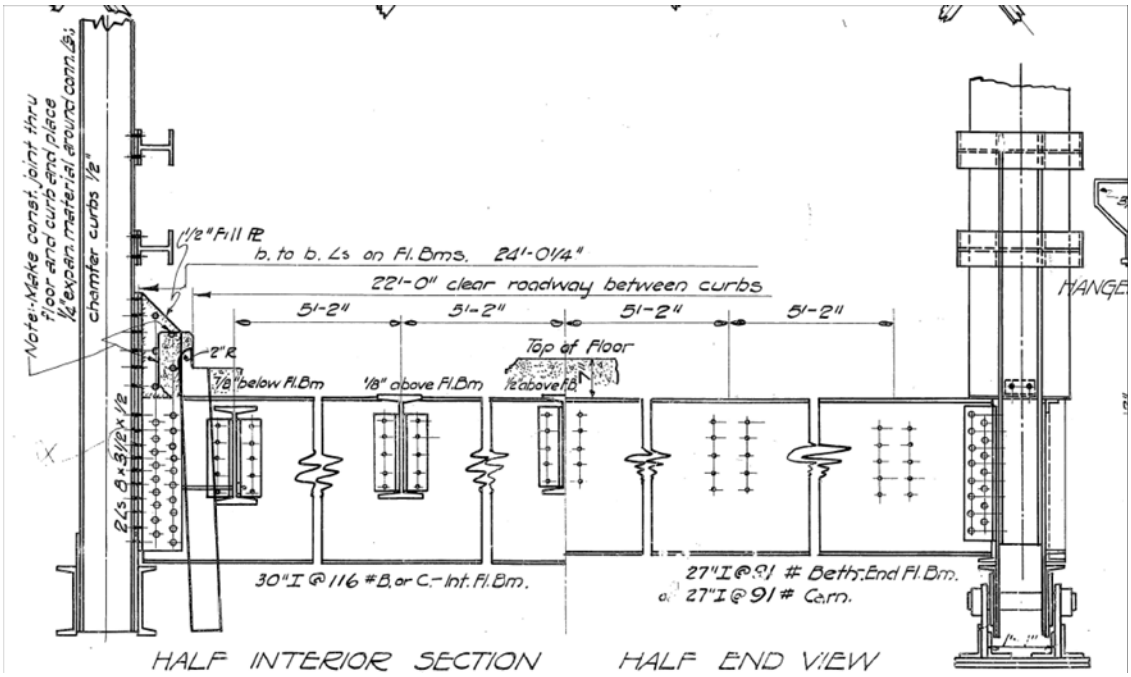
AASHTO EQS
(10-113) AND (10-114):

$$\boxed{V_u = 277.725} \quad kips$$

LOADING

Live Load





The first wheel shall be applied at:

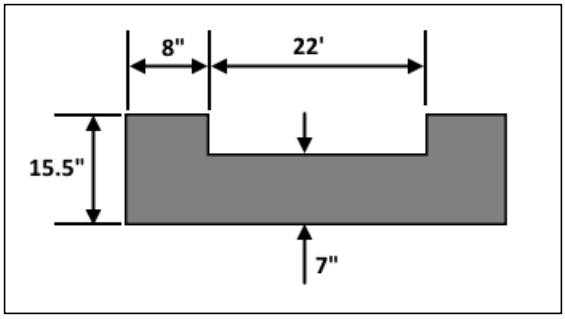
$$\frac{(24\text{ft} + 11\text{in}) - (22\text{ft})}{2} + (2\text{ft}) = 3.458 \cdot \text{ft}$$

For a 22' roadway, the number of lanes is: $\frac{22\text{ft}}{12 \cdot \text{ft}} = 1.833$ For a 32' roadway, the number of lanes is: $\frac{28\text{ft}}{12 \cdot \text{ft}} = 2.333$

Dead Load

Dead load to Stringers from concrete deck:

From Infrastructure Engineering inspection notes (Roadway Deck):



$$Area_{deck} := 2\cdot(8in\cdot 15.5in) + (22ft\cdot 7in) = 14.556\cdot ft^2$$

$$Weight_{deck} := Area_{deck}\cdot 0.15\,\frac{kip}{ft^3} = 2.183\cdot\frac{kip}{ft}$$

There are 5 stringers. The load to each is:

$$\frac{Weight_{deck}}{5} = 0.437\cdot\frac{kip}{ft}$$

Dead load to floorbeams from traffic railing:

Railing consists of steel lattice railing attached to vertical posts of truss and guardrail attached to lattice railing.

Each Panel is 20 ft. long

$$Wt_{per\_ft\_guardrail} := 20\,\frac{lb}{ft}$$

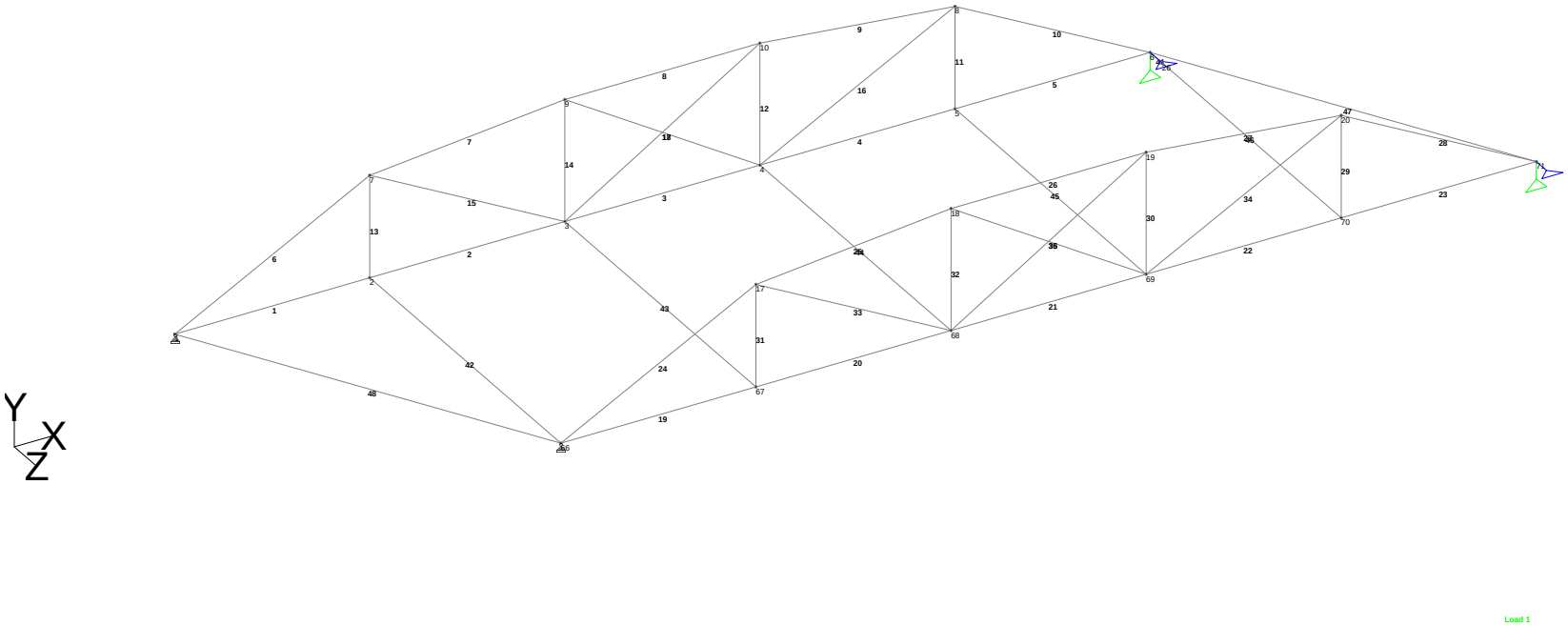
$$Wt_{per\_ft\_lattice} := 20\,\frac{lb}{ft}$$

$$Wt_{applied\_interior\_posts} := \left(Wt_{per\_ft\_guardrail} + Wt_{per\_ft\_lattice}\right)\cdot 20ft = 800\cdot lb$$

$$Wt_{applied\_exterior\_posts} := \left(Wt_{per\_ft\_guardrail} + Wt_{per\_ft\_lattice}\right)\cdot 10ft = 400\cdot lb$$

STAAD.Pro Analysis

Software licensed to TranSystems	Job No	Sheet No **1**	Rev
	Part		
Job Title	Ref		
	By JPD	Date 14-Nov-14	Chd
Client	File C-100 4_widened_Rev 1	Date/Time 18-Nov-2014 10:42	



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****************************************************
*                                                  *
*           STAAD.Pro V8i SELECTseries2            *
*           Version  20.07.07.19                   *
*           Proprietary Program of                 *
*           Bentley Systems, Inc.                  *
*           Date=    NOV 18, 2014                  *
*           Time=    10:42:34                      *
*                                                  *
*      USER ID: TranSystems                        *
****************************************************
```

```
     1. STAAD SPACE
INPUT FILE: C-100  4_widened_Rev 1.STD
     2. START JOB INFORMATION
     3. ENGINEER DATE 14-NOV-14
     4. JOB COMMENT TRUSS SPAN USING STANDARD INDEX (1931) C-100 4
     5. ENGINEER NAME JPD
     6. END JOB INFORMATION
     7. INPUT WIDTH 79
     8. UNIT FEET KIP
     9. JOINT COORDINATES
    10. 1 0 0 0; 2 20 0 0; 3 40 0 0; 4 60 0 0; 5 80 0 0; 6 100 0 0; 7 20 10.5 0
    11. 8 80 10.5 0; 9 40 12.5 0; 10 60 12.5 0; 17 40 10.5 33.9167; 18 60 12.5 33.9167
    12. 19 80 12.5 33.9167; 20 100 10.5 33.9167; 26 100 0 2.125; 66 20 0 33.9167
    13. 67 40 0 33.9167; 68 60 0 33.9167; 69 80 0 33.9167; 70 100 0 33.9167
    14. 71 120 0 33.9167
    15. MEMBER INCIDENCES
    16. 1 1 2; 2 2 3; 3 3 4; 4 4 5; 5 5 6; 6 1 7; 7 7 9; 8 9 10; 9 10 8; 10 8 6
    17. 11 8 5; 12 10 4; 13 7 2; 14 9 3; 15 7 3; 16 8 4; 17 9 4; 18 10 3; 19 66 67
    18. 20 67 68; 21 68 69; 22 69 70; 23 70 71; 24 66 17; 25 17 18; 26 18 19; 27 19 20
    19. 28 20 71; 29 20 70; 30 19 69; 31 17 67; 32 18 68; 33 17 68; 34 20 69; 35 18 69
    20. 36 19 68; 41 6 26; 42 2 66; 43 3 67; 44 4 68; 45 5 69; 46 6 70; 47 6 71
    21. 48 1 66
    22. DEFINE MATERIAL START
    23. ISOTROPIC STEEL
    24. E 4.176E+006
    25. POISSON 0.3
    26. DENSITY 0.489024
    27. ALPHA 6.5E-006
    28. DAMP 0.03
    29. TYPE STEEL
    30. STRENGTH FY 5184 FU 8352 RY 1.5 RT 1.2
    31. END DEFINE MATERIAL
    32. MEMBER PROPERTY AMERICAN
    33. 1 2 4 5 19 20 22 23 PRIS AX 0.122083 IX 7.7E-005 IY 0.027853 IZ 0.015548
    34. 3 21 PRIS AX 0.1425 IX 0.000124 IY 0.032608 IZ 0.017245
    35. 11 TO 14 29 TO 32 PRIS AX 0.075556 IX 3.6E-005 IY 0.002035 IZ 0.009496
    36. 15 16 33 34 PRIS AX 0.042986 IX 1E-005 IY 0.000468 IZ 0.005126
    37. 17 18 35 36 PRIS AX 0.0225 IX 5E-006 IY 0.005263 IZ 0.000135
    38. 6 10 24 28 PRIS AX 0.148542 IX 6.2E-005 IY 0.04073 IZ 0.022375
    39. 7 TO 9 25 TO 27 PRIS AX 0.156354 IX 7.1E-005 IY 0.042192 IZ 0.023396
    40. 41 PRIS AX 0.237014 IX 0.000294 IY 0.007388 IZ 0.237225
```

```
 41. 42 TO 48 TABLE ST W33X241
 42. CONSTANTS
 43. MATERIAL STEEL ALL
 44. SUPPORTS
 45. 1 66 PINNED
 46. 6 71 FIXED BUT FX MX MY MZ
 47. DEFINE MOVING LOAD
 48. TYPE 1 LOAD 4 16 16
 49. DIST 14 14 WID 6
 50. TYPE 2 LOAD 16 16 4
 51. DIST 14 14 WID 6
 52. LOAD 1 LOADTYPE DEAD  TITLE DEAD
 53. SELFWEIGHT Y -1.1
 54. ***ADD 10% FOR LACING AND CONNECTION ELEMENTS
 55. **
 56. **FOLLOWING MEMBER AND JOINT LOADS ARE FOR CONCRETE DECK AND MISCE.
 57. JOINT LOAD
 58. 1 6 66 71 FY -0.4
 59. 2 TO 5 67 TO 70 FY -0.8
 60. *******************************************************
 61. *** ADD THE WEIGHT OF CONCRETE DECK AND STRINGERS
 62. ***(33'/2*(7"/12)*.15KCF+0.05KLF*7/2)*20'*1.05 = 34.0 KIPS PER NODE
 63. ***
 64. 2 TO 5 67 TO 70 FY -34
 65. **LIVE LOAD GENERATIONS***********************************
 66. **FOR LEFT TRUSS (TWO LANES HS20 FORWARD)
 67. LOAD GENERATION 100
 68. TYPE 1 0 0 10.9583 XINC 1
 69. TYPE 1 0 0 22.9583 XINC 1
 70. **FOR LEFT TRUSS (TWO LANES HS20 BACKWARD)
 71. LOAD GENERATION 100
**WARNING-A MOVING LOAD THAT WOULD HAVE BEEN APPLIED BEYOND THE X AND Z RANGES
          OF THE STRUCTURE HAS BEEN IGNORED. CASE=   95 WHEEL   5 OF   6
**WARNING-A MOVING LOAD THAT WOULD HAVE BEEN APPLIED BEYOND THE X AND Z RANGES
          OF THE STRUCTURE HAS BEEN IGNORED. CASE=   95 WHEEL   6 OF   6
**WARNING-A MOVING LOAD THAT WOULD HAVE BEEN APPLIED BEYOND THE X AND Z RANGES
          OF THE STRUCTURE HAS BEEN IGNORED. CASE=   95 WHEEL   5 OF   6
**WARNING-A MOVING LOAD THAT WOULD HAVE BEEN APPLIED BEYOND THE X AND Z RANGES
          OF THE STRUCTURE HAS BEEN IGNORED. CASE=   95 WHEEL   6 OF   6
**WARNING-A MOVING LOAD THAT WOULD HAVE BEEN APPLIED BEYOND THE X AND Z RANGES
          OF THE STRUCTURE HAS BEEN IGNORED. CASE=   96 WHEEL   5 OF   6
**WARNING-A MOVING LOAD THAT WOULD HAVE BEEN APPLIED BEYOND THE X AND Z RANGES
          OF THE STRUCTURE HAS BEEN IGNORED. CASE=   96 WHEEL   6 OF   6
**WARNING-A MOVING LOAD THAT WOULD HAVE BEEN APPLIED BEYOND THE X AND Z RANGES
          OF THE STRUCTURE HAS BEEN IGNORED. CASE=   96 WHEEL   5 OF   6
**WARNING-A MOVING LOAD THAT WOULD HAVE BEEN APPLIED BEYOND THE X AND Z RANGES
          OF THE STRUCTURE HAS BEEN IGNORED. CASE=   96 WHEEL   6 OF   6
**WARNING-A MOVING LOAD THAT WOULD HAVE BEEN APPLIED BEYOND THE X AND Z RANGES
          OF THE STRUCTURE HAS BEEN IGNORED. CASE=   97 WHEEL   5 OF   6
**WARNING-A MOVING LOAD THAT WOULD HAVE BEEN APPLIED BEYOND THE X AND Z RANGES
          OF THE STRUCTURE HAS BEEN IGNORED. CASE=   97 WHEEL   6 OF   6
*ADDITIONAL MOVING LOAD MESSAGES SUPPRESSED
*ADDITIONAL MOVING LOAD MESSAGES SUPPRESSED
 72. TYPE 2 0 0 10.9583 XINC 1
 73. TYPE 2 0 0 22.9583 XINC 1
 74. PERFORM ANALYSIS
```

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

  NUMBER OF JOINTS/MEMBER+ELEMENTS/SUPPORTS =    21/    44/     4

        SOLVER USED IS THE OUT-OF-CORE BASIC SOLVER

  ORIGINAL/FINAL BAND-WIDTH=    15/     5/     36 DOF
  TOTAL PRIMARY LOAD CASES =  201, TOTAL DEGREES OF FREEDOM =    116
  SIZE OF STIFFNESS MATRIX =        5 DOUBLE  KILO-WORDS
  REQRD/AVAIL. DISK SPACE  =     12.8/      0.0 MB



 **** WARNING : AVAILABLE HARD DISK SPACE MAY NOT BE
ENOUGH TO COMPLETE EXECUTION. IF YOUR AVAILABLE HARD DISK
SPACE ON THE ANALYSIS DRIVE IS GREATER THAN 3GB THIS MESSAGE
MAY BE ERRONEOUS


   75. ***DEAD LOAD EFFECTS IN TRUSS MEMBERS
   76. LOAD LIST 1
   77. PRINT MEMBER FORCES LIST 1 TO 18
```

MEMBER END FORCES STRUCTURE TYPE = SPACE

ALL UNITS ARE -- KIP FEET (LOCAL)

MEMBER	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
1	1	1	-163.34	1.15	0.10	0.00	-0.51	2.30
		2	163.34	0.17	-0.10	0.00	-1.44	7.50
2	1	2	-165.13	0.97	0.17	-0.01	-1.75	1.22
		3	165.13	0.34	-0.17	0.01	-1.74	5.03
3	1	3	-205.13	0.75	0.32	-0.01	-3.29	-2.76
		4	205.13	0.78	-0.32	0.01	-3.12	2.52
4	1	4	-164.49	0.36	0.24	-0.01	-2.45	-5.02
		5	164.49	0.95	-0.24	0.01	-2.37	-0.91
5	1	5	-162.90	-0.14	0.27	-0.01	-2.14	-9.18
		6	162.90	1.45	-0.27	0.01	-3.22	-6.78
6	1	1	185.71	0.94	0.08	0.00	1.84	-1.78
		7	-184.87	0.65	-0.08	0.00	-3.58	5.06
7	1	7	208.00	1.38	-0.13	-0.01	3.30	2.65
		9	-207.83	0.30	0.13	0.01	-0.75	8.21
8	1	9	209.28	0.83	-0.10	0.00	1.33	-4.64
		10	-209.28	0.85	0.10	0.00	0.65	4.47
9	1	10	207.56	0.34	-0.16	-0.01	0.00	-8.02
		8	-207.73	1.34	0.16	0.01	3.23	-1.97
10	1	8	183.45	0.31	-0.02	0.00	-3.46	-7.13
		6	-184.29	1.29	0.02	0.00	3.87	-3.92
11	1	8	-40.55	1.85	-0.14	0.00	1.20	9.45
		5	40.12	-1.85	0.14	0.00	0.23	9.99
12	1	10	-18.01	0.62	0.06	0.00	-0.40	4.00
		4	17.50	-0.62	-0.06	0.00	-0.33	3.79
13	1	7	-41.31	-1.62	0.20	0.00	-1.27	-8.21
		2	40.89	1.62	-0.20	0.00	-0.82	-8.81
14	1	9	-18.26	-0.63	-0.03	0.00	0.29	-4.01
		3	17.75	0.63	0.03	0.00	0.04	-3.82
15	1	7	-46.71	0.30	0.00	0.00	-0.13	0.50
		3	46.46	0.16	0.00	0.00	0.02	1.00

MEMBER END FORCES STRUCTURE TYPE = SPACE

ALL UNITS ARE -- KIP FEET (LOCAL)

MEMBER	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
16	1	8	-47.75	0.29	0.01	0.00	-0.16	0.36
		4	47.50	0.17	-0.01	0.00	0.03	0.96
17	1	9	-2.23	0.12	0.00	0.00	-0.69	0.44
		4	2.08	0.12	0.00	0.00	0.74	-0.44
18	1	10	-2.54	0.12	0.00	0.00	-0.76	0.44
		3	2.39	0.12	0.00	0.00	0.85	-0.44

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

```
78. ***LIVE LOAD EFFECTS IN TRUSS MEMBERS
79. LOAD LIST 2 TO 201
80. PRINT MAXFORCE ENVELOPE LIST 1 TO 18
```

MEMBER FORCE ENVELOPE

ALL UNITS ARE KIP FEET

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	0.50	0.00	122	2.13	0.00	122			
		0.20	0.00	128	4.21	0.00	102	3.68 T	0.00	101
	MIN	0.00	20.00	101	-7.81	20.00	122			
		-0.27	20.00	102	-2.25	0.00	122	85.36 T	20.00	122
2	MAX	0.83	0.00	142	6.43	0.00	142			
		0.07	0.00	162	0.80	20.00	122	3.66 T	0.00	101
	MIN	-0.46	20.00	108	-10.24	20.00	142			
		0.00	20.00	102	-0.71	0.00	54	86.01 T	20.00	122
3	MAX	0.67	0.00	162	4.01	20.00	14			
		0.15	0.00	108	1.31	20.00	108	2.90 T	0.00	101
	MIN	-0.68	20.00	14	-9.59	0.00	14			
		0.02	20.00	142	-1.70	0.00	108	117.27 T	20.00	142
4	MAX	0.66	0.00	182	6.13	20.00	34			
		0.11	0.00	34	1.06	20.00	122	0.95 T	0.00	102
	MIN	-0.82	20.00	34	-10.17	0.00	34			
		0.03	20.00	101	-1.35	0.00	34	103.64 T	20.00	54
5	MAX	1.04	0.00	74	32.76	20.00	94			
		0.16	0.00	122	1.87	20.00	88	0.39 T	0.00	101
	MIN	-2.28	20.00	94	-18.81	20.00	74			
		-0.01	20.00	54	-1.39	0.00	122	102.92 T	20.00	54
6	MAX	0.29	0.00	122	-0.01	0.00	101			
		0.29	0.00	102	5.24	0.00	122	122.85 C	0.00	122
	MIN	0.01	22.59	101	-7.37	22.59	122			
		-0.27	22.59	122	-7.93	0.00	102	0.73 T	22.59	101
7	MAX	1.07	0.00	142	7.63	0.00	142			
		0.18	0.00	102	2.62	0.00	148	137.77 C	0.00	28
	MIN	-0.44	20.10	108	-13.80	20.10	142			
		-0.23	20.10	142	-2.31	20.10	128	1.04 T	20.10	101
8	MAX	0.71	0.00	162	3.34	20.00	14			
		0.03	0.00	8	1.93	20.00	102	132.21 C	0.00	142
	MIN	-0.72	20.00	14	-11.12	0.00	128			
		-0.10	20.00	168	-2.12	20.00	148	1.12 T	20.00	101
9	MAX	0.66	0.00	182	7.06	20.10	34			
		0.13	0.00	34	1.64	0.00	102	137.85 C	0.00	148

	MIN	-1.03	20.10	34	-13.62	0.00	34			
		-0.22	20.10	182	-3.64	20.10	68	1.44 T	20.10	101
10	MAX	1.29	0.00	74	41.70	22.59	94			
		0.31	0.00	54	3.58	22.59	54	125.68 C	0.00	54
	MIN	-2.57	22.59	94	-25.80	22.59	74			
		-0.23	22.59	201	-6.10	22.59	88	3.76 T	22.59	101
11	MAX	1.97	0.00	34	10.45	0.00	34			
		0.14	0.00	201	1.62	10.50	201	0.94 C	0.00	101
	MIN	-1.18	10.50	74	-10.18	10.50	34			
		-0.41	10.50	168	-2.92	10.50	168	51.18 T	10.50	68
12	MAX	1.31	0.00	128	8.21	0.00	128			
		0.15	0.00	14	1.38	12.50	182	4.41 C	0.00	14
	MIN	-0.84	12.50	68	-8.13	12.50	128			
		-0.22	12.50	48	-2.21	12.50	48	25.18 T	12.50	162
13	MAX	0.20	0.00	108	9.23	10.50	142			
		0.26	0.00	142	1.60	10.50	102	0.02 C	0.00	201
	MIN	-1.78	10.50	142	-9.46	0.00	142			
		-0.24	10.50	122	-2.16	10.50	122	46.88 T	10.50	8
14	MAX	0.68	0.00	8	8.04	12.50	48			
		0.17	0.00	102	1.53	12.50	102	4.76 C	0.00	162
	MIN	-1.29	12.50	48	-8.11	0.00	48			
		-0.26	12.50	128	-2.49	12.50	128	25.08 T	12.50	14
15	MAX	0.12	0.00	142	0.79	0.00	142			
		0.01	0.00	162	0.14	0.00	102	19.75 C	0.00	108
	MIN	-0.03	22.59	108	-2.01	22.59	28			
		-0.01	22.59	28	-0.18	22.59	28	58.64 T	22.59	142
16	MAX	0.11	0.00	34	0.67	0.00	34			
		0.01	0.00	148	0.16	22.59	148	28.55 C	0.00	182
	MIN	-0.08	22.59	94	-1.95	22.59	148			
		-0.01	22.59	182	-0.14	22.59	182	59.27 T	22.59	34
17	MAX	0.00	0.00	162	0.01	23.58	182			
		0.10	0.00	14	1.34	23.58	14	22.40 C	0.00	14
	MIN	0.00	23.58	14	-0.04	23.58	148			
		-0.12	23.58	162	-2.27	23.58	48	23.97 T	23.58	162
18	MAX	0.00	0.00	14	0.00	0.00	94			
		0.12	0.00	14	1.88	23.58	14	22.25 C	0.00	162
	MIN	0.00	23.58	162	-0.04	23.58	28			
		-0.10	23.58	162	-1.84	23.58	162	22.89 T	23.58	14

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

81. FINISH

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

      **** DATE= NOV 18,2014   TIME= 10:42:40 ****

************************************************************
*         For questions on STAAD.Pro, please contact       *
*    Bentley Systems Offices at the following locations    *
*                                                          *
*               Telephone             Web / Email          *
*                                                          *
*  USA:      +1 (714)974-2500                              *
*  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    *
*  CHINA     +86 10 5929 7000                              *
*  THAILAND  +66(0)2645-1018/19 partha.p@reisoftwareth.com *
*                                                          *
* Worldwide    http://selectservices.bentley.com/en-US/    *
*                                                          *
************************************************************
```

APPENDIX C

Alternative 2(c) and 3(a) Analysis Results (Pony Truss Main Span)

SH-66B over Captain Creek
LFR Inventory and Operating Ratings

By: JPD 11/24/2014
Check: JH 11/24/2014

TRUSS SPAN: 22'-0" CURB-TO-CURB WIDTH (As-Built)

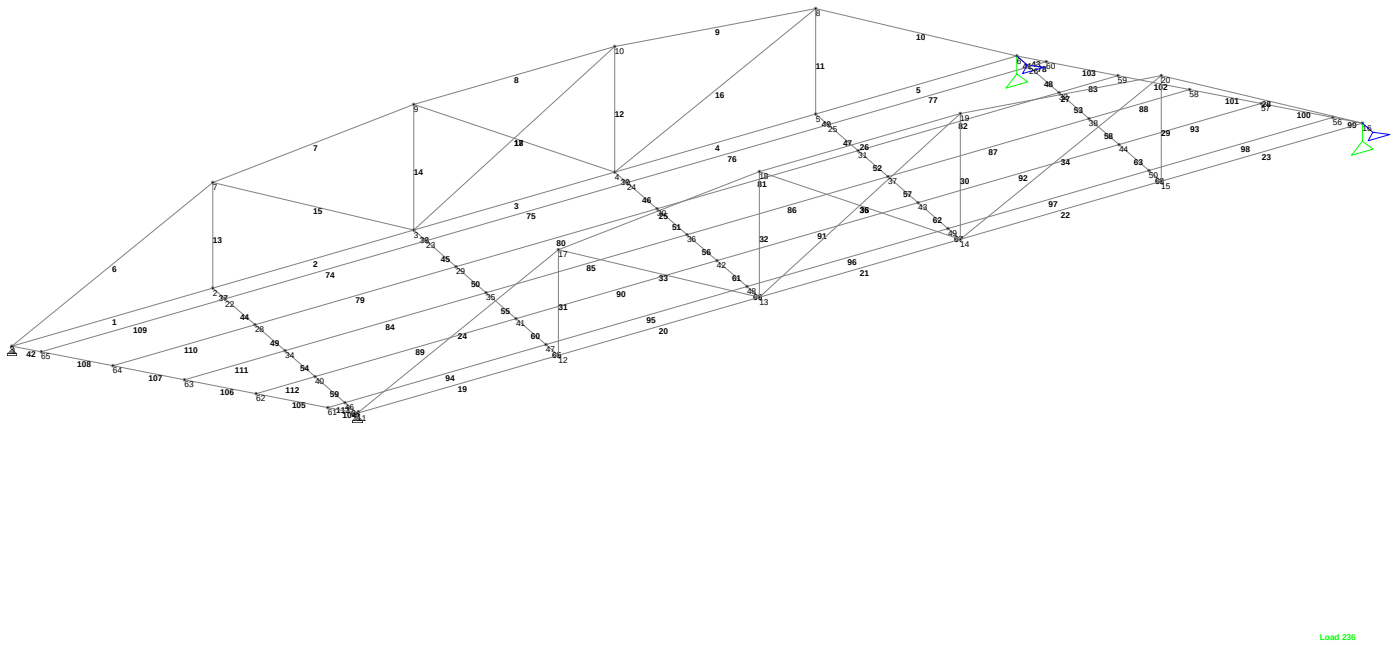
				CAPACITY			DEMAND					
Section	A (gross)	A (net)	Ref. Sect.	Yielding (kip)	Fracture (kip)	Buckling (kip)	DL Effects (T)	LL Effects (T)	DL Effects (C)	LL Effects (C)	Inventory Rating Factor	Operating Rating Factor
(2) 12C30	17.58	15.8	**1**	527.4	948	**-**	91.740	74.550	-	-	**2.064**	**3.446**
(2) 12C35	20.52	18.34	**2**	615.6	1100.4	**-**	101.770	80.460	-	-	**2.265**	**3.780**
(1) 10W37	10.88	9.14	**3**	326.4	548.4	**-**	29.190	44.270	-	-	**2.457**	**4.101**
(1) 10W21	6.19	5.06	**4**	185.7	303.6	**149.559**	34.170	48.330	-	21.860	**1.102**	**1.369**
(2) L3x2.5x5/16	3.24	2.69	**5**	97.2	-	**51.42**	-	18.540	1.130	19.340	**0.974**	**1.626**
(2) 12C25, (1) PL 18 x 3/8	21.39	21.39	**6**	641.7	-	**519.67**	-	-	132.290	106.150	**1.235**	**2.061**
(2) 12C25, (1) PL 18 x 7/16	22.515	22.515	**7**	675.45	-	**552.93**	-	-	146.860	118.730	**1.150**	**1.919**

				Capacity						Inventory Rating		Operating Rating	
Section	A	I_z	Ref. Sect.	Shear (kip)	Moment (k-ft)	DL Effects (V, kip)	LL Effects (V, kip)	DL Effects (M, k-ft)	LL Effects (M, k-ft)	Factor (V)	Factor (M)	Factor (V)	Factor (M)
27W91 - End FB	26.77	3129.2	**8**	213.601	575.188	7.460	55.740	46.520	328.420	**1.297**	**0.556**	**2.165**	**0.927**
30W116 - Interior FB	34.13	4919.1	**9**	277.725	809.704	25.800	44.240	159.470	321.450	**1.957**	**0.664**	**3.266**	**1.109**
18W47 - Stringers	13.81	736.4	**10**	102.677	203.452	4.920	22.900	9.400	70.860	**1.490**	**0.957**	**2.488**	**1.597**

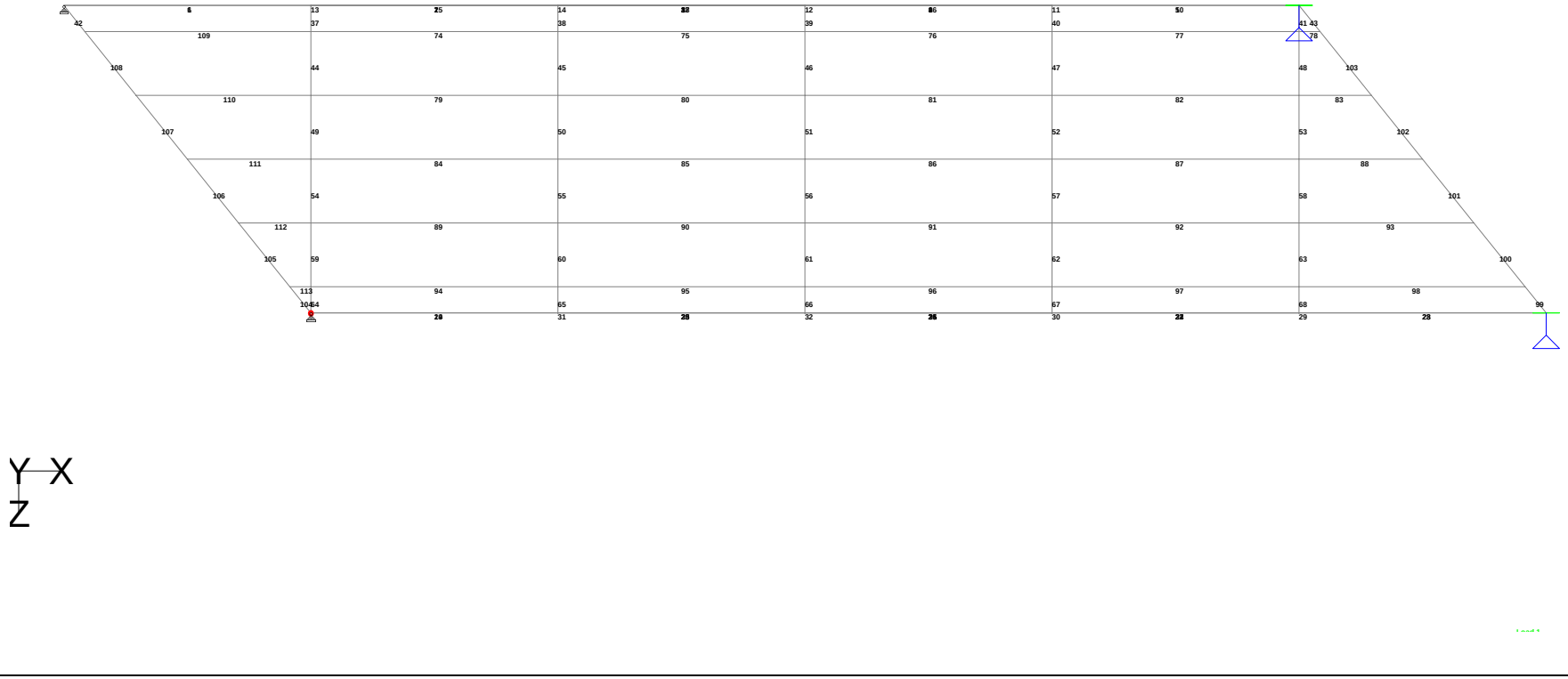
IMPACT FACTOR 0.222 for Trusses
0.300 for Stringers and Floorbeams

For Reference:
Prismatic Section 1 = Bottom Chord (outer)
Prismatic Section 2 = Bottom Chord (center)
Prismatic Section 3 = Verticals
Prismatic Section 4 = Diagonals (outer)
Prismatic Section 5 = Diagonals (center)
Prismatic Section 6 = Top Chord (outer)
Prismatic Section 7 = Top Chord (center)
Prismatic Section 8 = End Floorbeams
Prismatic Section 9 = Interior Floorbeams
Prismatic Section 10 = Stringers

Software licensed to TranSystems	Job No	Sheet No **1**	Rev
	Part		
Job Title	Ref		
	By JPD	Date 14-Nov-14	Chd
Client	File C-100 4_existing_Rev 1.:	Date/Time 18-Nov-2014 10:16	



Software licensed to TranSystems	Job No	Sheet No 1	Rev
	Part		
Job Title	Ref		
	By JPD	Date 14-Nov-14	Chd
Client	File C-100 4_existing_Rev 1.s	Date/Time 18-Nov-2014 10:16	



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****************************************************
*                                                  *
*           STAAD.Pro V8i SELECTseries2            *
*           Version  20.07.07.19                   *
*           Proprietary Program of                 *
*           Bentley Systems, Inc.                  *
*           Date=    NOV 18, 2014                  *
*           Time=    10:16:40                      *
*                                                  *
*      USER ID: TranSystems                        *
****************************************************
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     1. STAAD SPACE
INPUT FILE: C-100  4_existing_Rev 1.STD
     2. START JOB INFORMATION
     3. ENGINEER DATE 14-NOV-14
     4. JOB COMMENT TRUSS SPAN USING STANDARD INDEX (1931) C-100 4
     5. ENGINEER NAME JPD
     6. END JOB INFORMATION
     7. INPUT WIDTH 79
     8. UNIT FEET KIP
     9. JOINT COORDINATES
    10. 1 0 0 0; 2 20 0 0; 3 40 0 0; 4 60 0 0; 5 80 0 0; 6 100 0 0; 7 20 10.5 0
    11. 8 80 10.5 0; 9 40 12.5 0; 10 60 12.5 0; 11 20 0 24.9167; 12 40 0 24.9167
    12. 13 60 0 24.9167; 14 80 0 24.9167; 15 100 0 24.9167; 16 120 0 24.9167
    13. 17 40 10.5 24.9167; 18 60 12.5 24.9167; 19 80 12.5 24.9167
    14. 20 100 10.5 24.9167; 22 20 0 2.125; 23 40 0 2.125; 24 60 0 2.125
    15. 25 80 0 2.125; 26 100 0 2.125; 28 20 0 7.29167; 29 40 0 7.29167
    16. 30 60 0 7.29167; 31 80 0 7.29167; 32 100 0 7.29167; 34 20 0 12.4583
    17. 35 40 0 12.4583; 36 60 0 12.4583; 37 80 0 12.4583; 38 100 0 12.4583
    18. 40 20 0 17.625; 41 40 0 17.625; 42 60 0 17.625; 43 80 0 17.625
    19. 44 100 0 17.625; 46 20 0 22.7917; 47 40 0 22.7917; 48 60 0 22.7917
    20. 49 80 0 22.7917; 50 100 0 22.7917; 56 118.294 0 22.7917; 57 114.147 0 17.625
    21. 58 110 0 12.4583; 59 105.853 0 7.29167; 60 101.706 0 2.125
    22. 61 18.2943 0 22.7917; 62 14.1472 0 17.625; 63 10 0 12.4583
    23. 64 5.85284 0 7.29167; 65 1.70569 0 2.125
    24. MEMBER INCIDENCES
    25. 1 1 2; 2 2 3; 3 3 4; 4 4 5; 5 5 6; 6 1 7; 7 7 9; 8 9 10; 9 10 8; 10 8 6
    26. 11 8 5; 12 10 4; 13 7 2; 14 9 3; 15 7 3; 16 8 4; 17 9 4; 18 10 3; 19 11 12
    27. 20 12 13; 21 13 14; 22 14 15; 23 15 16; 24 11 17; 25 17 18; 26 18 19; 27 19 20
    28. 28 20 16; 29 20 15; 30 19 14; 31 17 12; 32 18 13; 33 17 13; 34 20 14; 35 18 14
    29. 36 19 13; 37 2 22; 38 3 23; 39 4 24; 40 5 25; 41 6 26; 42 1 65; 43 6 60
    30. 44 22 28; 45 23 29; 46 24 30; 47 25 31; 48 26 32; 49 28 34; 50 29 35; 51 30 36
    31. 52 31 37; 53 32 38; 54 34 40; 55 35 41; 56 36 42; 57 37 43; 58 38 44; 59 40 46
    32. 60 41 47; 61 42 48; 62 43 49; 63 44 50; 64 46 11; 65 47 12; 66 48 13; 67 49 14
    33. 68 50 15; 74 22 23; 75 23 24; 76 24 25; 77 25 26; 78 26 60; 79 28 29; 80 29 30
    34. 81 30 31; 82 31 32; 83 32 59; 84 34 35; 85 35 36; 86 36 37; 87 37 38; 88 38 58
    35. 89 40 41; 90 41 42; 91 42 43; 92 43 44; 93 44 57; 94 46 47; 95 47 48; 96 48 49
    36. 97 49 50; 98 50 56; 99 56 16; 100 57 56; 101 58 57; 102 59 58; 103 60 59
    37. 104 61 11; 105 62 61; 106 63 62; 107 64 63; 108 65 64; 109 65 22; 110 64 28
    38. 111 63 34; 112 62 40; 113 61 46
    39. DEFINE MATERIAL START
    40. ISOTROPIC STEEL
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41. E 4.176E+006
42. POISSON 0.3
43. DENSITY 0.489024
44. ALPHA 6.5E-006
45. DAMP 0.03
46. TYPE STEEL
47. STRENGTH FY 5184 FU 8352 RY 1.5 RT 1.2
48. END DEFINE MATERIAL
49. MEMBER PROPERTY AMERICAN
50. 1 2 4 5 19 20 22 23 PRIS AX 0.122083 IX 7.7E-005 IY 0.027853 IZ 0.015548
51. 3 21 PRIS AX 0.1425 IX 0.000124 IY 0.032608 IZ 0.017245
52. 11 TO 14 29 TO 32 PRIS AX 0.075556 IX 3.6E-005 IY 0.002035 IZ 0.009496
53. 15 16 33 34 PRIS AX 0.042986 IX 1E-005 IY 0.000468 IZ 0.005126
54. 17 18 35 36 PRIS AX 0.0225 IX 5E-006 IY 0.005263 IZ 0.000135
55. 6 10 24 28 PRIS AX 0.148542 IX 6.2E-005 IY 0.04073 IZ 0.022375
56. 7 TO 9 25 TO 27 PRIS AX 0.156354 IX 7.1E-005 IY 0.042192 IZ 0.023396
57. 42 43 99 TO 108 PRIS AX 0.185903 IX 0.000164 IY 0.005257 IZ 0.150907
58. 37 TO 41 44 TO 68 PRIS AX 0.237014 IX 0.000294 IY 0.007388 IZ 0.237225
59. 74 TO 98 109 TO 113 PRIS AX 0.095903 IX 4.6E-005 IY 0.001616 IZ 0.035513
60. CONSTANTS
61. MATERIAL STEEL ALL
62. SUPPORTS
63. 1 11 PINNED
64. 6 16 FIXED BUT FX MX MY MZ
65. DEFINE MOVING LOAD
66. TYPE 1 LOAD 4 16 16
67. DIST 14 14 WID 6
68. TYPE 2 LOAD 16 16 4
69. DIST 14 14 WID 6
70. LOAD 1 LOADTYPE DEAD  TITLE DEAD
71. SELFWEIGHT Y -1.1
72. ***ADD 10% FOR LACING AND CONNECTION ELEMENTS
73. **
74. **FOLLOWING MEMBER AND JOINT LOADS ARE FOR CONCRETE DECK AND MISCE.
75. MEMBER LOAD
76. 74 TO 98 109 TO 113 UNI GY -0.437
77. JOINT LOAD
78. 1 6 11 16 FY -0.4
79. 2 TO 5 12 TO 15 FY -0.8
80. **LIVE LOAD GENERATIONS***********************************
81. **FOR LEFT TRUSS (TWO LANES HS20 FORWARD)
82. LOAD GENERATION 100
83. TYPE 1 0 0 9.4583 XINC 1
84. TYPE 1 0 0 21.4583 XINC 1
85. **FOR LEFT TRUSS (TWO LANES HS20 BACKWARD)
86. LOAD GENERATION 100
**WARNING-A MOVING LOAD THAT WOULD HAVE BEEN APPLIED BEYOND THE X AND Z RANGES
          OF THE STRUCTURE HAS BEEN IGNORED. CASE=   95 WHEEL   5 OF   6
**WARNING-A MOVING LOAD THAT WOULD HAVE BEEN APPLIED BEYOND THE X AND Z RANGES
          OF THE STRUCTURE HAS BEEN IGNORED. CASE=   95 WHEEL   6 OF   6
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          OF THE STRUCTURE HAS BEEN IGNORED. CASE=   96 WHEEL   5 OF   6
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**WARNING-A MOVING LOAD THAT WOULD HAVE BEEN APPLIED BEYOND THE X AND Z RANGES
          OF THE STRUCTURE HAS BEEN IGNORED. CASE=   97 WHEEL   5 OF   6
**WARNING-A MOVING LOAD THAT WOULD HAVE BEEN APPLIED BEYOND THE X AND Z RANGES
          OF THE STRUCTURE HAS BEEN IGNORED. CASE=   97 WHEEL   6 OF   6
*ADDITIONAL MOVING LOAD MESSAGES SUPPRESSED
*ADDITIONAL MOVING LOAD MESSAGES SUPPRESSED
 87. TYPE 2 0 0 9.4583 XINC 1
 88. TYPE 2 0 0 21.4583 XINC 1
 89. **FOR CENTER STRINGERS
 90. LOAD GENERATION 100
 91. TYPE 1 0 0 12.4583 XINC 1
 92. **FOR MOMENTS OF FLOOR BEAMS (TWO LANES HS20)
 93. LOAD GENERATION 100
 94. TYPE 1 0 0 10.4583 XINC 1
 95. TYPE 1 0 0 20.4583 XINC 1
 96. LOAD GENERATION 100
 97. TYPE 2 0 0 10.4583 XINC 1
 98. TYPE 2 0 0 20.4583 XINC 1
 99. PERFORM ANALYSIS


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

  NUMBER OF JOINTS/MEMBER+ELEMENTS/SUPPORTS =    55/   108/     4

        SOLVER USED IS THE OUT-OF-CORE BASIC SOLVER

  ORIGINAL/FINAL BAND-WIDTH=    54/     7/     48 DOF
  TOTAL PRIMARY LOAD CASES =  501, TOTAL DEGREES OF FREEDOM =    320
  SIZE OF STIFFNESS MATRIX =       16 DOUBLE  KILO-WORDS
  REQRD/AVAIL. DISK SPACE  =     16.7/      0.0 MB



 **** WARNING : AVAILABLE HARD DISK SPACE MAY NOT BE
ENOUGH TO COMPLETE EXECUTION. IF YOUR AVAILABLE HARD DISK
SPACE ON THE ANALYSIS DRIVE IS GREATER THAN 3GB THIS MESSAGE
MAY BE ERRONEOUS



 100. LOAD LIST 1
 101. ***DEAD LOAD EFFECTS IN TRUSS MEMBERS
 102. PRINT MEMBER FORCES LIST 1 TO 18
```

MEMBER END FORCES STRUCTURE TYPE = SPACE

ALL UNITS ARE -- KIP FEET (LOCAL)

MEMBER	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
1	1	1	-91.74	1.01	-2.01	0.00	23.85	3.17
		2	91.74	0.31	2.01	0.00	16.36	3.85
2	1	2	-76.29	0.99	-1.12	0.00	11.77	3.15
		3	76.29	0.33	1.12	0.00	10.55	3.45
3	1	3	-101.77	0.77	0.18	-0.01	-0.68	-0.89
		4	101.77	0.76	-0.18	0.01	-2.88	1.01
4	1	4	-77.45	0.34	0.72	-0.01	-6.23	-3.31
		5	77.45	0.98	-0.72	0.01	-8.11	-3.10
5	1	5	-89.27	0.48	2.06	0.00	-14.34	-3.01
		6	89.27	0.84	-2.06	0.00	-26.80	-0.61
6	1	1	129.23	0.89	-0.35	0.01	10.52	0.69
		7	-128.39	0.71	0.35	-0.01	-2.65	1.37
7	1	7	146.30	1.33	-0.28	-0.01	2.49	4.51
		9	-146.13	0.35	0.28	0.01	3.17	5.36
8	1	9	145.81	0.85	-0.06	0.00	-2.35	-2.11
		10	-145.81	0.83	0.06	0.00	3.65	2.27
9	1	10	146.86	0.35	0.06	0.00	-3.38	-5.25
		8	-147.03	1.33	-0.06	0.00	2.23	-4.61
10	1	8	131.45	0.91	0.44	-0.01	-2.50	-0.25
		6	-132.29	0.69	-0.44	0.01	-7.49	2.67
11	1	8	-29.19	1.14	-0.38	0.00	0.94	5.87
		5	28.76	-1.14	0.38	0.00	3.06	6.14
12	1	10	-13.85	0.54	-0.12	0.00	0.16	3.44
		4	13.34	-0.54	0.12	0.00	1.30	3.29
13	1	7	-27.02	-1.32	-0.06	0.01	-0.90	-6.84
		2	26.60	1.32	0.06	-0.01	1.58	-7.06
14	1	9	-13.33	-0.58	-0.20	0.00	0.81	-3.70
		3	12.82	0.58	0.20	0.00	1.70	-3.56
15	1	7	-34.17	0.30	0.00	0.00	-0.14	0.95
		3	33.92	0.17	0.00	0.00	0.19	0.52

MEMBER END FORCES STRUCTURE TYPE = SPACE

ALL UNITS ARE -- KIP FEET (LOCAL)

MEMBER	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
16	1	8	-32.03	0.30	0.00	0.00	-0.01	1.02
		4	31.79	0.16	0.00	0.00	-0.07	0.55
17	1	9	0.17	0.12	-0.02	0.00	-0.95	0.45
		4	-0.32	0.12	0.02	0.00	1.33	-0.45
18	1	10	0.98	0.12	0.01	0.00	-0.33	0.45
		3	-1.13	0.12	-0.01	0.00	0.20	-0.45

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

103. ***DEAD LOAD EFFECTS IN STRINGERS
104. PRINT MEMBER FORCES LIST 85

MEMBER END FORCES STRUCTURE TYPE = SPACE

ALL UNITS ARE -- KIP FEET (LOCAL)

MEMBER	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
85	1	35	4.01	4.92	0.04	0.00	-0.40	9.40
		36	-4.01	4.85	-0.04	0.00	-0.39	-8.68

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

105. ***DEAD LOAD EFFECTS IN INT. AND END FLOOR BEAMS
106. PRINT MEMBER FORCES LIST 12 32 39 42 46 51 56 61 66 104 TO 108

MEMBER END FORCES STRUCTURE TYPE = SPACE

ALL UNITS ARE -- KIP FEET (LOCAL)

MEMBER	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
12	1	10	-13.85	0.54	-0.12	0.00	0.16	3.44
		4	13.34	-0.54	0.12	0.00	1.30	3.29
32	1	18	-13.85	-0.54	0.12	0.00	-0.16	-3.45
		13	13.35	0.54	-0.12	0.00	-1.30	-3.29
39	1	4	-0.68	25.80	-4.65	0.01	8.04	2.04
		24	0.68	-25.53	4.65	-0.01	1.84	52.50
42	1	1	-14.76	7.46	17.52	0.05	-33.17	-6.22
		65	14.76	-7.19	-17.52	-0.05	-14.58	26.18
46	1	24	-0.79	15.85	-0.06	0.02	-0.53	-52.50
		30	0.79	-15.19	0.06	-0.02	0.86	132.71
51	1	30	-0.83	5.51	-0.08	0.02	0.04	-132.71
		36	0.83	-4.85	0.08	-0.02	0.39	159.47
56	1	36	-0.83	-4.85	-0.08	0.02	0.39	-159.47
		42	0.83	5.51	0.08	-0.02	0.04	132.71
61	1	42	-0.79	-15.19	-0.06	0.02	0.86	-132.71
		48	0.79	15.85	0.06	-0.02	-0.53	52.50
66	1	48	-0.68	-25.53	-4.65	0.01	1.84	-52.50
		13	0.68	25.80	4.65	-0.01	8.03	-2.04
104	1	61	8.24	0.31	-6.45	0.00	6.46	-2.85
		11	-8.24	-0.04	6.45	0.00	11.10	3.34
105	1	62	1.65	-3.20	1.05	0.01	-0.06	-26.25
		61	-1.65	3.86	-1.05	-0.01	-6.87	2.84
106	1	63	0.08	-2.35	0.81	0.02	-1.47	-44.02
		62	-0.08	3.01	-0.81	-0.02	-3.87	26.24
107	1	64	0.17	-0.05	-0.01	0.01	0.78	-46.52
		63	-0.17	0.71	0.01	-0.01	-0.74	44.02
108	1	65	0.78	3.39	-1.19	0.00	10.44	-26.23
		64	-0.78	-2.73	1.19	0.00	-2.56	46.53

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

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107. LOAD LIST 2 TO 501
108. ***LIVE LOAD EFFECTS IN TRUSS MEMBERS
109. PRINT MAXFORCE ENVELOPE LIST 1 TO 18
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MEMBER FORCE ENVELOPE

ALL UNITS ARE KIP FEET

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	0.48	0.00	423	3.38	0.00	428			
		-0.04	0.00	301	15.86	0.00	402	1.93 T	0.00	301
	MIN	0.00	20.00	301	-6.56	20.00	120			
		-1.18	20.00	402	-9.23	20.00	35	65.40 T	20.00	126
2	MAX	0.65	0.00	143	5.21	0.00	144			
		0.08	0.00	394	9.76	0.00	143	1.82 T	0.00	301
	MIN	-0.39	20.00	403	-8.04	20.00	140			
		-0.97	20.00	145	-9.76	20.00	146	57.19 T	20.00	125
3	MAX	0.52	0.00	161	3.00	0.00	164			
		0.44	0.00	4	4.58	20.00	121	0.91 T	0.00	301
	MIN	-0.51	20.00	16	-7.76	20.00	158			
		-0.28	20.00	63	-4.59	0.00	2	80.46 T	20.00	145
4	MAX	0.41	0.00	180	5.49	20.00	31			
		0.70	0.00	26	6.76	20.00	138	2.26 C	0.00	402
	MIN	-0.67	20.00	33	-8.17	0.00	36			
		-0.04	20.00	184	-7.21	0.00	24	68.23 T	20.00	57
5	MAX	0.63	0.00	70	26.76	20.00	394			
		1.27	0.00	158	16.99	20.00	53	1.05 C	0.00	301
	MIN	-1.84	20.00	394	-13.23	20.00	70			
		0.07	20.00	301	-8.70	0.00	152	74.55 T	20.00	57
6	MAX	0.30	0.00	423	1.50	0.00	431			
		0.50	0.00	402	12.98	0.00	428	105.26 C	0.00	124
	MIN	-0.03	22.59	402	-6.11	22.59	118			
		-0.55	22.59	426	-15.17	0.00	402	2.60 T	22.59	394
7	MAX	0.84	0.00	141	6.28	0.00	144			
		0.42	0.00	402	4.74	20.10	402	118.73 C	0.00	136
	MIN	-0.38	20.10	103	-10.99	20.10	139			
		-0.43	20.10	442	-5.94	20.10	434	3.58 T	20.10	394
8	MAX	0.55	0.00	161	2.52	20.00	11			
		0.05	0.00	308	4.10	20.00	402	112.94 C	0.00	143
	MIN	-0.54	20.00	16	-9.07	20.00	157			
		-0.11	20.00	468	-5.15	20.00	448	4.05 T	20.00	394
9	MAX	0.37	0.00	181	6.60	20.10	31			
		0.31	0.00	334	3.35	0.00	402	118.23 C	0.00	40

	MIN	-0.86	20.10	33	-11.11	0.00	36			
		-0.23	20.10	488	-5.85	0.00	342	5.30 T	20.10	394
10	MAX	0.88	0.00	70	34.39	22.59	394			
		0.72	0.00	354	12.85	22.59	354	106.15 C	0.00	55
	MIN	-2.10	22.59	394	-19.14	22.59	70			
		-0.46	22.59	394	-11.03	22.59	394	10.91 T	22.59	394
11	MAX	1.58	0.00	36	8.38	0.00	35			
		0.29	0.00	394	3.18	10.50	394	4.43 C	0.00	394
	MIN	-0.90	10.50	71	-8.21	10.50	36			
		-0.72	10.50	361	-5.83	10.50	359	44.27 T	10.50	62
12	MAX	1.18	0.00	21	7.35	0.00	21			
		0.19	0.00	494	1.63	12.50	494	3.31 C	0.00	9
	MIN	-0.69	12.50	175	-7.34	12.50	21			
		-0.44	12.50	455	-4.32	12.50	455	21.51 T	12.50	159
13	MAX	0.37	0.00	402	8.12	10.50	140			
		0.21	0.00	448	2.15	10.50	402	0.82 C	0.00	153
	MIN	-1.56	10.50	141	-8.29	0.00	141			
		-0.37	10.50	422	-3.41	10.50	422	43.04 T	10.50	3
14	MAX	0.68	0.00	2	7.17	12.50	155			
		0.39	0.00	402	3.60	12.50	402	3.70 C	0.00	168
	MIN	-1.15	12.50	155	-7.18	0.00	155			
		-0.48	12.50	433	-4.53	12.50	433	21.69 T	12.50	17
15	MAX	0.10	0.00	138	0.64	0.00	143			
		0.00	0.00	468	0.28	22.59	402	19.80 C	0.00	403
	MIN	-0.02	22.59	102	-1.68	22.59	135			
		-0.02	22.59	438	-0.36	22.59	437	47.59 T	22.59	144
16	MAX	0.10	0.00	37	0.68	0.00	33			
		0.02	0.00	337	0.29	22.59	338	21.86 C	0.00	181
	MIN	-0.06	22.59	394	-1.68	22.59	40			
		-0.01	22.59	480	-0.22	0.00	394	48.33 T	22.59	32
17	MAX	0.00	0.00	158	0.00	23.58	394			
		0.13	0.00	314	1.65	23.58	308	19.34 C	0.00	13
	MIN	0.00	23.58	16	-0.04	23.58	41			
		-0.18	23.58	459	-3.65	23.58	458	18.54 T	23.58	163
18	MAX	0.00	0.00	18	0.00	0.00	394			
		0.17	0.00	428	2.92	23.58	319	18.91 C	0.00	163
	MIN	0.00	23.58	160	-0.04	23.58	135			
		-0.14	23.58	462	-2.25	23.58	465	17.94 T	23.58	13

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

110. ***LIVE LOAD EFFECTS IN STRINGERS
111. PRINT MAXFORCE ENVELOPE LIST 85

MEMBER FORCE ENVELOPE

ALL UNITS ARE KIP FEET

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
85	MAX	22.90	0.00	329	37.02	20.00	241			
		0.02	0.00	358	0.24	20.00	358	2.62 C	0.00	346
	MIN	-22.89	20.00	447	-70.86	10.00	438			
		0.00	20.00	301	-0.24	0.00	358	0.04 C	20.00	301

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

112. ***LIVE LOAD EFFECTS IN INT. AND END FLOOR BEAMS
113. PRINT MAXFORCE ENVELOPE LIST 12 32 39 42 46 51 56 61 66 104 TO 108

MEMBER FORCE ENVELOPE

ALL UNITS ARE KIP FEET

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
12	MAX	1.18	0.00	21	7.35	0.00	21			
		0.19	0.00	494	1.63	12.50	494	3.31 C	0.00	9
	MIN	-0.69	12.50	175	-7.34	12.50	21			
		-0.44	12.50	455	-4.32	12.50	455	21.51 T	12.50	159
32	MAX	0.69	0.00	21	7.34	12.50	175			
		0.44	0.00	341	4.32	12.50	341	3.31 C	0.00	187
	MIN	-1.18	12.50	175	-7.35	0.00	175			
		-0.18	12.50	302	-1.60	12.50	302	21.52 T	12.50	37
39	MAX	44.24	0.00	154	6.37	0.00	455			
		4.49	0.00	175	12.06	0.00	126	0.22 C	0.00	402
	MIN	-2.21	2.12	4	-88.18	2.12	42			
		-8.08	2.12	126	-5.30	0.00	475	1.14 T	2.12	454
42	MAX	37.46	0.00	102	9.08	0.00	402			
		12.52	0.00	428	10.17	2.72	126	0.21 T	0.00	301
	MIN	-2.71	2.72	433	-93.96	2.72	102			
		0.27	2.72	301	-24.06	0.00	430	10.47 T	2.72	430
46	MAX	38.12	0.00	348	10.17	5.17	303			
		0.70	0.00	18	3.96	0.00	175	0.22 C	0.00	402
	MIN	-1.49	5.17	494	-251.01	5.17	454			
		-0.94	5.17	175	-3.69	0.00	18	1.24 T	5.17	454
51	MAX	18.76	0.00	448	13.37	5.17	302			
		0.04	0.00	180	0.35	0.00	16	0.21 C	0.00	402
	MIN	-11.59	5.17	234	-321.45	5.17	454			
		-0.10	5.17	20	-0.44	0.00	179	1.26 T	5.17	453
56	MAX	1.12	0.00	206	13.37	0.00	302			
		0.00	0.00	135	0.35	0.00	119	0.21 C	0.00	394
	MIN	-18.76	5.17	348	-321.45	0.00	454			
		-0.08	5.17	402	-0.25	5.17	169	1.26 T	5.17	453
61	MAX	1.49	0.00	302	10.15	0.00	493			
		0.77	0.00	180	4.01	5.17	70	0.22 C	0.00	394
	MIN	-38.12	4.74	448	-251.00	0.00	342			
		-1.00	5.17	20	-4.22	5.17	20	1.24 T	5.17	342
66	MAX	2.21	0.00	192	6.37	2.12	341			
		4.41	0.00	21	5.33	0.00	70	0.22 C	0.00	394

```
    MIN    -44.24   2.12   42     -88.17   0.00  154
            -7.96   2.12   70     -11.57   2.12   70      1.14 T   2.12  342

104 MAX      8.89   0.00  130      97.59   2.72  402
             0.63   0.00  402       5.37   0.00  441      6.59 C   0.00  138
    MIN    -23.70   2.72  105     -55.61   0.00  422
            -5.42   2.72  442      -9.41   2.72  442      0.05 T   2.72  401

105 MAX      4.88   0.00  430      46.18   6.63  402
             0.93   0.00  137       5.76   6.63  139      1.04 C   0.00  442
    MIN    -55.74   6.63  102    -197.30   0.00  403
            -0.04   6.63   94      -0.49   0.00   16      0.02 C   6.63  301

106 MAX      4.16   0.00  212      20.76   0.00  434
             0.58   0.00  146       2.76   6.63  147      0.18 C   0.00  118
    MIN    -31.22   6.63  102    -326.65   0.00  402
             0.01   6.63  301      -1.09   0.00  145      0.10 T   6.63  152

107 MAX     15.22   0.00  402      20.77   6.63  434
             0.06   0.00  306       0.79   0.00  353      0.14 C   0.00  119
    MIN     -3.98   6.07  410    -328.42   4.42  402
            -0.06   6.63   58      -0.17   0.00  402      0.02 T   6.63  145

108 MAX     35.08   0.00  402      14.53   6.63  433
            -0.04   0.00  266       7.62   0.00  125      0.86 C   0.00  119
    MIN     -2.21   6.63  433    -266.93   6.63  402
            -1.01   6.63  121      -0.07   6.63  294      0.03 T   6.63   56


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


114. FINISH


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

             **** DATE= NOV 18,2014   TIME= 10:17: 6 ****
```

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*************************************************************
*         For questions on STAAD.Pro, please contact        *
*    Bentley Systems Offices at the following locations     *
*                                                           *
*               Telephone             Web / Email           *
*                                                           *
*  USA:      +1 (714)974-2500                               *
*  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     *
*  CHINA     +86 10 5929 7000                               *
*  THAILAND  +66(0)2645-1018/19 partha.p@reisoftwareth.com *
*                                                           *
* Worldwide    http://selectservices.bentley.com/en-US/     *
*                                                           *
*************************************************************
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APPENDIX D

Alternative 3(c) Analysis Results (Pony Truss Main Span)

SH-66B over Captain Creek

LFR Inventory and Operating Ratings

By: JPD 12/3/2014

Check: JH 12/3/2014

TRUSS SPAN: 22'-0" CURB-TO-CURB WIDTH (Pedestrian Loading)

				CAPACITY			DEMAND					
Section	A (gross)	A (net)	Ref. Sect.	Yielding (kip)	Fracture (kip)	Buckling (kip)	DL Effects (T)	LL Effects (T)	DL Effects (C)	LL Effects (C)	Inventory Rating Factor	Operating Rating Factor
(2) 12C30	17.58	15.8	**1**	527.4	948	-	91.740	53.740	-	-	**2.864**	**4.780**
(2) 12C35	20.52	18.34	**2**	615.6	1100.4	-	101.770	60.840	-	-	**2.995**	**5.000**
(1) 10W37	10.88	9.14	**3**	326.4	548.4	-	29.190	19.060	-	-	**5.706**	**9.525**
(1) 10W21	6.19	5.06	**4**	185.7	303.6	149.559	34.170	21.520	-	-	**2.475**	**4.132**
(2) L3x2.5x5/16	3.24	2.69	**5**	97.2	-	**51.42**	-	-	1.130	0.760	**24.782**	**41.366**
(2) 12C25, (1) PL 18 x 3/8	21.39	21.39	**6**	641.7	-	**519.67**	-	-	132.290	79.440	**1.650**	**2.755**
(2) 12C25, (1) PL 18 x 7/16	22.515	22.515	**7**	675.45	-	**552.93**	-	-	147.030	88.070	**1.549**	**2.585**

				Capacity						Inventory Rating		Operating Rating	
Section	A	I_z	Ref. Sect.	Shear (kip)	Moment (k-ft)	DL Effects (V, kip)	LL Effects (V, kip)	DL Effects (M, k-ft)	LL Effects (M, k-ft)	Factor (V)	Factor (M)	Factor (V)	Factor (M)
27W91 - End FB	26.77	3129.2	**8**	213.601	575.188	7.460	4.230	52.500	31.780	**17.088**	**5.655**	**28.523**	**9.439**
30W116 - Interior FB	34.13	4919.1	**9**	277.725	809.704	25.800	18.500	159.470	133.790	**4.679**	**1.596**	**7.810**	**2.664**
18W47 - Stringers	13.81	736.4	**10**	102.677	203.452	4.920	4.060	9.400	10.780	**8.406**	**6.288**	**14.032**	**10.497**

IMPACT FACTOR 0.222 for Trusses

0.300 for Stringers and Floor Beams

For Reference:

Prismatic Section 1 = Bottom Chord (outer)

Prismatic Section 2 = Bottom Chord (center)

Prismatic Section 3 = Verticals

Prismatic Section 4 = Diagonals (outer)

Prismatic Section 5 = Diagonals (center)

Prismatic Section 6 = Top Chord (outer)

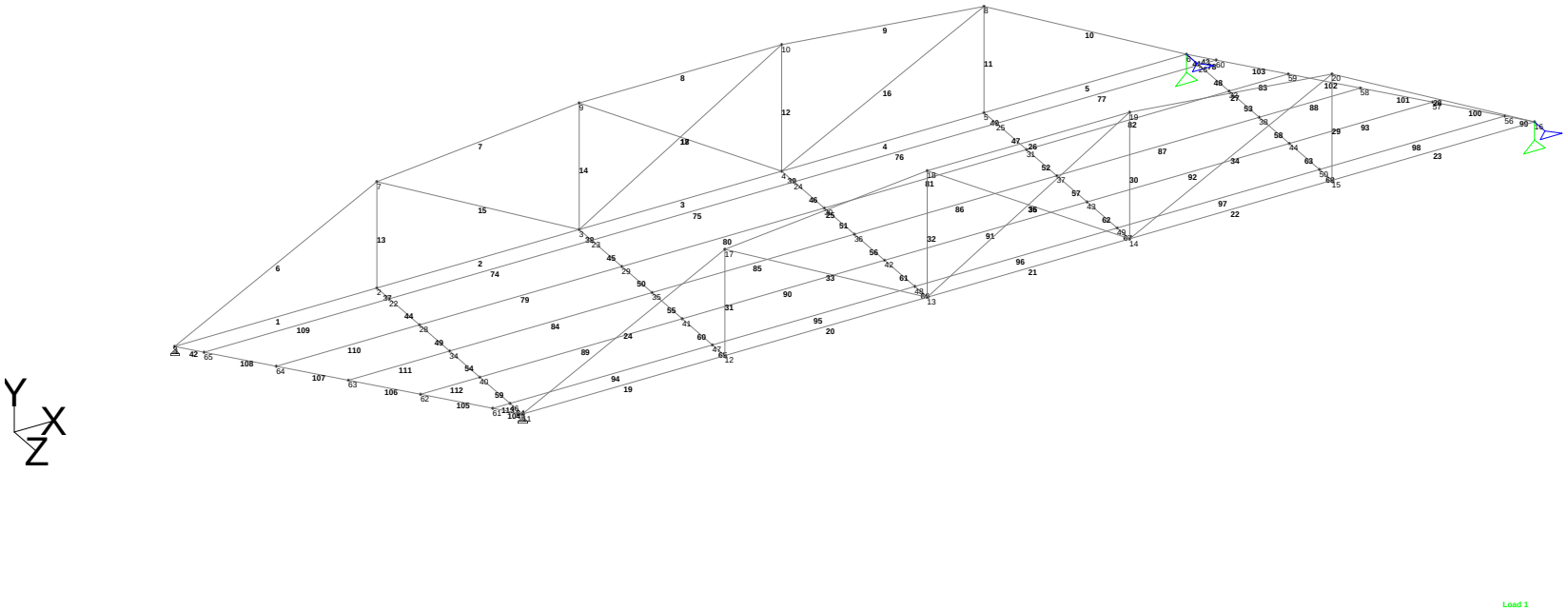
Prismatic Section 7 = Top Chord (center)

Prismatic Section 8 = End Floorbeams

Prismatic Section 9 = Interior Floorbeams

Prismatic Section 10 = Stringers

Software licensed to TranSystems	Job No	Sheet No **1**	Rev
	Part		
Job Title	Ref		
	By JPD	Date 14-Nov-14	Chd
Client	File C-100 4_pedestrian_Rev	Date/Time 18-Nov-2014 10:27	



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****************************************************
*                                                  *
*           STAAD.Pro V8i SELECTseries2            *
*           Version  20.07.07.19                   *
*           Proprietary Program of                 *
*           Bentley Systems, Inc.                  *
*           Date=    NOV 18, 2014                  *
*           Time=    10:29:21                      *
*                                                  *
*      USER ID: TranSystems                        *
****************************************************
```

```
     1. STAAD SPACE
INPUT FILE: C-100  4_pedestrian_Rev 1.STD
     2. START JOB INFORMATION
     3. ENGINEER DATE 14-NOV-14
     4. JOB COMMENT TRUSS SPAN USING STANDARD INDEX (1931) C-100 4
     5. ENGINEER NAME JPD
     6. END JOB INFORMATION
     7. INPUT WIDTH 79
     8. UNIT FEET KIP
     9. JOINT COORDINATES
    10. 1 0 0 0; 2 20 0 0; 3 40 0 0; 4 60 0 0; 5 80 0 0; 6 100 0 0; 7 20 10.5 0
    11. 8 80 10.5 0; 9 40 12.5 0; 10 60 12.5 0; 11 20 0 24.9167; 12 40 0 24.9167
    12. 13 60 0 24.9167; 14 80 0 24.9167; 15 100 0 24.9167; 16 120 0 24.9167
    13. 17 40 10.5 24.9167; 18 60 12.5 24.9167; 19 80 12.5 24.9167
    14. 20 100 10.5 24.9167; 22 20 0 2.125; 23 40 0 2.125; 24 60 0 2.125
    15. 25 80 0 2.125; 26 100 0 2.125; 28 20 0 7.29167; 29 40 0 7.29167
    16. 30 60 0 7.29167; 31 80 0 7.29167; 32 100 0 7.29167; 34 20 0 12.4583
    17. 35 40 0 12.4583; 36 60 0 12.4583; 37 80 0 12.4583; 38 100 0 12.4583
    18. 40 20 0 17.625; 41 40 0 17.625; 42 60 0 17.625; 43 80 0 17.625
    19. 44 100 0 17.625; 46 20 0 22.7917; 47 40 0 22.7917; 48 60 0 22.7917
    20. 49 80 0 22.7917; 50 100 0 22.7917; 56 118.294 0 22.7917; 57 114.147 0 17.625
    21. 58 110 0 12.4583; 59 105.853 0 7.29167; 60 101.706 0 2.125
    22. 61 18.2943 0 22.7917; 62 14.1472 0 17.625; 63 10 0 12.4583
    23. 64 5.85284 0 7.29167; 65 1.70569 0 2.125
    24. MEMBER INCIDENCES
    25. 1 1 2; 2 2 3; 3 3 4; 4 4 5; 5 5 6; 6 1 7; 7 7 9; 8 9 10; 9 10 8; 10 8 6
    26. 11 8 5; 12 10 4; 13 7 2; 14 9 3; 15 7 3; 16 8 4; 17 9 4; 18 10 3; 19 11 12
    27. 20 12 13; 21 13 14; 22 14 15; 23 15 16; 24 11 17; 25 17 18; 26 18 19; 27 19 20
    28. 28 20 16; 29 20 15; 30 19 14; 31 17 12; 32 18 13; 33 17 13; 34 20 14; 35 18 14
    29. 36 19 13; 37 2 22; 38 3 23; 39 4 24; 40 5 25; 41 6 26; 42 1 65; 43 6 60
    30. 44 22 28; 45 23 29; 46 24 30; 47 25 31; 48 26 32; 49 28 34; 50 29 35; 51 30 36
    31. 52 31 37; 53 32 38; 54 34 40; 55 35 41; 56 36 42; 57 37 43; 58 38 44; 59 40 46
    32. 60 41 47; 61 42 48; 62 43 49; 63 44 50; 64 46 11; 65 47 12; 66 48 13; 67 49 14
    33. 68 50 15; 74 22 23; 75 23 24; 76 24 25; 77 25 26; 78 26 60; 79 28 29; 80 29 30
    34. 81 30 31; 82 31 32; 83 32 59; 84 34 35; 85 35 36; 86 36 37; 87 37 38; 88 38 58
    35. 89 40 41; 90 41 42; 91 42 43; 92 43 44; 93 44 57; 94 46 47; 95 47 48; 96 48 49
    36. 97 49 50; 98 50 56; 99 56 16; 100 57 56; 101 58 57; 102 59 58; 103 60 59
    37. 104 61 11; 105 62 61; 106 63 62; 107 64 63; 108 65 64; 109 65 22; 110 64 28
    38. 111 63 34; 112 62 40; 113 61 46
    39. DEFINE MATERIAL START
    40. ISOTROPIC STEEL
```

```
41. E 4.176E+006
42. POISSON 0.3
43. DENSITY 0.489024
44. ALPHA 6.5E-006
45. DAMP 0.03
46. TYPE STEEL
47. STRENGTH FY 5184 FU 8352 RY 1.5 RT 1.2
48. END DEFINE MATERIAL
49. MEMBER PROPERTY AMERICAN
50. 1 2 4 5 19 20 22 23 PRIS AX 0.122083 IX 7.7E-005 IY 0.027853 IZ 0.015548
51. 3 21 PRIS AX 0.1425 IX 0.000124 IY 0.032608 IZ 0.017245
52. 11 TO 14 29 TO 32 PRIS AX 0.075556 IX 3.6E-005 IY 0.002035 IZ 0.009496
53. 15 16 33 34 PRIS AX 0.042986 IX 1E-005 IY 0.000468 IZ 0.005126
54. 17 18 35 36 PRIS AX 0.0225 IX 5E-006 IY 0.005263 IZ 0.000135
55. 6 10 24 28 PRIS AX 0.148542 IX 6.2E-005 IY 0.04073 IZ 0.022375
56. 7 TO 9 25 TO 27 PRIS AX 0.156354 IX 7.1E-005 IY 0.042192 IZ 0.023396
57. 42 43 99 TO 108 PRIS AX 0.185903 IX 0.000164 IY 0.005257 IZ 0.150907
58. 37 TO 41 44 TO 68 PRIS AX 0.237014 IX 0.000294 IY 0.007388 IZ 0.237225
59. 74 TO 98 109 TO 113 PRIS AX 0.095903 IX 4.6E-005 IY 0.001616 IZ 0.035513
60. CONSTANTS
61. MATERIAL STEEL ALL
62. SUPPORTS
63. 1 11 PINNED
64. 6 16 FIXED BUT FX MX MY MZ
65. LOAD 1 LOADTYPE DEAD  TITLE DEAD
66. SELFWEIGHT Y -1.1
67. ***ADD 10% FOR LACING AND CONNECTION ELEMENTS
68. **
69. **FOLLOWING MEMBER AND JOINT LOADS ARE FOR CONCRETE DECK AND MISCE.
70. MEMBER LOAD
71. 74 TO 98 109 TO 113 UNI GY -0.437
72. JOINT LOAD
73. 1 6 11 16 FY -0.4
74. 2 TO 5 12 TO 15 FY -0.8
75. LOAD 2 LOADTYPE LIVE  TITLE PEDESTRIAN LOAD
76. FLOOR LOAD
77. YRANGE 0 0 FLOAD -0.09 XRANGE 0 120  ZRANGE 1.458 23.458  GY
**WARNING** about Floor/OneWay Loads/Weights.
  Please note that depending on the shape of the floor you may
  have to break up the FLOOR/ONEWAY LOAD into multiple commands.
  For details please refer to Technical Reference Manual
  Section 5.32.4 Note 6.

78. PERFORM ANALYSIS
```

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

  NUMBER OF JOINTS/MEMBER+ELEMENTS/SUPPORTS =    55/   108/     4

        SOLVER USED IS THE OUT-OF-CORE BASIC SOLVER

  ORIGINAL/FINAL BAND-WIDTH=    54/     7/     48 DOF
  TOTAL PRIMARY LOAD CASES =    2, TOTAL DEGREES OF FREEDOM =    320
  SIZE OF STIFFNESS MATRIX =       16 DOUBLE  KILO-WORDS
  REQRD/AVAIL. DISK SPACE  =     12.3/      0.0 MB



 **** WARNING : AVAILABLE HARD DISK SPACE MAY NOT BE
ENOUGH TO COMPLETE EXECUTION. IF YOUR AVAILABLE HARD DISK
SPACE ON THE ANALYSIS DRIVE IS GREATER THAN 3GB THIS MESSAGE
MAY BE ERRONEOUS



   79. LOAD LIST 1
   80. ***DEAD LOAD EFFECTS IN TRUSS MEMBERS
   81. PRINT MEMBER FORCES LIST 1 TO 18
```

MEMBER END FORCES STRUCTURE TYPE = SPACE

ALL UNITS ARE -- KIP FEET (LOCAL)

MEMBER	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
1	1	1	-91.74	1.01	-2.01	0.00	23.85	3.17
		2	91.74	0.31	2.01	0.00	16.36	3.85
2	1	2	-76.29	0.99	-1.12	0.00	11.77	3.15
		3	76.29	0.33	1.12	0.00	10.55	3.45
3	1	3	-101.77	0.77	0.18	-0.01	-0.68	-0.89
		4	101.77	0.76	-0.18	0.01	-2.88	1.01
4	1	4	-77.45	0.34	0.72	-0.01	-6.23	-3.31
		5	77.45	0.98	-0.72	0.01	-8.11	-3.10
5	1	5	-89.27	0.48	2.06	0.00	-14.34	-3.01
		6	89.27	0.84	-2.06	0.00	-26.80	-0.61
6	1	1	129.23	0.89	-0.35	0.01	10.52	0.69
		7	-128.39	0.71	0.35	-0.01	-2.65	1.37
7	1	7	146.30	1.33	-0.28	-0.01	2.49	4.51
		9	-146.13	0.35	0.28	0.01	3.17	5.36
8	1	9	145.81	0.85	-0.06	0.00	-2.35	-2.11
		10	-145.81	0.83	0.06	0.00	3.65	2.27
9	1	10	146.86	0.35	0.06	0.00	-3.38	-5.25
		8	-147.03	1.33	-0.06	0.00	2.23	-4.61
10	1	8	131.45	0.91	0.44	-0.01	-2.50	-0.25
		6	-132.29	0.69	-0.44	0.01	-7.49	2.67
11	1	8	-29.19	1.14	-0.38	0.00	0.94	5.87
		5	28.76	-1.14	0.38	0.00	3.06	6.14
12	1	10	-13.85	0.54	-0.12	0.00	0.16	3.44
		4	13.34	-0.54	0.12	0.00	1.30	3.29
13	1	7	-27.02	-1.32	-0.06	0.01	-0.90	-6.84
		2	26.60	1.32	0.06	-0.01	1.58	-7.06
14	1	9	-13.33	-0.58	-0.20	0.00	0.81	-3.70
		3	12.82	0.58	0.20	0.00	1.70	-3.56
15	1	7	-34.17	0.30	0.00	0.00	-0.14	0.95
		3	33.92	0.17	0.00	0.00	0.19	0.52

MEMBER END FORCES STRUCTURE TYPE = SPACE

ALL UNITS ARE -- KIP FEET (LOCAL)

MEMBER	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
16	1	8	-32.03	0.30	0.00	0.00	-0.01	1.02
		4	31.79	0.16	0.00	0.00	-0.07	0.55
17	1	9	0.17	0.12	-0.02	0.00	-0.95	0.45
		4	-0.32	0.12	0.02	0.00	1.33	-0.45
18	1	10	0.98	0.12	0.01	0.00	-0.33	0.45
		3	-1.13	0.12	-0.01	0.00	0.20	-0.45

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

82. ***DEAD LOAD EFFECTS IN STRINGERS
83. PRINT MEMBER FORCES LIST 85

MEMBER END FORCES STRUCTURE TYPE = SPACE

ALL UNITS ARE -- KIP FEET (LOCAL)

MEMBER	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
85	1	35	4.01	4.92	0.04	0.00	-0.40	9.40
		36	-4.01	4.85	-0.04	0.00	-0.39	-8.68

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

```
84. ***DEAD LOAD EFFECTS IN INT. AND END FLOOR BEAMS
85. PRINT MEMBER FORCES LIST 12 32 39 42 46 51 56 61 66 104 TO 108
```

MEMBER END FORCES STRUCTURE TYPE = SPACE

ALL UNITS ARE -- KIP FEET (LOCAL)

MEMBER	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
12	1	10	-13.85	0.54	-0.12	0.00	0.16	3.44
		4	13.34	-0.54	0.12	0.00	1.30	3.29
32	1	18	-13.85	-0.54	0.12	0.00	-0.16	-3.45
		13	13.35	0.54	-0.12	0.00	-1.30	-3.29
39	1	4	-0.68	25.80	-4.65	0.01	8.04	2.04
		24	0.68	-25.53	4.65	-0.01	1.84	52.50
42	1	1	-14.76	7.46	17.52	0.05	-33.17	-6.22
		65	14.76	-7.19	-17.52	-0.05	-14.58	26.18
46	1	24	-0.79	15.85	-0.06	0.02	-0.53	-52.50
		30	0.79	-15.19	0.06	-0.02	0.86	132.71
51	1	30	-0.83	5.51	-0.08	0.02	0.04	-132.71
		36	0.83	-4.85	0.08	-0.02	0.39	159.47
56	1	36	-0.83	-4.85	-0.08	0.02	0.39	-159.47
		42	0.83	5.51	0.08	-0.02	0.04	132.71
61	1	42	-0.79	-15.19	-0.06	0.02	0.86	-132.71
		48	0.79	15.85	0.06	-0.02	-0.53	52.50
66	1	48	-0.68	-25.53	-4.65	0.01	1.84	-52.50
		13	0.68	25.80	4.65	-0.01	8.03	-2.04
104	1	61	8.24	0.31	-6.45	0.00	6.46	-2.85
		11	-8.24	-0.04	6.45	0.00	11.10	3.34
105	1	62	1.65	-3.20	1.05	0.01	-0.06	-26.25
		61	-1.65	3.86	-1.05	-0.01	-6.87	2.84
106	1	63	0.08	-2.35	0.81	0.02	-1.47	-44.02
		62	-0.08	3.01	-0.81	-0.02	-3.87	26.24
107	1	64	0.17	-0.05	-0.01	0.01	0.78	-46.52
		63	-0.17	0.71	0.01	-0.01	-0.74	44.02
108	1	65	0.78	3.39	-1.19	0.00	10.44	-26.23
		64	-0.78	-2.73	1.19	0.00	-2.56	46.53

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

```
86. LOAD LIST 2
87. ***PEDESTRAIN LOAD EFFECTS IN TRUSS MEMBERS
88. PRINT MEMBER FORCES LIST 1 TO 18
```

MEMBER END FORCES STRUCTURE TYPE = SPACE

ALL UNITS ARE -- KIP FEET (LOCAL)

MEMBER	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
1	2	1	-53.74	0.30	-1.18	0.00	13.97	1.94
		2	53.74	-0.30	1.18	0.00	9.63	4.00
2	2	2	-44.64	0.20	-0.68	0.00	7.11	0.59
		3	44.64	-0.20	0.68	0.00	6.45	3.43
3	2	3	-60.84	0.00	0.09	0.00	-0.25	-2.07
		4	60.84	0.00	-0.09	0.00	-1.58	2.16
4	2	4	-46.71	-0.18	0.42	0.00	-3.66	-3.19
		5	46.71	0.18	-0.42	0.00	-4.82	-0.41
5	2	5	-53.73	-0.11	1.22	0.00	-8.48	-3.18
		6	53.73	0.11	-1.22	0.00	-15.88	0.93
6	2	1	75.60	0.16	-0.21	0.00	6.38	0.41
		7	-75.60	-0.16	0.21	0.00	-1.70	3.23
7	2	7	87.23	0.31	-0.18	-0.01	1.59	1.18
		9	-87.23	-0.31	0.18	0.01	2.04	5.14
8	2	9	87.27	0.01	-0.04	0.00	-1.53	-2.88
		10	-87.27	-0.01	0.04	0.00	2.33	2.99
9	2	10	88.07	-0.30	0.04	0.00	-2.18	-4.92
		8	-88.07	0.30	-0.04	0.00	1.33	-1.14
10	2	8	79.44	0.06	0.29	-0.01	-1.50	-2.12
		6	-79.44	-0.06	-0.29	0.01	-4.96	3.38
11	2	8	-19.06	0.66	-0.24	0.00	0.57	3.36
		5	19.06	-0.66	0.24	0.00	1.97	3.60
12	2	10	-9.47	0.30	-0.08	0.00	0.12	1.92
		4	9.47	-0.30	0.08	0.00	0.85	1.87
13	2	7	-16.26	-0.87	-0.03	0.00	-0.58	-4.46
		2	16.26	0.87	0.03	0.00	0.85	-4.64
14	2	9	-8.90	-0.36	-0.13	0.00	0.51	-2.25
		3	8.90	0.36	0.13	0.00	1.12	-2.21
15	2	7	-21.52	0.04	0.00	0.00	-0.08	0.06
		3	21.52	-0.04	0.00	0.00	0.12	0.84

MEMBER END FORCES STRUCTURE TYPE = SPACE

ALL UNITS ARE -- KIP FEET (LOCAL)

MEMBER	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
16	2	8	-18.75	0.04	0.00	0.00	0.00	0.11
		4	18.75	-0.04	0.00	0.00	-0.04	0.86
17	2	9	-0.17	0.00	-0.01	0.00	-0.58	-0.01
		4	0.17	0.00	0.01	0.00	0.83	0.02
18	2	10	0.76	0.00	0.01	0.00	-0.19	-0.01
		3	-0.76	0.00	-0.01	0.00	0.06	0.02

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

```
89. ***PEDESTRIAN LOAD EFFECTS IN STRINGERS
90. PRINT MEMBER FORCES LIST 85
```

MEMBER END FORCES STRUCTURE TYPE = SPACE

ALL UNITS ARE -- KIP FEET (LOCAL)

MEMBER	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
85	2	35	2.39	4.06	0.02	0.00	-0.23	10.78
		36	-2.39	4.04	-0.02	0.00	-0.23	-10.59

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

```
91. ***PEDESTRIAN LOAD EFFECTS IN INT. AND END FLOOR BEAMS
92. PRINT MEMBER FORCES LIST 12 32 39 42 46 51 56 61 66 104 TO 108
```

MEMBER END FORCES STRUCTURE TYPE = SPACE

ALL UNITS ARE -- KIP FEET (LOCAL)

MEMBER	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
12	2	10	-9.47	0.30	-0.08	0.00	0.12	1.92
		4	9.47	-0.30	0.08	0.00	0.85	1.87
32	2	18	-9.47	-0.30	0.08	0.00	-0.12	-1.92
		13	9.47	0.30	-0.08	0.00	-0.85	-1.87
39	2	4	-0.42	18.50	-2.62	0.01	4.56	1.31
		24	0.42	-18.50	2.62	-0.01	1.00	38.00
42	2	1	-8.72	4.23	10.34	0.03	-19.62	-3.78
		65	8.72	-4.23	-10.34	-0.03	-8.55	15.30
46	2	24	-0.49	14.50	-0.05	0.01	-0.25	-38.00
		30	0.49	-13.30	0.05	-0.01	0.51	109.81
51	2	30	-0.52	5.24	-0.05	0.01	0.02	-109.81
		36	0.52	-4.04	0.05	-0.01	0.23	133.79
56	2	36	-0.52	-4.04	-0.05	0.01	0.23	-133.79
		42	0.52	5.24	0.05	-0.01	0.02	109.81
61	2	42	-0.49	-13.30	-0.05	0.01	0.51	-109.81
		48	0.49	14.50	0.05	-0.01	-0.25	38.00
66	2	48	-0.42	-18.50	-2.62	0.01	1.00	-38.00
		13	0.42	18.50	2.62	-0.01	4.56	-1.31
104	2	61	4.93	-0.62	-3.90	0.00	3.90	-8.60
		11	-4.93	0.62	3.90	0.00	6.74	6.91
105	2	62	0.98	-1.49	0.63	0.01	-0.04	-19.94
		61	-0.98	1.97	-0.63	-0.01	-4.12	8.59
106	2	63	0.04	-1.24	0.48	0.01	-0.88	-30.56
		62	-0.04	2.18	-0.48	-0.01	-2.32	19.94
107	2	64	0.09	0.52	-0.01	0.01	0.48	-31.78
		63	-0.09	0.89	0.01	-0.01	-0.44	30.56
108	2	65	0.44	3.43	-0.69	0.01	6.10	-15.31
		64	-0.44	-1.54	0.69	-0.01	-1.55	31.78

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

 93. FINISH

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

            **** DATE= NOV 18,2014   TIME= 10:29:21 ****

      ************************************************************
      *         For questions on STAAD.Pro, please contact       *
      *    Bentley Systems Offices at the following locations    *
      *                                                          *
      *               Telephone             Web / Email          *
      *                                                          *
      *  USA:      +1 (714)974-2500                              *
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      *  SINGAPORE +65 6225-6158                                 *
      *  EUROPE    +31 23 5560560                                *
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      *                                                          *
      * Worldwide    http://selectservices.bentley.com/en-US/    *
      *                                                          *
      ************************************************************
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APPENDIX E

Analysis Results (Spans 1 & 3, Approach Spans)

LOAD RATING AND POSTING SUMMARY SHEET

Structure No.:	03800	Location:	SH-66B over Captain Creek, Lincoln County

Date of Previous Load Rating:		Date of Current Load Rating:	February 2015

DESIGN LOADING:	☒ H15 ☐ H20 ☐ HS15 ☐ HS 20 ☐ Other: Unknown
RATING METHOD	☐ ASR ☒ LFR ☐ LRFR ☐ Assigned ☐ Other: _____

TRUCK TYPE	INVENTORY RATING (NORMAL TRAFFIC)	OPERATING RATING (MAXIMUM LOAD)
	TONS	TONS
HS	45.9	76.5
TYPE 3	44.3	73.8
TYPE 3S2	56.3	93.8
TYPE 3-3	64.6	107.7
LOAD RATING CONTROLLED BY:	Pier Beam flexure controls for Spans 1 and 3 (Note: Overall, the load rating is controlled by the main truss span)	

POSTING:

CURRENTLY POSTED:	☐ NO	☒ YES	Posted Limit: 19, 25 and 42 Tons
REVISE POSTING (Based on current load rating calculations):	☒ NO	☐ YES	Revised Posted Limit:
NEW POSTING (Based on current load rating calculation):	☒ NO	☐ YES	New Posted Limit:

REMARKS:	This analysis is for the approach spans (Spans 1 and 3) only. A separate analysis was performed on the main pony truss span (Span 2). Overall, the load rating for the existing bridge is controlled by Span 2, and the approach spans can be widened without any strengthening of the existing beams or the pier beam. Refer to the attached load rating calculations.

Made by: Jeff Anderson Date: 02/2015

Checked by: Gregg Hostetler Date: 02/2015

Backchecked by: Jeff Anderson Date: 02/2015

Rating Summary:

Two runs of BAR7, one for the floor beams and one for the stringers/girders

Rating Summary:
Two runs of BAR7, one for the floor beams and one for the stringers/girders

HS20	**Inventory**	**Operating Rating**
Floor	**45.9 Tons**	**76.5 Tons**
Stringers/ Girders	**67.5 Tons**	**112.4 Tons**

Note: In this analysis, the beams are referred to as stringers and the pier beam is referred to as a floorbeam since the bridge was modeled in Bars7 as a stringer-floorbeam configuration.

Captains Creek Bridge - Approach Spans

5 composite girders - W36 x 158

Span length = 62.67 feet

Girder spacing = 5.2 feet

7" thick concrete slab

Girder Distribution Factor = S/5.5 for two loaded lanes

D.F. = 5.2'/5.5 = 0.945455 wheels = 0.472727 lanes

Deflection D.F. = #lanes/#girders = 2/5 = 0.4 lanes

D.L. 1: curb and diaphragm weights

Diaphragms: 30 plf x 5.2"/1000 at third points:

.03 klf x 5.2 = 0.156 kips

maximum moment due to diaphragms = P x a = .156k x 20' = 3.12 kft

Equivalent uniform load = 8 x 3.12kft/60^2 = 0.006933 klf

Total = 0.006933 klf

D.L. 2: Curb and railing

Railing load: Use 36 plf/side

.036 x 2/5 girders = 0.0144 klf

Curbs: assume 10" height; .150 kcf x .833' x 1.5' x 2 = 0.37485 klf

Weight per girder = .375/5 = 0.07497 klf

Total = 0.08937 klf

N

4000 psi concrete per the plans

E concrete = 57000 x f'c^.5 = 3604997 psi

Es = 29,000,000 psi

N = 29/3.605 = 8.044383 Use 8

Floor Beam D.L.: weight of the haunch (assume 2")

W36 x 192 floor beams. Flange width = 12" (assumed from W36 x 194)

Haunch weight = .150 kcf x 1' x 2/12 = 0.025 klf

BRIDGE ANALYSIS AND RATING (BAR7)

STRUCTURE ID - - GIRDERS

PROJECT IDENTIFICATION

BRG TYPE	SLC LEV	LANES	LIVE LOAD	OUT-PUT	IMP FACT	GAGE DIST	PASS DIST	FAT-IGUE	CONC DECK	SPEC	RE-DIST	DIR	S OVER FACTOR	END PAN
GFS		D	E	0	0.00	0.0	0.0		Y				0.00	

SKEW
CORR
HYB FACTOR
0.000

BRIDGE CROSS SECTION AND LOADING

DECK WIDTH	OVERHANG OR SPACING	CL OF GIRDER OR TRUSS TO CURB	ROADWAY WIDTH	DISTRIBUTION FACTORS SHEAR	MOMENT	DEFLECT
25.00	0.50	1.00	22.00	0.423	0.423	0.400

SLAB THICKNESS	HAUNCH	DEAD LOADS DL1	DL2	F'C	N	SYMMETRY
7.00	0.00	0.007	0.089	4.000	8.	Y

STRINGER DL1	FLOORBEAM DL1	UNIT WEIGHT DECK CONCRETE
0.000	0.000	150.

SPAN LENGTHS (SIMPLE)

SPAN #	1
LENGTH	59.63

TRAFFIC LANE LOCATIONS

LANE #	1	2	3	4	5	6
DIST						
WIDTH						
% LL						

STRINGER SPAN LENGTHS (SIMPLE)

SPAN #	1
LENGTH	59.63

STRINGER LOCATIONS

STRINGER #	1	2	3	4	5
DISTANCE	1.60	6.80	12.00	17.20	22.40

CONCRETE MEMBER PROPERTIES

TYPE	DEPTH	B	D	AS	D'	A'S	FY REINF
S	7.00	0.00	0.00	0.00	2.38	0.14	33.

ALLOWABLE FS IR	OR	ST DET	AV	SPECS	ALPHA	INTEGRAL WEARING SURFACE
0.0	0.0		0.00	0	0.	0.0

STEEL MEMBER PROPERTIES

G F S	S P A N	RANGE	T Y P E	WF BM OF I OR VRT LEG	WF BM AREA OR HRZ LEG	FLANGE OR ANGLE THICK	FLANGE WIDTH	V A R	WF BM OR WEB PLATE DEPTH	WEB THICK
G	1	29.82	W	99999.90	60.00	2.0000	10.000		40.00	2.0000

TPW	TPT	BPW	BPT	COMP	FY	FY TOP	FY BOT	CG TOP	CG BOT
0.00	0.0000	0.00	0.0000	N	99.9	0.0	0.0	0.000	0.000

	RANGE		M OF I	AREA	THICK	WIDTH	V	DEPTH	THICK
F 1	25.00	W	12082.00	56.46	1.2900	12.110		36.50	0.7450

TPW	TPT	BPW	BPT	COMP	FY	FY TOP	FY BOT	CG TOP	CG BOT
0.00	0.0000	0.00	0.0000	Y	30.0	0.0	0.0	0.000	0.000

	RANGE		M OF I	AREA	THICK	WIDTH	V	DEPTH	THICK
F 2	25.00	W	12082.00	56.46	1.2900	12.110		36.50	0.7450

TPW	TPT	BPW	BPT	COMP	FY	FY TOP	FY BOT	CG TOP	CG BOT
0.00	0.0000	0.00	0.0000	Y	30.0	0.0	0.0	0.000	0.000

	RANGE		M OF I	AREA	THICK	WIDTH	V	DEPTH	THICK
S 1	29.82	W	9665.20	46.44	1.0400	12.000		36.00	0.6350

TPW	TPT	BPW	BPT	COMP	FY	FY TOP	FY BOT	CG TOP	CG BOT
0.00	0.0000	0.00	0.0000	Y	30.0	0.0	0.0	0.000	0.000

LATERAL BRACE POINTS AND STIFFENER SPACINGS

B OR G CODE	S OR F SPAN	C O D E	NO. OF SPCS	SPACING	C O D E	NO. OF SPCS	SPACING	C O D E	NO. OF SPCS	SPACING	C O D E	NO. OF SPCS	SPACING
BG	1	C	1	0.50	C	1	29.32		0	0.00		0	0.00
			0	0.00		0	0.00		0	0.00		0	0.00
BF	1	C	1	25.00	B	1	1.60	B	2	5.20		0	0.00
			0	0.00		0	0.00		0	0.00		0	0.00
BF	2	C	1	25.00	B	1	1.60	B	2	5.20		0	0.00
			0	0.00		0	0.00		0	0.00		0	0.00
SF	1	T	1	1.60	T	2	5.20		0	0.00		0	0.00
			0	0.00		0	0.00		0	0.00		0	0.00
SF	2	T	1	1.60	T	2	5.20		0	0.00		0	0.00
			0	0.00		0	0.00		0	0.00		0	0.00

DEFAULT VALUES

SLC LEVEL	LANES	GAGE DISTANCE	PASSING DISTANCE	UNIT WEIGHT DECK	FY REINF	ALLOWABLE FS IR	OR	INTEGRAL WEARING SURFACE
I	---	6.0	4.0	---	---	18.0	25.0	0.5

```
+++++++++++++++++++++++++++++++++++++++++++++
+                                           +
+     S T R I N G E R   A N A L Y S I S     +
+                                           +
+++++++++++++++++++++++++++++++++++++++++++++
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```
/====================\
<  STRINGER AT   1.60  >
\====================/
```

LIVE LOAD DISTRIBUTION FACTOR FOR MOMENT 0.423

LIVE LOAD DISTRIBUTION FACTOR FOR SHEAR 0.423

DEAD LOADS ACTING ON STRINGER

STRINGER WEIGHT	SLAB WEIGHT	INPUT DL1	TOTAL DL1	TOTAL DL2
0.158	0.411	0.000	0.569	0.036

STRINGER SECTION PROPERTIES

SPAN 1 - EFFECTIVE SLAB WIDTH: 56.40 THICKNESS: 6.50
=======

	DEPTH	GROSS AREA	MOMENT OF INERTIA	C BOTTOM	SECTION MODULUS TOP	BOTTOM	CONC OR NEG REINF
NON-COMPOSITE	36.00	46.44	9665.20	18.00	536.96	536.96	
COMPOSITE (N= 8)	42.50	92.27	20241.93	28.55	2718.56	708.90	1451.47
COMPOSITE (N=24)	42.50	61.72	14909.38	23.26	1170.24	641.00	774.90
COMPOSITE (NEG M)	42.50	47.10	9982.66	18.31	564.28	545.23	457.69

DEFLECTIONS

SPAN 1 - LIVE LOAD IMPACT FACTOR FOR DEFLECTION: 1.27
=======

	DEAD LOAD		---------- LIVE LOAD + IMPACT ----------				
X	DL1	DL2	H20	HS20	3	3S2	3-3
0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000
5.96	0.180	0.007	0.085	0.128	0.092	0.103	0.096
11.93	0.340	0.014	0.161	0.243	0.175	0.195	0.181
17.89	0.466	0.019	0.221	0.335	0.241	0.267	0.248
23.85	0.546	0.022	0.261	0.392	0.282	0.312	0.289
29.82	0.573	0.023	0.275	0.412	0.295	0.325	0.303
35.78	0.546	0.022	0.261	0.392	0.282	0.312	0.289
41.74	0.466	0.019	0.221	0.335	0.241	0.267	0.248
47.70	0.340	0.014	0.161	0.243	0.175	0.195	0.181
53.67	0.180	0.007	0.085	0.128	0.092	0.103	0.096
59.63	0.000	0.000	0.000	0.000	0.000	0.000	0.000

```
**********************************
*  STRINGER  -  LIVE LOAD  H20   *
**********************************
```

MAXIMUM REACTIONS

SUPPORT	DL1	DL2	+(LL+I)	-(LL+I)	REACTIONS +I.F.	-I.F.	MOMENTS +I.F.	-I.F.

```
       1      17.0      1.1     24.2 L      0.0    1.27


NOTE: ALL SUPPORT REACTIONS AND END SHEARS IN EACH SPAN DUE TO A LIVE LOAD
      ARE CALCULATED BASED ON AASHTO ARTICLE 3.23.1
      AS INTERPRETED IN SOL 431-93-05.


                          UNFACTORED MOMENTS AND SHEARS

SPAN  1 - LIVE LOAD IMPACT FACTORS : POS MOM 1.27
=======
            DL1    DL2  +(LL+I)  -(LL+I)     DL1    DL2  +(LL+I) -(LL+I)
     X    MOMENT  MOMENT MOMENT   MOMENT    SHEAR  SHEAR  SHEAR   SHEAR  I.F.
    0.00     0.0     0.0    0.0      0.0     17.0    1.1   24.2L    0.0  1.27
            SIMULT SHEAR    0.0      0.0      SIMULT MOM    0.0     0.0
    5.96    91.1     5.7  109.4      0.0     13.6    0.8   21.0L   -1.7  1.28
            SIMULT SHEAR   18.5      0.0      SIMULT MOM  124.6    92.3
   11.93   161.9    10.1  193.1      0.0     10.2    0.6   18.0L   -3.5  1.29
            SIMULT SHEAR   16.4      0.0      SIMULT MOM  211.6   164.1
   17.89   212.5    13.3  251.2      0.0      6.8    0.4   15.1L   -5.6  1.30
            SIMULT SHEAR   14.4      0.0      SIMULT MOM  264.9   227.1
   23.85   242.9    15.2  285.3L     0.0      3.4    0.2   12.4L   -7.8  1.30
            SIMULT SHEAR    8.0      0.0      SIMULT MOM  288.1   271.6
   29.82   253.0    15.8  297.2L     0.0      0.0    0.0   10.0   -10.0  1.30
            SIMULT SHEAR   -4.9      0.0      SIMULT MOM  290.4   290.4
   35.78   242.9    15.2  285.3L     0.0     -3.4   -0.2    7.8   -12.4L 1.30
            SIMULT SHEAR   -8.0      0.0      SIMULT MOM  271.6   288.1
   41.74   212.5    13.3  251.2      0.0     -6.8   -0.4    5.6   -15.1L 1.30
            SIMULT SHEAR  -14.4      0.0      SIMULT MOM  227.1   264.9
   47.70   161.9    10.1  193.1      0.0    -10.2   -0.6    3.5   -18.0L 1.29
            SIMULT SHEAR  -16.4      0.0      SIMULT MOM  164.1   211.6
   53.67    91.1     5.7  109.4      0.0    -13.6   -0.8    1.7   -21.0L 1.28
            SIMULT SHEAR  -18.5      0.0      SIMULT MOM   92.3   124.6
   59.63     0.0     0.0    0.0      0.0    -17.0   -1.1    0.0   -24.2L 1.27
            SIMULT SHEAR    0.0      0.0      SIMULT MOM    0.0     0.0


                          FLEXURAL STRESSES - BEAM

SPAN  1
=======
              TOP FIBER STEEL STRESS             BOTTOM FIBER STEEL STRESS
   X       DL1      DL2   +(LL+I)  -(LL+I)     DL1      DL2   +(LL+I)  -(LL+I)
  0.00    0.000    0.000    0.000    0.000    0.000    0.000    0.000    0.000
  5.96   -2.036   -0.058   -0.483    0.000    2.036    0.107    1.851    0.000
 11.93   -3.619   -0.104   -0.852    0.000    3.619    0.190    3.269    0.000
 17.89   -4.750   -0.136   -1.109    0.000    4.750    0.249    4.252    0.000
 23.85   -5.428   -0.156   -1.259    0.000    5.428    0.284    4.829    0.000
 29.82   -5.655   -0.162   -1.312    0.000    5.655    0.296    5.030    0.000
 35.78   -5.428   -0.156   -1.259    0.000    5.428    0.284    4.829    0.000
 41.74   -4.750   -0.136   -1.109    0.000    4.750    0.249    4.252    0.000
 47.70   -3.619   -0.104   -0.852    0.000    3.619    0.190    3.269    0.000
 53.67   -2.036   -0.058   -0.483    0.000    2.036    0.107    1.851    0.000
 59.63    0.000    0.000    0.000    0.000    0.000    0.000    0.000    0.000


          FLEXURAL STRESSES - SLAB

SPAN  1
=======
         CONCRETE STRESS   SLAB REINF STRESS
   X       DL2   +(LL+I)    DL2    -(LL+I)
```

0.00	0.000	0.000	0.000	0.000
5.96	-0.004	-0.113	0.000	0.000
11.93	-0.007	-0.200	0.000	0.000
17.89	-0.009	-0.260	0.000	0.000
23.85	-0.010	-0.295	0.000	0.000
29.82	-0.010	-0.307	0.000	0.000
35.78	-0.010	-0.295	0.000	0.000
41.74	-0.009	-0.260	0.000	0.000
47.70	-0.007	-0.200	0.000	0.000
53.67	-0.004	-0.113	0.000	0.000
59.63	0.000	0.000	0.000	0.000

SHEAR STRESSES AND ALLOWABLE STRESS RATINGS

SPAN 1
=======

	SHEAR STRESSES				ALLOW COMPR	RATING FACTORS	
X	DL1	DL2	+(LL+I)	-(LL+I)	REDUCTION	IR	OR
0.00	0.788	0.049	1.125	0.000	1.000	8.14 V	11.34 V
5.96	0.630	0.039	0.977	-0.080	1.000	7.75 B	11.00 B
11.93	0.473	0.030	0.836	-0.162	1.000	3.88 B	5.72 B
17.89	0.315	0.020	0.703	-0.258	1.000	2.70 B	4.12 B
23.85	0.158	0.010	0.574	-0.361	1.000	2.23 B	3.48 B
29.82	0.000	0.000	0.463	-0.463	1.000	2.10 B	3.29 B
35.78	-0.158	-0.010	0.361	-0.574	1.000	2.23 B	3.48 B
41.74	-0.315	-0.020	0.258	-0.703	1.000	2.70 B	4.12 B
47.70	-0.473	-0.030	0.162	-0.836	1.000	3.88 B	5.72 B
53.67	-0.630	-0.039	0.080	-0.977	1.000	7.75 B	11.00 B
59.63	-0.788	-0.049	0.000	-1.125	1.000	8.14 V	11.34 V

NOTE: THE SHEAR CAPACITIES CALCULATED HEREIN ARE BASED ON STIFFENED OR UNSTIFFENED EQUATIONS AS SPECIFIED BY INPUT REGARDLESS OF THE STIFFENER SPACINGS INPUT AND ARE NOT CHECKED AGAINST AASHTO CRITERIA.

STRENGTHS AND LOAD FACTOR RATINGS

SPAN 1
=======

	NON-COMP MOMENT	OVERLOAD MOMENT	SHEAR	NON-COMPACT RATING FACTORS		COMPACT MOMENT	COMPACT RATING FACTORS	
X	STRENGTH	STRENGTH	STRENGTH	IR	OR	STRENGTH	IR	OR
0.00	1772.2 B	1683.6	374.8	6.69 V	11.15 V	2356.1	6.69 V	11.15 V
5.96	1772.2 B	1683.6	374.8	6.78 B	11.31 B	2356.1	7.81 V	13.02 V
11.93	1772.2 B	1683.6	374.8	3.54 B	5.89 B	2356.1	4.53 O	7.55 O
17.89	1772.2 B	1683.6	374.8	2.55 B	4.25 B	2356.1	3.32 O	5.53 O
23.85	1772.2 B	1683.6	374.8	2.16 B	3.60 B	2356.1	2.83 O	4.72 O
29.82	1772.2 B	1683.6	374.8	2.04 B	3.40 B	2356.1	2.69 O	4.48 O
35.78	1772.2 B	1683.6	374.8	2.16 B	3.60 B	2356.1	2.83 O	4.72 O
41.74	1772.2 B	1683.6	374.8	2.55 B	4.25 B	2356.1	3.32 O	5.53 O
47.70	1772.2 B	1683.6	374.8	3.54 B	5.89 B	2356.1	4.53 O	7.55 O
53.67	1772.2 B	1683.6	374.8	6.78 B	11.31 B	2356.1	7.81 V	13.02 V
59.63	1772.2 B	1683.6	374.8	6.69 V	11.15 V	2356.1	6.69 V	11.15 V

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*  STRINGER  -  LIVE LOAD  HS20  *
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MAXIMUM REACTIONS

SUPPORT	DL1	DL2	+(LL+I)	-(LL+I)	REACTIONS +I.F.	REACTIONS -I.F.	MOMENTS +I.F.	MOMENTS -I.F.
1	17.0	1.1	32.6	0.0	1.27			

NOTE: ALL SUPPORT REACTIONS AND END SHEARS IN EACH SPAN DUE TO A LIVE LOAD
ARE CALCULATED BASED ON AASHTO ARTICLE 3.23.1
AS INTERPRETED IN SOL 431-93-05.

UNFACTORED MOMENTS AND SHEARS

SPAN 1 - LIVE LOAD IMPACT FACTORS : POS MOM 1.27
=======

X	DL1 MOMENT	DL2 MOMENT	+(LL+I) MOMENT	-(LL+I) MOMENT	DL1 SHEAR	DL2 SHEAR	+(LL+I) SHEAR	-(LL+I) SHEAR	I.F.
0.00	0.0	0.0	0.0	0.0	17.0	1.1	32.6	0.0	1.27
	SIMULT SHEAR		0.0	0.0	SIMULT MOM		0.0	0.0	
5.96	91.1	5.7	171.6	0.0	13.6	0.8	29.0	-1.7	1.28
	SIMULT SHEAR		29.0	0.0	SIMULT MOM		171.6	92.3	
11.93	161.9	10.1	297.0	0.0	10.2	0.6	25.3	-3.5	1.29
	SIMULT SHEAR		25.3	0.0	SIMULT MOM		297.0	164.1	
17.89	212.5	13.3	376.3	0.0	6.8	0.4	21.5	-6.4	1.30
	SIMULT SHEAR		21.5	0.0	SIMULT MOM		376.3	262.2	
23.85	242.9	15.2	421.4	0.0	3.4	0.2	17.6	-9.9	1.30
	SIMULT SHEAR		16.3	0.0	SIMULT MOM		409.4	347.9	
29.82	253.0	15.8	426.5	0.0	0.0	0.0	13.6	-13.6	1.30
	SIMULT SHEAR		-12.3	0.0	SIMULT MOM		396.4	396.4	
35.78	242.9	15.2	421.4	0.0	-3.4	-0.2	9.9	-17.6	1.30
	SIMULT SHEAR		-16.3	0.0	SIMULT MOM		347.9	409.4	
41.74	212.5	13.3	376.3	0.0	-6.8	-0.4	6.4	-21.5	1.30
	SIMULT SHEAR		-21.5	0.0	SIMULT MOM		262.2	376.3	
47.70	161.9	10.1	297.0	0.0	-10.2	-0.6	3.5	-25.3	1.29
	SIMULT SHEAR		-25.3	0.0	SIMULT MOM		164.1	297.0	
53.67	91.1	5.7	171.6	0.0	-13.6	-0.8	1.7	-29.0	1.28
	SIMULT SHEAR		-29.0	0.0	SIMULT MOM		92.3	171.6	
59.63	0.0	0.0	0.0	0.0	-17.0	-1.1	0.0	-32.6	1.27
	SIMULT SHEAR		0.0	0.0	SIMULT MOM		0.0	0.0	

FLEXURAL STRESSES - BEAM

SPAN 1
=======

	TOP FIBER STEEL STRESS				BOTTOM FIBER STEEL STRESS			
X	DL1	DL2	+(LL+I)	-(LL+I)	DL1	DL2	+(LL+I)	-(LL+I)
0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
5.96	-2.036	-0.058	-0.757	0.000	2.036	0.107	2.905	0.000
11.93	-3.619	-0.104	-1.311	0.000	3.619	0.190	5.028	0.000
17.89	-4.750	-0.136	-1.661	0.000	4.750	0.249	6.370	0.000
23.85	-5.428	-0.156	-1.860	0.000	5.428	0.284	7.134	0.000
29.82	-5.655	-0.162	-1.882	0.000	5.655	0.296	7.219	0.000
35.78	-5.428	-0.156	-1.860	0.000	5.428	0.284	7.134	0.000
41.74	-4.750	-0.136	-1.661	0.000	4.750	0.249	6.370	0.000
47.70	-3.619	-0.104	-1.311	0.000	3.619	0.190	5.028	0.000
53.67	-2.036	-0.058	-0.757	0.000	2.036	0.107	2.905	0.000
59.63	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

FLEXURAL STRESSES - SLAB

SPAN 1
=======

X	CONCRETE STRESS DL2	+(LL+I)	SLAB REINF STRESS DL2	-(LL+I)
0.00	0.000	0.000	0.000	0.000
5.96	-0.004	-0.177	0.000	0.000
11.93	-0.007	-0.307	0.000	0.000
17.89	-0.009	-0.389	0.000	0.000
23.85	-0.010	-0.436	0.000	0.000
29.82	-0.010	-0.441	0.000	0.000
35.78	-0.010	-0.436	0.000	0.000
41.74	-0.009	-0.389	0.000	0.000
47.70	-0.007	-0.307	0.000	0.000
53.67	-0.004	-0.177	0.000	0.000
59.63	0.000	0.000	0.000	0.000

SHEAR STRESSES AND ALLOWABLE STRESS RATINGS

SPAN 1
=======

X	SHEAR STRESSES DL1	DL2	+(LL+I)	-(LL+I)	ALLOW COMPR REDUCTION	RATING FACTORS IR	OR
0.00	0.788	0.049	1.516	0.000	1.000	6.05 V	8.42 V
5.96	0.630	0.039	1.345	-0.080	1.000	4.94 B	7.01 B
11.93	0.473	0.030	1.173	-0.162	1.000	2.52 B	3.72 B
17.89	0.315	0.020	0.999	-0.298	1.000	1.81 B	2.75 B
23.85	0.158	0.010	0.815	-0.462	1.000	1.51 B	2.35 B
29.82	0.000	0.000	0.631	-0.631	1.000	1.46 B	2.29 B
35.78	-0.158	-0.010	0.462	-0.815	1.000	1.51 B	2.35 B
41.74	-0.315	-0.020	0.298	-0.999	1.000	1.81 B	2.75 B
47.70	-0.473	-0.030	0.162	-1.173	1.000	2.52 B	3.72 B
53.67	-0.630	-0.039	0.080	-1.345	1.000	4.94 B	7.01 B
59.63	-0.788	-0.049	0.000	-1.516	1.000	6.05 V	8.42 V

NOTE: THE SHEAR CAPACITIES CALCULATED HEREIN ARE BASED ON STIFFENED OR UNSTIFFENED EQUATIONS AS SPECIFIED BY INPUT REGARDLESS OF THE STIFFENER SPACINGS INPUT AND ARE NOT CHECKED AGAINST AASHTO CRITERIA.

STRENGTHS AND LOAD FACTOR RATINGS

SPAN 1
=======

X	NON-COMP MOMENT STRENGTH	OVERLOAD MOMENT STRENGTH	SHEAR STRENGTH	NON-COMPACT RATING FACTORS IR	OR	COMPACT MOMENT STRENGTH	COMPACT RATING FACTORS IR	OR
0.00	1772.2 B	1683.6	374.8	4.97 V	8.28 V	2356.1	4.97 V	8.28 V
5.96	1772.2 B	1683.6	374.8	4.32 B	7.21 B	2356.1	5.44 O	9.07 O
11.93	1772.2 B	1683.6	374.8	2.30 B	3.83 B	2356.1	2.95 O	4.91 O
17.89	1772.2 B	1683.6	374.8	1.70 B	2.84 B	2356.1	2.21 O	3.69 O
23.85	1772.2 B	1683.6	374.8	1.46 B	2.43 B	2356.1	1.92 O	3.19 O
29.82	1772.2 B	1683.6	374.8	1.42 B	2.37 B	2356.1	1.87 O	3.12 O
35.78	1772.2 B	1683.6	374.8	1.46 B	2.43 B	2356.1	1.92 O	3.19 O
41.74	1772.2 B	1683.6	374.8	1.70 B	2.84 B	2356.1	2.21 O	3.69 O
47.70	1772.2 B	1683.6	374.8	2.30 B	3.83 B	2356.1	2.95 O	4.91 O
53.67	1772.2 B	1683.6	374.8	4.32 B	7.21 B	2356.1	5.44 O	9.07 O
59.63	1772.2 B	1683.6	374.8	4.97 V	8.28 V	2356.1	4.97 V	8.28 V

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**********************************
*  STRINGER  -  LIVE LOAD   3    *
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MAXIMUM REACTIONS

SUPPORT	DL1	DL2	+(LL+I)	-(LL+I)	REACTIONS +I.F.	REACTIONS -I.F.	MOMENTS +I.F.	MOMENTS -I.F.
1	17.0	1.1	23.5	0.0	1.27			

NOTE: ALL SUPPORT REACTIONS AND END SHEARS IN EACH SPAN DUE TO A LIVE LOAD
ARE CALCULATED BASED ON AASHTO ARTICLE 3.23.1
AS INTERPRETED IN SOL 431-93-05.

UNFACTORED MOMENTS AND SHEARS

SPAN 1 - LIVE LOAD IMPACT FACTORS : POS MOM 1.27
=======

X	DL1 MOMENT	DL2 MOMENT	+(LL+I) MOMENT	-(LL+I) MOMENT	DL1 SHEAR	DL2 SHEAR	+(LL+I) SHEAR	-(LL+I) SHEAR	I.F.
0.00	0.0	0.0	0.0	0.0	17.0	1.1	23.5	0.0	1.27
	SIMULT SHEAR		0.0	0.0	SIMULT MOM		0.0	0.0	
5.96	91.1	5.7	124.2	0.0	13.6	0.8	21.0	-1.2	1.28
	SIMULT SHEAR		21.0	0.0	SIMULT MOM		124.2	65.2	
11.93	161.9	10.1	216.4	0.0	10.2	0.6	18.4	-3.1	1.29
	SIMULT SHEAR		18.4	0.0	SIMULT MOM		216.4	145.1	
17.89	212.5	13.3	276.6	0.0	6.8	0.4	15.8	-5.0	1.30
	SIMULT SHEAR		15.8	0.0	SIMULT MOM		276.6	203.3	
23.85	242.9	15.2	311.1	0.0	3.4	0.2	13.1	-7.6	1.30
	SIMULT SHEAR		5.6	0.0	SIMULT MOM		304.7	264.7	
29.82	253.0	15.8	317.9	0.0	0.0	0.0	10.3	-10.3	1.30
	SIMULT SHEAR		-6.5	0.0	SIMULT MOM		300.7	300.7	
35.78	242.9	15.2	311.1	0.0	-3.4	-0.2	7.6	-13.1	1.30
	SIMULT SHEAR		-5.6	0.0	SIMULT MOM		264.7	304.7	
41.74	212.5	13.3	276.6	0.0	-6.8	-0.4	5.0	-15.8	1.30
	SIMULT SHEAR		-15.8	0.0	SIMULT MOM		203.3	276.6	
47.70	161.9	10.1	216.4	0.0	-10.2	-0.6	3.1	-18.4	1.29
	SIMULT SHEAR		-18.4	0.0	SIMULT MOM		145.1	216.4	
53.67	91.1	5.7	124.2	0.0	-13.6	-0.8	1.2	-21.0	1.28
	SIMULT SHEAR		-21.0	0.0	SIMULT MOM		65.2	124.2	
59.63	0.0	0.0	0.0	0.0	-17.0	-1.1	0.0	-23.5	1.27
	SIMULT SHEAR		0.0	0.0	SIMULT MOM		0.0	0.0	

FLEXURAL STRESSES - BEAM

SPAN 1
=======

	TOP FIBER STEEL STRESS				BOTTOM FIBER STEEL STRESS			
X	DL1	DL2	+(LL+I)	-(LL+I)	DL1	DL2	+(LL+I)	-(LL+I)
0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
5.96	-2.036	-0.058	-0.548	0.000	2.036	0.107	2.103	0.000
11.93	-3.619	-0.104	-0.955	0.000	3.619	0.190	3.664	0.000
17.89	-4.750	-0.136	-1.221	0.000	4.750	0.249	4.682	0.000
23.85	-5.428	-0.156	-1.373	0.000	5.428	0.284	5.266	0.000
29.82	-5.655	-0.162	-1.403	0.000	5.655	0.296	5.381	0.000
35.78	-5.428	-0.156	-1.373	0.000	5.428	0.284	5.266	0.000
41.74	-4.750	-0.136	-1.221	0.000	4.750	0.249	4.682	0.000
47.70	-3.619	-0.104	-0.955	0.000	3.619	0.190	3.664	0.000
53.67	-2.036	-0.058	-0.548	0.000	2.036	0.107	2.103	0.000
59.63	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

FLEXURAL STRESSES - SLAB

SPAN 1
=======

X	CONCRETE STRESS DL2	+(LL+I)	SLAB REINF STRESS DL2	-(LL+I)
0.00	0.000	0.000	0.000	0.000
5.96	-0.004	-0.128	0.000	0.000
11.93	-0.007	-0.224	0.000	0.000
17.89	-0.009	-0.286	0.000	0.000
23.85	-0.010	-0.322	0.000	0.000
29.82	-0.010	-0.329	0.000	0.000
35.78	-0.010	-0.322	0.000	0.000
41.74	-0.009	-0.286	0.000	0.000
47.70	-0.007	-0.224	0.000	0.000
53.67	-0.004	-0.128	0.000	0.000
59.63	0.000	0.000	0.000	0.000

SHEAR STRESSES AND ALLOWABLE STRESS RATINGS

SPAN 1
=======

X	SHEAR STRESSES DL1	DL2	+(LL+I)	-(LL+I)	ALLOW COMPR REDUCTION	RATING FACTORS IR	OR
0.00	0.788	0.049	1.092	0.000	1.000	8.39 V	11.69 V
5.96	0.630	0.039	0.974	-0.057	1.000	6.83 B	9.68 B
11.93	0.473	0.030	0.855	-0.143	1.000	3.46 B	5.10 B
17.89	0.315	0.020	0.734	-0.231	1.000	2.46 B	3.74 B
23.85	0.158	0.010	0.607	-0.351	1.000	2.05 B	3.19 B
29.82	0.000	0.000	0.479	-0.479	1.000	1.96 B	3.08 B
35.78	-0.158	-0.010	0.351	-0.607	1.000	2.05 B	3.19 B
41.74	-0.315	-0.020	0.231	-0.734	1.000	2.46 B	3.74 B
47.70	-0.473	-0.030	0.143	-0.855	1.000	3.46 B	5.10 B
53.67	-0.630	-0.039	0.057	-0.974	1.000	6.83 B	9.68 B
59.63	-0.788	-0.049	0.000	-1.092	1.000	8.39 V	11.69 V

NOTE: THE SHEAR CAPACITIES CALCULATED HEREIN ARE BASED ON STIFFENED OR UNSTIFFENED EQUATIONS AS SPECIFIED BY INPUT REGARDLESS OF THE STIFFENER SPACINGS INPUT AND ARE NOT CHECKED AGAINST AASHTO CRITERIA.

STRENGTHS AND LOAD FACTOR RATINGS

SPAN 1
=======

X	NON-COMP MOMENT STRENGTH	OVERLOAD MOMENT STRENGTH	SHEAR STRENGTH	NON-COMPACT RATING FACTORS IR	OR	COMPACT MOMENT STRENGTH	COMPACT RATING FACTORS IR	OR
0.00	1772.2 B	1683.6	374.8	6.89 V	11.49 V	2356.1	6.89 V	11.49 V
5.96	1772.2 B	1683.6	374.8	5.97 B	9.95 B	2356.1	7.52 O	12.53 O
11.93	1772.2 B	1683.6	374.8	3.16 B	5.26 B	2356.1	4.04 O	6.74 O
17.89	1772.2 B	1683.6	374.8	2.32 B	3.86 B	2356.1	3.01 O	5.02 O
23.85	1772.2 B	1683.6	374.8	1.98 B	3.30 B	2356.1	2.60 O	4.33 O
29.82	1772.2 B	1683.6	374.8	1.91 B	3.18 B	2356.1	2.51 O	4.19 O
35.78	1772.2 B	1683.6	374.8	1.98 B	3.30 B	2356.1	2.60 O	4.33 O
41.74	1772.2 B	1683.6	374.8	2.32 B	3.86 B	2356.1	3.01 O	5.02 O
47.70	1772.2 B	1683.6	374.8	3.16 B	5.26 B	2356.1	4.04 O	6.74 O
53.67	1772.2 B	1683.6	374.8	5.97 B	9.95 B	2356.1	7.52 O	12.53 O
59.63	1772.2 B	1683.6	374.8	6.89 V	11.49 V	2356.1	6.89 V	11.49 V

****
* STRINGER - LIVE LOAD 3S2 *

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MAXIMUM REACTIONS

SUPPORT	DL1	DL2	+(LL+I)	-(LL+I)	REACTIONS +I.F.	REACTIONS -I.F.	MOMENTS +I.F.	MOMENTS -I.F.
1	17.0	1.1	26.6	0.0	1.27			

NOTE: ALL SUPPORT REACTIONS AND END SHEARS IN EACH SPAN DUE TO A LIVE LOAD
ARE CALCULATED BASED ON AASHTO ARTICLE 3.23.1
AS INTERPRETED IN SOL 431-93-05.

UNFACTORED MOMENTS AND SHEARS

SPAN 1 - LIVE LOAD IMPACT FACTORS : POS MOM 1.27
=======

X	DL1 MOMENT	DL2 MOMENT	+(LL+I) MOMENT	-(LL+I) MOMENT	DL1 SHEAR	DL2 SHEAR	+(LL+I) SHEAR	-(LL+I) SHEAR	I.F.
0.00	0.0	0.0	0.0	0.0	17.0	1.1	26.6	0.0	1.27
	SIMULT SHEAR		0.0	0.0	SIMULT MOM		0.0	0.0	
5.96	91.1	5.7	135.7	0.0	13.6	0.8	22.9	-1.1	1.28
	SIMULT SHEAR		22.9	0.0	SIMULT MOM		135.7	59.4	
11.93	161.9	10.1	225.2	0.0	10.2	0.6	19.2	-2.8	1.29
	SIMULT SHEAR		19.2	0.0	SIMULT MOM		225.2	132.3	
17.89	212.5	13.3	293.3	0.0	6.8	0.4	15.4	-4.5	1.30
	SIMULT SHEAR		14.7	0.0	SIMULT MOM		268.6	185.3	
23.85	242.9	15.2	325.5	0.0	3.4	0.2	11.9	-6.2	1.30
	SIMULT SHEAR		4.8	0.0	SIMULT MOM		277.0	218.5	
29.82	253.0	15.8	320.0	0.0	0.0	0.0	8.5	-8.5	1.30
	SIMULT SHEAR		7.7	0.0	SIMULT MOM		247.7	247.7	
35.78	242.9	15.2	325.5	0.0	-3.4	-0.2	6.2	-11.9	1.30
	SIMULT SHEAR		-4.8	0.0	SIMULT MOM		218.5	277.0	
41.74	212.5	13.3	293.3	0.0	-6.8	-0.4	4.5	-15.4	1.30
	SIMULT SHEAR		-14.7	0.0	SIMULT MOM		185.3	268.6	
47.70	161.9	10.1	225.2	0.0	-10.2	-0.6	2.8	-19.2	1.29
	SIMULT SHEAR		-19.2	0.0	SIMULT MOM		132.3	225.2	
53.67	91.1	5.7	135.7	0.0	-13.6	-0.8	1.1	-22.9	1.28
	SIMULT SHEAR		-22.9	0.0	SIMULT MOM		59.4	135.7	
59.63	0.0	0.0	0.0	0.0	-17.0	-1.1	0.0	-26.6	1.27
	SIMULT SHEAR		0.0	0.0	SIMULT MOM		0.0	0.0	

FLEXURAL STRESSES - BEAM

SPAN 1
=======

	TOP FIBER STEEL STRESS				BOTTOM FIBER STEEL STRESS			
X	DL1	DL2	+(LL+I)	-(LL+I)	DL1	DL2	+(LL+I)	-(LL+I)
0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
5.96	-2.036	-0.058	-0.599	0.000	2.036	0.107	2.297	0.000
11.93	-3.619	-0.104	-0.994	0.000	3.619	0.190	3.812	0.000
17.89	-4.750	-0.136	-1.295	0.000	4.750	0.249	4.965	0.000
23.85	-5.428	-0.156	-1.437	0.000	5.428	0.284	5.511	0.000
29.82	-5.655	-0.162	-1.413	0.000	5.655	0.296	5.417	0.000
35.78	-5.428	-0.156	-1.437	0.000	5.428	0.284	5.511	0.000
41.74	-4.750	-0.136	-1.295	0.000	4.750	0.249	4.965	0.000
47.70	-3.619	-0.104	-0.994	0.000	3.619	0.190	3.812	0.000
53.67	-2.036	-0.058	-0.599	0.000	2.036	0.107	2.297	0.000
59.63	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

FLEXURAL STRESSES - SLAB

SPAN 1
=======

X	CONCRETE STRESS DL2	+(LL+I)	SLAB REINF STRESS DL2	-(LL+I)
0.00	0.000	0.000	0.000	0.000
5.96	-0.004	-0.140	0.000	0.000
11.93	-0.007	-0.233	0.000	0.000
17.89	-0.009	-0.303	0.000	0.000
23.85	-0.010	-0.336	0.000	0.000
29.82	-0.010	-0.331	0.000	0.000
35.78	-0.010	-0.336	0.000	0.000
41.74	-0.009	-0.303	0.000	0.000
47.70	-0.007	-0.233	0.000	0.000
53.67	-0.004	-0.140	0.000	0.000
59.63	0.000	0.000	0.000	0.000

SHEAR STRESSES AND ALLOWABLE STRESS RATINGS

SPAN 1
=======

X	SHEAR STRESSES DL1	DL2	+(LL+I)	-(LL+I)	ALLOW COMPR REDUCTION	RATING FACTORS IR	OR
0.00	0.788	0.049	1.236	0.000	1.000	7.41 V	10.33 V
5.96	0.630	0.039	1.064	-0.052	1.000	6.25 B	8.86 B
11.93	0.473	0.030	0.890	-0.131	1.000	3.33 B	4.90 B
17.89	0.315	0.020	0.713	-0.211	1.000	2.32 B	3.53 B
23.85	0.158	0.010	0.552	-0.290	1.000	1.96 B	3.05 B
29.82	0.000	0.000	0.394	-0.394	1.000	1.95 B	3.05 B
35.78	-0.158	-0.010	0.290	-0.552	1.000	1.96 B	3.05 B
41.74	-0.315	-0.020	0.211	-0.713	1.000	2.32 B	3.53 B
47.70	-0.473	-0.030	0.131	-0.890	1.000	3.33 B	4.90 B
53.67	-0.630	-0.039	0.052	-1.064	1.000	6.25 B	8.86 B
59.63	-0.788	-0.049	0.000	-1.236	1.000	7.41 V	10.33 V

NOTE: THE SHEAR CAPACITIES CALCULATED HEREIN ARE BASED ON STIFFENED OR UNSTIFFENED EQUATIONS AS SPECIFIED BY INPUT REGARDLESS OF THE STIFFENER SPACINGS INPUT AND ARE NOT CHECKED AGAINST AASHTO CRITERIA.

STRENGTHS AND LOAD FACTOR RATINGS

SPAN 1
=======

X	NON-COMP MOMENT STRENGTH	OVERLOAD MOMENT STRENGTH	SHEAR STRENGTH	NON-COMPACT RATING FACTORS IR	OR	COMPACT MOMENT STRENGTH	COMPACT RATING FACTORS IR	OR
0.00	1772.2 B	1683.6	374.8	6.09 V	10.15 V	2356.1	6.09 V	10.15 V
5.96	1772.2 B	1683.6	374.8	5.47 B	9.11 B	2356.1	6.89 O	11.48 O
11.93	1772.2 B	1683.6	374.8	3.03 B	5.05 B	2356.1	3.89 O	6.48 O
17.89	1772.2 B	1683.6	374.8	2.18 B	3.64 B	2356.1	2.84 O	4.73 O
23.85	1772.2 B	1683.6	374.8	1.89 B	3.15 B	2356.1	2.48 O	4.14 O
29.82	1772.2 B	1683.6	374.8	1.90 B	3.16 B	2356.1	2.50 O	4.16 O
35.78	1772.2 B	1683.6	374.8	1.89 B	3.15 B	2356.1	2.48 O	4.14 O
41.74	1772.2 B	1683.6	374.8	2.18 B	3.64 B	2356.1	2.84 O	4.73 O
47.70	1772.2 B	1683.6	374.8	3.03 B	5.05 B	2356.1	3.89 O	6.48 O
53.67	1772.2 B	1683.6	374.8	5.47 B	9.11 B	2356.1	6.89 O	11.48 O
59.63	1772.2 B	1683.6	374.8	6.09 V	10.15 V	2356.1	6.09 V	10.15 V

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**********************************
*  STRINGER  -  LIVE LOAD  3-3   *
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MAXIMUM REACTIONS

SUPPORT	DL1	DL2	+(LL+I)	-(LL+I)	REACTIONS +I.F.	REACTIONS -I.F.	MOMENTS +I.F.	MOMENTS -I.F.
1	17.0	1.1	25.8	0.0	1.27			

NOTE: ALL SUPPORT REACTIONS AND END SHEARS IN EACH SPAN DUE TO A LIVE LOAD
ARE CALCULATED BASED ON AASHTO ARTICLE 3.23.1
AS INTERPRETED IN SOL 431-93-05.

UNFACTORED MOMENTS AND SHEARS

SPAN 1 - LIVE LOAD IMPACT FACTORS : POS MOM 1.27
=======

X	DL1 MOMENT	DL2 MOMENT	+(LL+I) MOMENT	-(LL+I) MOMENT	DL1 SHEAR	DL2 SHEAR	+(LL+I) SHEAR	-(LL+I) SHEAR	I.F.
0.00	0.0	0.0	0.0	0.0	17.0	1.1	25.8	0.0	1.27
	SIMULT SHEAR		0.0	0.0	SIMULT MOM		0.0	0.0	
5.96	91.1	5.7	128.2	0.0	13.6	0.8	21.7	-1.0	1.28
	SIMULT SHEAR		21.7	0.0	SIMULT MOM		128.2	53.7	
11.93	161.9	10.1	212.9	0.0	10.2	0.6	18.1	-2.5	1.29
	SIMULT SHEAR		18.1	0.0	SIMULT MOM		212.9	119.5	
17.89	212.5	13.3	267.7	0.0	6.8	0.4	14.5	-4.1	1.30
	SIMULT SHEAR		9.3	0.0	SIMULT MOM		253.9	167.4	
23.85	242.9	15.2	283.2	0.0	3.4	0.2	11.1	-6.2	1.30
	SIMULT SHEAR		8.4	0.0	SIMULT MOM		259.7	217.2	
29.82	253.0	15.8	299.8	0.0	0.0	0.0	8.6	-8.6	1.30
	SIMULT SHEAR		-4.6	0.0	SIMULT MOM		251.5	251.5	
35.78	242.9	15.2	283.2	0.0	-3.4	-0.2	6.2	-11.1	1.30
	SIMULT SHEAR		-8.4	0.0	SIMULT MOM		217.2	259.7	
41.74	212.5	13.3	267.7	0.0	-6.8	-0.4	4.1	-14.5	1.30
	SIMULT SHEAR		-9.3	0.0	SIMULT MOM		167.4	253.9	
47.70	161.9	10.1	212.9	0.0	-10.2	-0.6	2.5	-18.1	1.29
	SIMULT SHEAR		-18.1	0.0	SIMULT MOM		119.5	212.9	
53.67	91.1	5.7	128.2	0.0	-13.6	-0.8	1.0	-21.7	1.28
	SIMULT SHEAR		-21.7	0.0	SIMULT MOM		53.7	128.2	
59.63	0.0	0.0	0.0	0.0	-17.0	-1.1	0.0	-25.8	1.27
	SIMULT SHEAR		0.0	0.0	SIMULT MOM		0.0	0.0	

FLEXURAL STRESSES - BEAM

SPAN 1
=======

	TOP FIBER STEEL STRESS				BOTTOM FIBER STEEL STRESS			
X	DL1	DL2	+(LL+I)	-(LL+I)	DL1	DL2	+(LL+I)	-(LL+I)
0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
5.96	-2.036	-0.058	-0.566	0.000	2.036	0.107	2.171	0.000
11.93	-3.619	-0.104	-0.940	0.000	3.619	0.190	3.603	0.000
17.89	-4.750	-0.136	-1.181	0.000	4.750	0.249	4.531	0.000
23.85	-5.428	-0.156	-1.250	0.000	5.428	0.284	4.793	0.000
29.82	-5.655	-0.162	-1.323	0.000	5.655	0.296	5.075	0.000
35.78	-5.428	-0.156	-1.250	0.000	5.428	0.284	4.793	0.000
41.74	-4.750	-0.136	-1.181	0.000	4.750	0.249	4.531	0.000
47.70	-3.619	-0.104	-0.940	0.000	3.619	0.190	3.603	0.000
53.67	-2.036	-0.058	-0.566	0.000	2.036	0.107	2.171	0.000
59.63	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

FLEXURAL STRESSES - SLAB

SPAN 1
=======

X	CONCRETE STRESS DL2	+(LL+I)	SLAB REINF STRESS DL2	-(LL+I)
0.00	0.000	0.000	0.000	0.000
5.96	-0.004	-0.133	0.000	0.000
11.93	-0.007	-0.220	0.000	0.000
17.89	-0.009	-0.277	0.000	0.000
23.85	-0.010	-0.293	0.000	0.000
29.82	-0.010	-0.310	0.000	0.000
35.78	-0.010	-0.293	0.000	0.000
41.74	-0.009	-0.277	0.000	0.000
47.70	-0.007	-0.220	0.000	0.000
53.67	-0.004	-0.133	0.000	0.000
59.63	0.000	0.000	0.000	0.000

SHEAR STRESSES AND ALLOWABLE STRESS RATINGS

SPAN 1
=======

X	SHEAR STRESSES DL1	DL2	+(LL+I)	-(LL+I)	ALLOW COMPR REDUCTION	RATING FACTORS IR	OR
0.00	0.788	0.049	1.196	0.000	1.000	7.66 V	10.67 V
5.96	0.630	0.039	1.005	-0.047	1.000	6.61 B	9.38 B
11.93	0.473	0.030	0.841	-0.118	1.000	3.52 B	5.19 B
17.89	0.315	0.020	0.674	-0.190	1.000	2.54 B	3.86 B
23.85	0.158	0.010	0.517	-0.288	1.000	2.25 B	3.50 B
29.82	0.000	0.000	0.401	-0.401	1.000	2.08 B	3.26 B
35.78	-0.158	-0.010	0.288	-0.517	1.000	2.25 B	3.50 B
41.74	-0.315	-0.020	0.190	-0.674	1.000	2.54 B	3.86 B
47.70	-0.473	-0.030	0.118	-0.841	1.000	3.52 B	5.19 B
53.67	-0.630	-0.039	0.047	-1.005	1.000	6.61 B	9.38 B
59.63	-0.788	-0.049	0.000	-1.196	1.000	7.66 V	10.67 V

NOTE: THE SHEAR CAPACITIES CALCULATED HEREIN ARE BASED ON STIFFENED OR UNSTIFFENED EQUATIONS AS SPECIFIED BY INPUT REGARDLESS OF THE STIFFENER SPACINGS INPUT AND ARE NOT CHECKED AGAINST AASHTO CRITERIA.

STRENGTHS AND LOAD FACTOR RATINGS

SPAN 1
=======

X	NON-COMP MOMENT STRENGTH	OVERLOAD MOMENT STRENGTH	SHEAR STRENGTH	NON-COMPACT RATING FACTORS IR	OR	COMPACT MOMENT STRENGTH	COMPACT RATING FACTORS IR	OR
0.00	1772.2 B	1683.6	374.8	6.29 V	10.49 V	2356.1	6.29 V	10.49 V
5.96	1772.2 B	1683.6	374.8	5.79 B	9.64 B	2356.1	7.29 O	12.14 O
11.93	1772.2 B	1683.6	374.8	3.21 B	5.35 B	2356.1	4.11 O	6.85 O
17.89	1772.2 B	1683.6	374.8	2.39 B	3.99 B	2356.1	3.11 O	5.19 O
23.85	1772.2 B	1683.6	374.8	2.17 B	3.62 B	2356.1	2.85 O	4.75 O
29.82	1772.2 B	1683.6	374.8	2.02 B	3.37 B	2356.1	2.67 O	4.44 O
35.78	1772.2 B	1683.6	374.8	2.17 B	3.62 B	2356.1	2.85 O	4.75 O
41.74	1772.2 B	1683.6	374.8	2.39 B	3.99 B	2356.1	3.11 O	5.19 O
47.70	1772.2 B	1683.6	374.8	3.21 B	5.35 B	2356.1	4.11 O	6.85 O
53.67	1772.2 B	1683.6	374.8	5.79 B	9.64 B	2356.1	7.29 O	12.14 O
59.63	1772.2 B	1683.6	374.8	6.29 V	10.49 V	2356.1	6.29 V	10.49 V

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+                                          +
+        R A T I N G   S U M M A R Y       +
+                                          +
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MEMBER: STRINGER AT 1.60

LOAD		ALLOWABLE STRESS RATING FACTOR		TONS	X	SPAN	LOAD FACTOR RATING FACTOR		TONS	X	SPAN
H20	IR (CRITICAL)	2.10	B	41.9	29.82	1	2.69	O	53.8	29.82	1
	OR (CRITICAL)	3.29	B	65.8	29.82	1	4.48	O	89.7	29.82	1
	IR (POS MOM)	2.10	B	41.9	29.82	1	2.69	O	53.8	29.82	1
	OR (POS MOM)	3.29	B	65.8	29.82	1	4.48	O	89.7	29.82	1
HS20	IR (CRITICAL)	1.46	B	52.6	29.82	1	1.87	O	67.5	29.82	1
	OR (CRITICAL)	2.29	B	82.5	29.82	1	3.12	O	112.4	29.82	1
	IR (POS MOM)	1.46	B	52.6	29.82	1	1.87	O	67.5	29.82	1
	OR (POS MOM)	2.29	B	82.5	29.82	1	3.12	O	112.4	29.82	1
3	IR (CRITICAL)	1.96	B	49.0	29.82	1	2.51	O	62.9	29.82	1
	OR (CRITICAL)	3.08	B	76.9	29.82	1	4.19	O	104.8	29.82	1
	IR (POS MOM)	1.96	B	49.0	29.82	1	2.51	O	62.9	29.82	1
	OR (POS MOM)	3.08	B	76.9	29.82	1	4.19	O	104.8	29.82	1
3S2	IR (CRITICAL)	1.95	B	70.1	29.82	1	2.48	O	89.3	35.78	1
	OR (CRITICAL)	3.05	B	109.7	35.78	1	4.14	O	148.9	35.78	1
	IR (POS MOM)	1.95	B	70.1	29.82	1	2.48	O	89.3	35.78	1
	OR (POS MOM)	3.05	B	109.7	35.78	1	4.14	O	148.9	35.78	1
3-3	IR (CRITICAL)	2.08	B	83.1	29.82	1	2.67	O	106.6	29.82	1
	OR (CRITICAL)	3.26	B	130.4	29.82	1	4.44	O	177.7	29.82	1
	IR (POS MOM)	2.08	B	83.1	29.82	1	2.67	O	106.6	29.82	1
	OR (POS MOM)	3.26	B	130.4	29.82	1	4.44	O	177.7	29.82	1

BRIDGE ANALYSIS AND RATING (BAR7)

STRUCTURE ID - - PIERBEAM 010 00

PROJECT IDENTIFICATION

BRG TYPE	SLC LEV	LANES	LIVE LOAD	OUT-PUT	IMP FACT	GAGE DIST	PASS DIST	FAT-IGUE	CONC DECK	SPEC	RE-DIST	DIR	S OVER FACTOR	END PAN
GFS			E	0	0.00	7.2	4.8		Y				0.00	

SKEW
CORR
HYB FACTOR
0.000

BRIDGE CROSS SECTION AND LOADING

DECK WIDTH	OVERHANG OR SPACING	CL OF GIRDER OR TRUSS TO CURB	ROADWAY WIDTH	DISTRIBUTION FACTORS SHEAR	MOMENT	DEFLECT
32.27	0.64	1.29	28.40	0.423	0.423	0.400

SLAB THICKNESS	HAUNCH	DEAD LOADS DL1	DL2	F'C	N	SYMMETRY
7.00	0.00	0.007	0.089	4.000	8.	Y

STRINGER DL1	FLOORBEAM DL1	UNIT WEIGHT DECK CONCRETE
0.000	0.000	116.

SPAN LENGTHS (SIMPLE)

SPAN #	1
LENGTH	59.63

TRAFFIC LANE LOCATIONS

LANE #	1	2	3	4	5	6
DIST	1.20	14.20				
WIDTH	13.00	13.00				
% LL	100.	100.				

STRINGER SPAN LENGTHS (SIMPLE)

SPAN #	1
LENGTH	59.63

STRINGER LOCATIONS

STRINGER #	1	2	3	4	5
DISTANCE	2.06	8.78	15.49	22.20	28.92

CONCRETE MEMBER PROPERTIES

TYPE	DEPTH	B	D	AS	D'	A'S	FY REINF
S	7.00	0.00	0.00	0.00	2.38	0.14	33.

ALLOWABLE FS IR	OR	ST DET	AV	SPECS	ALPHA	INTEGRAL WEARING SURFACE
0.0	0.0		0.00	0	0.	0.0

STEEL MEMBER PROPERTIES

G F S	S P A N	RANGE	T Y P E	WF BM M OF I OR VRT LEG	WF BM AREA OR HRZ LEG	FLANGE OR ANGLE THICK	FLANGE WIDTH	V A R	WF BM OR WEB PLATE DEPTH	WEB THICK
G	1	29.82	W	99999.90	60.00	2.0000	10.000		40.00	2.0000

TPW	TPT	BPW	BPT	COMP	FY	FY TOP	FY BOT	CG TOP	CG BOT
0.00	0.0000	0.00	0.0000	N	99.9	0.0	0.0	0.000	0.000

	RANGE	M OF I	AREA	THICK	WIDTH	V	DEPTH	THICK
F 1	32.26 W	12082.00	56.46	1.2900	12.110		36.50	0.7450

TPW	TPT	BPW	BPT	COMP	FY	FY TOP	FY BOT	CG TOP	CG BOT
0.00	0.0000	0.00	0.0000	Y	30.0	0.0	0.0	0.000	0.000

	RANGE	M OF I	AREA	THICK	WIDTH	V	DEPTH	THICK
F 2	32.26 W	12082.00	56.46	1.2900	12.110		36.50	0.7450

TPW	TPT	BPW	BPT	COMP	FY	FY TOP	FY BOT	CG TOP	CG BOT
0.00	0.0000	0.00	0.0000	Y	30.0	0.0	0.0	0.000	0.000

	RANGE	M OF I	AREA	THICK	WIDTH	V	DEPTH	THICK
S 1	29.82 W	9665.20	46.44	1.0400	12.000		36.00	0.6350

TPW	TPT	BPW	BPT	COMP	FY	FY TOP	FY BOT	CG TOP	CG BOT
0.00	0.0000	0.00	0.0000	Y	30.0	0.0	0.0	0.000	0.000

LATERAL BRACE POINTS AND STIFFENER SPACINGS

B OR G CODE	S OR F SPAN	C O D E	NO. OF SPCS	SPACING	C O D E	NO. OF SPCS	SPACING	C O D E	NO. OF SPCS	SPACING	C O D E	NO. OF SPCS	SPACING
BG	1	C	1	0.50	C	1	29.32		0	0.00		0	0.00
			0	0.00		0	0.00		0	0.00		0	0.00
BF	1	C	1	32.26	B	1	2.06	B	2	6.71		0	0.00
			0	0.00		0	0.00		0	0.00		0	0.00
BF	2	C	1	32.26	B	1	2.06	B	2	6.71		0	0.00
			0	0.00		0	0.00		0	0.00		0	0.00
SF	1	T	1	2.06	T	2	6.71		0	0.00		0	0.00
			0	0.00		0	0.00		0	0.00		0	0.00
SF	2	T	1	2.06	T	2	6.71		0	0.00		0	0.00
			0	0.00		0	0.00		0	0.00		0	0.00

DEFAULT VALUES

SLC LEVEL	LANES	GAGE DISTANCE	PASSING DISTANCE	UNIT WEIGHT DECK	FY REINF	ALLOWABLE FS IR	OR	INTEGRAL WEARING SURFACE
I	D	---	---	---	---	18.0	25.0	0.5

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+                                          +
+    F L O O R B E A M   A N A L Y S I S   +
+                                          +
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FLOORBEAM SPAN: 30.98 CANTILEVER: 0.64

FLOORBEAM LIVE LOAD MOMENT AND SHEAR FACTORS

X	FACTOR		---------- WHEEL LOAD POSITIONS ---------- LANE 1/4/7		LANE 2/5/8		LANE 3/6
-0.01	0.000	M	0.00	0.00			
	0.000	V	0.00	0.00			
-0.32	0.000	M	0.00	0.00			
	0.000	V	0.00	0.00			
-0.64	0.000	M	0.00	0.00			
	0.000	V	0.00	0.00			
0.01	0.000	M	0.00	0.00			
	1.142	V	3.69	10.89	15.69	22.89	
3.10	3.538	M	3.69	10.89	15.69	22.89	
	1.142	V	3.69	10.89	15.69	22.89	
6.20	6.073	M	6.19	13.39	18.19	25.39	
	0.974	V	6.29	13.49	18.29	25.49	
9.29	7.812	M	3.69	10.89	15.69	22.89	
	0.642	V	3.69	10.89	15.69	22.89	
12.39	9.350	M	5.19	12.39	17.19	24.39	
	0.539	V	5.29	12.49	17.29	24.49	
15.49	9.490	M	3.69	10.89	15.69	22.89	
	0.384	V	15.49	22.69			

FACTOR CODES: M - MOMENT, V - SHEAR

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<    FLOORBEAM  1    >
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FLOORBEAM SECTION PROPERTIES

EFFECTIVE SLAB WIDTH: 78.00 THICKNESS: 6.50

	DEPTH	GROSS AREA	MOMENT OF INERTIA	C BOTTOM	SECTION MODULUS TOP	BOTTOM	CONC OR NEG REINF
NON-COMPOSITE	36.50	56.46	12082.00	18.25	662.03	662.03	
COMPOSITE (N= 8)	43.00	119.84	26107.45	29.62	3794.87	881.40	1951.28
COMPOSITE (N=24)	43.00	77.59	19262.57	24.10	1553.94	799.14	1019.40
COMPOSITE (NEG M)	43.00	56.46	12082.00	18.25	662.03	662.03	N/A

DEAD LOADS ACTING ON FLOORBEAM

UNIFORM LOAD FLOORBEAM WEIGHT	INPUT DL1	CONCENTRATED LOADS DIST	DL1	DL2
0.192	0.000	2.060	16.948	1.061
		8.780	18.259	1.061
		15.490	18.249	1.061
		22.200	18.259	1.061

28.920 16.948 1.061

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*  FLOORBEAM  -  LIVE LOAD  H20   *
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LIVE LOAD REACTION FROM DECK (ONE LANE) : 45.08
LIVE LOAD IMPACT FACTORS : POS MOM 1.30 NEG MOM 1.30

UNFACTORED MOMENTS AND SHEARS

X	DL1 MOMENT	DL2 MOMENT	LL+I MOMENT	DL1 SHEAR	DL2 SHEAR	LL+I SHEAR	I.F.
-0.01	0.0	0.0	0.0	-0.1	0.0	0.0	1.30
-0.32	0.0	0.0	0.0	-0.1	0.0	0.0	1.30
-0.64	0.0	0.0	0.0	0.0	0.0	0.0	1.30
0.01	0.2	0.0	0.0	47.3	2.7	66.9	1.30
3.10	128.0	7.1	207.3	29.8	1.6	66.9	1.30
6.20	219.3	12.1	355.9	29.2	1.6	57.1	1.30
9.29	299.3	16.4	457.8	10.3	0.5	37.6	1.30
12.39	330.4	18.1	548.0	9.7	0.5	31.6	1.30
15.49	359.6	19.7	556.2	-9.1	-0.5	22.5	1.30

FLEXURAL STRESSES - BEAM

	TOP FIBER STEEL STRESS				BOTTOM FIBER STEEL STRESS			
X	DL1	DL2	+(LL+I)	-(LL+I)	DL1	DL2	+(LL+I)	-(LL+I)
-0.01	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
-0.32	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
-0.64	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
0.01	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
3.10	-2.320	-0.055	-0.656	0.000	2.320	0.107	2.823	0.000
6.20	-3.975	-0.093	-1.125	0.000	3.975	0.181	4.846	0.000
9.29	-5.426	-0.127	-1.448	0.000	5.426	0.247	6.233	0.000
12.39	-5.989	-0.140	-1.733	0.000	5.989	0.272	7.460	0.000
15.49	-6.518	-0.152	-1.759	0.000	6.518	0.296	7.572	0.000

FLEXURAL STRESSES - SLAB

	CONCRETE STRESS		SLAB REINF STRESS	
X	DL2	+(LL+I)	DL2	-(LL+I)
-0.01	0.000	0.000	N/A	N/A
-0.32	0.000	0.000	N/A	N/A
-0.64	0.000	0.000	N/A	N/A
0.01	0.000	0.000	N/A	N/A
3.10	-0.003	-0.159	N/A	N/A
6.20	-0.006	-0.274	N/A	N/A
9.29	-0.008	-0.352	N/A	N/A
12.39	-0.009	-0.421	N/A	N/A
15.49	-0.010	-0.428	N/A	N/A

SHEAR STRESSES AND ALLOWABLE STRESS RATINGS

	SHEAR STRESSES				ALLOW COMPR	RATING FACTORS	
X	DL1	DL2	+(LL+I)	-(LL+I)	REDUCTION	IR	OR
-0.01	-0.005	0.000	0.000	0.000	1.000	999.99	999.99
-0.32	-0.002	0.000	0.000	0.000	1.000	999.99	999.99
-0.64	0.000	0.000	0.000	0.000	1.000	999.99	999.99
0.01	1.872	0.105	2.649	0.000	1.000	3.03 V	4.35 V

3.10	1.178	0.063	2.649	0.000	1.000	3.31 V	4.63 V
6.20	1.154	0.063	2.259	0.000	1.000	2.41 I	3.55 I
9.29	0.408	0.021	1.489	0.000	1.000	1.74 B	2.70 B
12.39	0.385	0.021	1.249	0.000	1.000	1.37 B	2.18 B
15.49	-0.361	-0.021	0.890	0.000	1.000	1.28 B	2.07 B

NOTE: THE SHEAR CAPACITIES CALCULATED HEREIN ARE BASED ON STIFFENED OR UNSTIFFENED EQUATIONS AS SPECIFIED BY INPUT REGARDLESS OF THE STIFFENER SPACINGS INPUT AND ARE NOT CHECKED AGAINST AASHTO CRITERIA.

STRENGTHS AND LOAD FACTOR RATINGS

	NON-COMP MOMENT	OVERLOAD MOMENT	SHEAR	NON-COMPACT RATING FACTORS		COMPACT MOMENT	COMPACT RATING FACTORS	
X	STRENGTH	STRENGTH	STRENGTH	IR	OR	STRENGTH	IR	OR
-0.01	-1655.1 B	-1572.3	439.7	999.99	999.99	-1910.8	999.99	999.99
-0.32	-1655.1 B	-1572.3	439.7	999.99	999.99	-1910.8	999.99	999.99
-0.64	-2203.5 B	-2093.3	439.7	999.99	999.99	-2975.2	999.99	999.99
0.01	2203.5 B	2093.3	439.7	2.58 V	4.31 V	2975.2	2.58 V	4.31 V
3.10	2203.5 B	2093.3	439.7	2.75 V	4.59 V	2975.2	2.75 V	4.59 V
6.20	2203.5 B	2093.3	439.7	2.16 I	3.61 I	2975.2	2.16 I	3.61 I
9.29	2203.5 B	2093.3	439.7	1.68 B	2.79 B	2975.2	2.20 O	3.66 O
12.39	2203.5 B	2093.3	439.7	1.35 B	2.25 B	2975.2	1.79 O	2.98 O
15.49	2203.5 B	2093.3	439.7	1.29 B	2.15 B	2975.2	1.72 O	2.86 O

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*  FLOORBEAM  -  LIVE LOAD  HS20  *
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LIVE LOAD REACTION FROM DECK (ONE TRUCK) : 60.73
LIVE LOAD IMPACT FACTORS : POS MOM 1.30 NEG MOM 1.30

UNFACTORED MOMENTS AND SHEARS

X	DL1 MOMENT	DL2 MOMENT	LL+I MOMENT	DL1 SHEAR	DL2 SHEAR	LL+I SHEAR	I.F.
-0.01	0.0	0.0	0.0	-0.1	0.0	0.0	1.30
-0.32	0.0	0.0	0.0	-0.1	0.0	0.0	1.30
-0.64	0.0	0.0	0.0	0.0	0.0	0.0	1.30
0.01	0.2	0.0	0.0	47.3	2.7	90.2	1.30
3.10	128.0	7.1	279.3	29.8	1.6	90.2	1.30
6.20	219.3	12.1	479.5	29.2	1.6	76.9	1.30
9.29	299.3	16.4	616.8	10.3	0.5	50.7	1.30
12.39	330.4	18.1	738.2	9.7	0.5	42.5	1.30
15.49	359.6	19.7	749.2	-9.1	-0.5	30.3	1.30

FLEXURAL STRESSES - BEAM

	TOP FIBER STEEL STRESS				BOTTOM FIBER STEEL STRESS			
X	DL1	DL2	+(LL+I)	-(LL+I)	DL1	DL2	+(LL+I)	-(LL+I)
-0.01	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
-0.32	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
-0.64	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
0.01	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
3.10	-2.320	-0.055	-0.883	0.000	2.320	0.107	3.803	0.000
6.20	-3.975	-0.093	-1.516	0.000	3.975	0.181	6.528	0.000
9.29	-5.426	-0.127	-1.950	0.000	5.426	0.247	8.397	0.000
12.39	-5.989	-0.140	-2.334	0.000	5.989	0.272	10.050	0.000
15.49	-6.518	-0.152	-2.369	0.000	6.518	0.296	10.201	0.000

FLEXURAL STRESSES - SLAB

X	CONCRETE STRESS DL2	CONCRETE STRESS +(LL+I)	SLAB REINF STRESS DL2	SLAB REINF STRESS -(LL+I)
-0.01	0.000	0.000	N/A	N/A
-0.32	0.000	0.000	N/A	N/A
-0.64	0.000	0.000	N/A	N/A
0.01	0.000	0.000	N/A	N/A
3.10	-0.003	-0.215	N/A	N/A
6.20	-0.006	-0.369	N/A	N/A
9.29	-0.008	-0.474	N/A	N/A
12.39	-0.009	-0.567	N/A	N/A
15.49	-0.010	-0.576	N/A	N/A

SHEAR STRESSES AND ALLOWABLE STRESS RATINGS

X	SHEAR STRESSES DL1	DL2	+(LL+I)	-(LL+I)	ALLOW COMPR REDUCTION	RATING FACTORS IR	OR
-0.01	-0.005	0.000	0.000	0.000	1.000	999.99	999.99
-0.32	-0.002	0.000	0.000	0.000	1.000	999.99	999.99
-0.64	0.000	0.000	0.000	0.000	1.000	999.99	999.99
0.01	1.872	0.105	3.568	0.000	1.000	2.25 V	3.23 V
3.10	1.178	0.063	3.568	0.000	1.000	2.45 V	3.44 V
6.20	1.154	0.063	3.044	0.000	1.000	1.79 I	2.63 I
9.29	0.408	0.021	2.006	0.000	1.000	1.29 B	2.00 B
12.39	0.385	0.021	1.683	0.000	1.000	1.02 B	1.62 B
15.49	-0.361	-0.021	1.199	0.000	1.000	0.95 B	1.54 B

NOTE: THE SHEAR CAPACITIES CALCULATED HEREIN ARE BASED ON STIFFENED OR UNSTIFFENED EQUATIONS AS SPECIFIED BY INPUT REGARDLESS OF THE STIFFENER SPACINGS INPUT AND ARE NOT CHECKED AGAINST AASHTO CRITERIA.

STRENGTHS AND LOAD FACTOR RATINGS

X	NON-COMP MOMENT STRENGTH	OVERLOAD MOMENT STRENGTH	SHEAR STRENGTH	NON-COMPACT RATING FACTORS IR	OR	COMPACT MOMENT STRENGTH	COMPACT RATING FACTORS IR	OR
-0.01	-1655.1 B	-1572.3	439.7	999.99	999.99	-1910.8	999.99	999.99
-0.32	-1655.1 B	-1572.3	439.7	999.99	999.99	-1910.8	999.99	999.99
-0.64	-2203.5 B	-2093.3	439.7	999.99	999.99	-2975.2	999.99	999.99
0.01	2203.5 B	2093.3	439.7	1.92 V	3.20 V	2975.2	1.92 V	3.20 V
3.10	2203.5 B	2093.3	439.7	2.04 V	3.40 V	2975.2	2.04 V	3.40 V
6.20	2203.5 B	2093.3	439.7	1.61 I	2.68 I	2975.2	1.61 I	2.68 I
9.29	2203.5 B	2093.3	439.7	1.24 B	2.07 B	2975.2	1.63 O	2.72 O
12.39	2203.5 B	2093.3	439.7	1.00 B	1.67 B	2975.2	1.33 O	2.21 O
15.49	2203.5 B	2093.3	439.7	0.96 B	1.59 B	2975.2	1.28 O	2.13 O

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*  FLOORBEAM  -  LIVE LOAD   3    *
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LIVE LOAD REACTION FROM DECK (ONE TRUCK) : 43.76
LIVE LOAD IMPACT FACTORS : POS MOM 1.30 NEG MOM 1.30

UNFACTORED MOMENTS AND SHEARS

DL1 DL2 LL+I DL1 DL2 LL+I

X	MOMENT	MOMENT	MOMENT	SHEAR	SHEAR	SHEAR	I.F.
-0.01	0.0	0.0	0.0	-0.1	0.0	0.0	1.30
-0.32	0.0	0.0	0.0	-0.1	0.0	0.0	1.30
-0.64	0.0	0.0	0.0	0.0	0.0	0.0	1.30
0.01	0.2	0.0	0.0	47.3	2.7	65.0	1.30
3.10	128.0	7.1	201.3	29.8	1.6	65.0	1.30
6.20	219.3	12.1	345.5	29.2	1.6	55.4	1.30
9.29	299.3	16.4	444.4	10.3	0.5	36.5	1.30
12.39	330.4	18.1	531.9	9.7	0.5	30.6	1.30
15.49	359.6	19.7	539.9	-9.1	-0.5	21.8	1.30

FLEXURAL STRESSES - BEAM

	TOP FIBER STEEL STRESS				BOTTOM FIBER STEEL STRESS			
X	DL1	DL2	+(LL+I)	-(LL+I)	DL1	DL2	+(LL+I)	-(LL+I)
-0.01	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
-0.32	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
-0.64	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
0.01	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
3.10	-2.320	-0.055	-0.636	0.000	2.320	0.107	2.740	0.000
6.20	-3.975	-0.093	-1.093	0.000	3.975	0.181	4.704	0.000
9.29	-5.426	-0.127	-1.405	0.000	5.426	0.247	6.051	0.000
12.39	-5.989	-0.140	-1.682	0.000	5.989	0.272	7.242	0.000
15.49	-6.518	-0.152	-1.707	0.000	6.518	0.296	7.350	0.000

FLEXURAL STRESSES - SLAB

	CONCRETE STRESS		SLAB REINF STRESS	
X	DL2	+(LL+I)	DL2	-(LL+I)
-0.01	0.000	0.000	N/A	N/A
-0.32	0.000	0.000	N/A	N/A
-0.64	0.000	0.000	N/A	N/A
0.01	0.000	0.000	N/A	N/A
3.10	-0.003	-0.155	N/A	N/A
6.20	-0.006	-0.266	N/A	N/A
9.29	-0.008	-0.342	N/A	N/A
12.39	-0.009	-0.409	N/A	N/A
15.49	-0.010	-0.415	N/A	N/A

SHEAR STRESSES AND ALLOWABLE STRESS RATINGS

	SHEAR STRESSES				ALLOW COMPR	RATING FACTORS	
X	DL1	DL2	+(LL+I)	-(LL+I)	REDUCTION	IR	OR
-0.01	-0.005	0.000	0.000	0.000	1.000	999.99	999.99
-0.32	-0.002	0.000	0.000	0.000	1.000	999.99	999.99
-0.64	0.000	0.000	0.000	0.000	1.000	999.99	999.99
0.01	1.872	0.105	2.571	0.000	1.000	3.12 V	4.48 V
3.10	1.178	0.063	2.571	0.000	1.000	3.41 V	4.77 V
6.20	1.154	0.063	2.193	0.000	1.000	2.48 I	3.65 I
9.29	0.408	0.021	1.445	0.000	1.000	1.79 B	2.78 B
12.39	0.385	0.021	1.213	0.000	1.000	1.41 B	2.24 B
15.49	-0.361	-0.021	0.864	0.000	1.000	1.32 B	2.13 B

NOTE: THE SHEAR CAPACITIES CALCULATED HEREIN ARE BASED ON STIFFENED OR UNSTIFFENED EQUATIONS AS SPECIFIED BY INPUT REGARDLESS OF THE STIFFENER SPACINGS INPUT AND ARE NOT CHECKED AGAINST AASHTO CRITERIA.

X	NON-COMP MOMENT STRENGTH	OVERLOAD MOMENT STRENGTH	SHEAR STRENGTH	NON-COMPACT RATING FACTORS IR	OR	COMPACT MOMENT STRENGTH	COMPACT RATING FACTORS IR	OR
-0.01	-1655.1 B	-1572.3	439.7	999.99	999.99	-1910.8	999.99	999.99
-0.32	-1655.1 B	-1572.3	439.7	999.99	999.99	-1910.8	999.99	999.99
-0.64	-2203.5 B	-2093.3	439.7	999.99	999.99	-2975.2	999.99	999.99
0.01	2203.5 B	2093.3	439.7	2.66 V	4.44 V	2975.2	2.66 V	4.44 V
3.10	2203.5 B	2093.3	439.7	2.83 V	4.72 V	2975.2	2.83 V	4.72 V
6.20	2203.5 B	2093.3	439.7	2.23 I	3.72 I	2975.2	2.23 I	3.72 I
9.29	2203.5 B	2093.3	439.7	1.73 B	2.88 B	2975.2	2.26 O	3.77 O
12.39	2203.5 B	2093.3	439.7	1.39 B	2.32 B	2975.2	1.84 O	3.07 O
15.49	2203.5 B	2093.3	439.7	1.33 B	2.21 B	2975.2	1.77 O	2.95 O

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*  FLOORBEAM  -  LIVE LOAD  3S2   *
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LIVE LOAD REACTION FROM DECK (ONE TRUCK) : 49.53
LIVE LOAD IMPACT FACTORS : POS MOM 1.30 NEG MOM 1.30

UNFACTORED MOMENTS AND SHEARS

X	DL1 MOMENT	DL2 MOMENT	LL+I MOMENT	DL1 SHEAR	DL2 SHEAR	LL+I SHEAR	I.F.
-0.01	0.0	0.0	0.0	-0.1	0.0	0.0	1.30
-0.32	0.0	0.0	0.0	-0.1	0.0	0.0	1.30
-0.64	0.0	0.0	0.0	0.0	0.0	0.0	1.30
0.01	0.2	0.0	0.0	47.3	2.7	73.5	1.30
3.10	128.0	7.1	227.8	29.8	1.6	73.5	1.30
6.20	219.3	12.1	391.0	29.2	1.6	62.7	1.30
9.29	299.3	16.4	503.0	10.3	0.5	41.3	1.30
12.39	330.4	18.1	602.0	9.7	0.5	34.7	1.30
15.49	359.6	19.7	611.0	-9.1	-0.5	24.7	1.30

FLEXURAL STRESSES - BEAM

X	TOP FIBER STEEL STRESS DL1	DL2	+(LL+I)	-(LL+I)	BOTTOM FIBER STEEL STRESS DL1	DL2	+(LL+I)	-(LL+I)
-0.01	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
-0.32	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
-0.64	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
0.01	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
3.10	-2.320	-0.055	-0.720	0.000	2.320	0.107	3.101	0.000
6.20	-3.975	-0.093	-1.236	0.000	3.975	0.181	5.324	0.000
9.29	-5.426	-0.127	-1.591	0.000	5.426	0.247	6.848	0.000
12.39	-5.989	-0.140	-1.904	0.000	5.989	0.272	8.196	0.000
15.49	-6.518	-0.152	-1.932	0.000	6.518	0.296	8.319	0.000

FLEXURAL STRESSES - SLAB

X	CONCRETE STRESS DL2	+(LL+I)	SLAB REINF STRESS DL2	-(LL+I)
-0.01	0.000	0.000	N/A	N/A
-0.32	0.000	0.000	N/A	N/A
-0.64	0.000	0.000	N/A	N/A
0.01	0.000	0.000	N/A	N/A
3.10	-0.003	-0.175	N/A	N/A
6.20	-0.006	-0.301	N/A	N/A
9.29	-0.008	-0.387	N/A	N/A

12.39	-0.009	-0.463	N/A	N/A
15.49	-0.010	-0.470	N/A	N/A

SHEAR STRESSES AND ALLOWABLE STRESS RATINGS

		SHEAR STRESSES			ALLOW COMPR	RATING FACTORS	
X	DL1	DL2	+(LL+I)	-(LL+I)	REDUCTION	IR	OR
-0.01	-0.005	0.000	0.000	0.000	1.000	999.99	999.99
-0.32	-0.002	0.000	0.000	0.000	1.000	999.99	999.99
-0.64	0.000	0.000	0.000	0.000	1.000	999.99	999.99
0.01	1.872	0.105	2.910	0.000	1.000	2.76 V	3.96 V
3.10	1.178	0.063	2.910	0.000	1.000	3.01 V	4.21 V
6.20	1.154	0.063	2.482	0.000	1.000	2.19 I	3.23 I
9.29	0.408	0.021	1.636	0.000	1.000	1.58 B	2.46 B
12.39	0.385	0.021	1.373	0.000	1.000	1.25 B	1.98 B
15.49	-0.361	-0.021	0.978	0.000	1.000	1.16 B	1.89 B

NOTE: THE SHEAR CAPACITIES CALCULATED HEREIN ARE BASED ON STIFFENED OR UNSTIFFENED EQUATIONS AS SPECIFIED BY INPUT REGARDLESS OF THE STIFFENER SPACINGS INPUT AND ARE NOT CHECKED AGAINST AASHTO CRITERIA.

STRENGTHS AND LOAD FACTOR RATINGS

	NON-COMP	OVERLOAD		NON-COMPACT		COMPACT	COMPACT	
	MOMENT	MOMENT	SHEAR	RATING FACTORS		MOMENT	RATING FACTORS	
X	STRENGTH	STRENGTH	STRENGTH	IR	OR	STRENGTH	IR	OR
-0.01	-1655.1 B	-1572.3	439.7	999.99	999.99	-1910.8	999.99	999.99
-0.32	-1655.1 B	-1572.3	439.7	999.99	999.99	-1910.8	999.99	999.99
-0.64	-2203.5 B	-2093.3	439.7	999.99	999.99	-2975.2	999.99	999.99
0.01	2203.5 B	2093.3	439.7	2.35 V	3.92 V	2975.2	2.35 V	3.92 V
3.10	2203.5 B	2093.3	439.7	2.50 V	4.17 V	2975.2	2.50 V	4.17 V
6.20	2203.5 B	2093.3	439.7	1.97 I	3.28 I	2975.2	1.97 I	3.28 I
9.29	2203.5 B	2093.3	439.7	1.52 B	2.54 B	2975.2	2.00 O	3.33 O
12.39	2203.5 B	2093.3	439.7	1.23 B	2.05 B	2975.2	1.63 O	2.71 O
15.49	2203.5 B	2093.3	439.7	1.17 B	1.95 B	2975.2	1.56 O	2.61 O

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*  FLOORBEAM  -  LIVE LOAD  3-3   *
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LIVE LOAD REACTION FROM DECK (ONE TRUCK) : 47.94
LIVE LOAD IMPACT FACTORS : POS MOM 1.30 NEG MOM 1.30

UNFACTORED MOMENTS AND SHEARS

	DL1	DL2	LL+I	DL1	DL2	LL+I	
X	MOMENT	MOMENT	MOMENT	SHEAR	SHEAR	SHEAR	I.F.
-0.01	0.0	0.0	0.0	-0.1	0.0	0.0	1.30
-0.32	0.0	0.0	0.0	-0.1	0.0	0.0	1.30
-0.64	0.0	0.0	0.0	0.0	0.0	0.0	1.30
0.01	0.2	0.0	0.0	47.3	2.7	71.2	1.30
3.10	128.0	7.1	220.5	29.8	1.6	71.2	1.30
6.20	219.3	12.1	378.4	29.2	1.6	60.7	1.30
9.29	299.3	16.4	486.8	10.3	0.5	40.0	1.30
12.39	330.4	18.1	582.7	9.7	0.5	33.6	1.30
15.49	359.6	19.7	591.4	-9.1	-0.5	23.9	1.30

	TOP FIBER STEEL STRESS				BOTTOM FIBER STEEL STRESS			
X	DL1	DL2	+(LL+I)	-(LL+I)	DL1	DL2	+(LL+I)	-(LL+I)
-0.01	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
-0.32	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
-0.64	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
0.01	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
3.10	-2.320	-0.055	-0.697	0.000	2.320	0.107	3.002	0.000
6.20	-3.975	-0.093	-1.197	0.000	3.975	0.181	5.152	0.000
9.29	-5.426	-0.127	-1.539	0.000	5.426	0.247	6.628	0.000
12.39	-5.989	-0.140	-1.842	0.000	5.989	0.272	7.933	0.000
15.49	-6.518	-0.152	-1.870	0.000	6.518	0.296	8.051	0.000

FLEXURAL STRESSES - SLAB

	CONCRETE STRESS		SLAB REINF STRESS	
X	DL2	+(LL+I)	DL2	-(LL+I)
-0.01	0.000	0.000	N/A	N/A
-0.32	0.000	0.000	N/A	N/A
-0.64	0.000	0.000	N/A	N/A
0.01	0.000	0.000	N/A	N/A
3.10	-0.003	-0.169	N/A	N/A
6.20	-0.006	-0.291	N/A	N/A
9.29	-0.008	-0.374	N/A	N/A
12.39	-0.009	-0.448	N/A	N/A
15.49	-0.010	-0.455	N/A	N/A

SHEAR STRESSES AND ALLOWABLE STRESS RATINGS

	SHEAR STRESSES				ALLOW COMPR	RATING FACTORS	
X	DL1	DL2	+(LL+I)	-(LL+I)	REDUCTION	IR	OR
-0.01	-0.005	0.000	0.000	0.000	1.000	999.99	999.99
-0.32	-0.002	0.000	0.000	0.000	1.000	999.99	999.99
-0.64	0.000	0.000	0.000	0.000	1.000	999.99	999.99
0.01	1.872	0.105	2.816	0.000	1.000	2.85 V	4.09 V
3.10	1.178	0.063	2.816	0.000	1.000	3.11 V	4.35 V
6.20	1.154	0.063	2.402	0.000	1.000	2.27 I	3.34 I
9.29	0.408	0.021	1.583	0.000	1.000	1.63 B	2.54 B
12.39	0.385	0.021	1.329	0.000	1.000	1.29 B	2.05 B
15.49	-0.361	-0.021	0.946	0.000	1.000	1.20 B	1.95 B

NOTE: THE SHEAR CAPACITIES CALCULATED HEREIN ARE BASED ON STIFFENED OR UNSTIFFENED EQUATIONS AS SPECIFIED BY INPUT REGARDLESS OF THE STIFFENER SPACINGS INPUT AND ARE NOT CHECKED AGAINST AASHTO CRITERIA.

STRENGTHS AND LOAD FACTOR RATINGS

	NON-COMP	OVERLOAD		NON-COMPACT		COMPACT	COMPACT	
	MOMENT	MOMENT	SHEAR	RATING FACTORS		MOMENT	RATING FACTORS	
X	STRENGTH	STRENGTH	STRENGTH	IR	OR	STRENGTH	IR	OR
-0.01	-1655.1 B	-1572.3	439.7	999.99	999.99	-1910.8	999.99	999.99
-0.32	-1655.1 B	-1572.3	439.7	999.99	999.99	-1910.8	999.99	999.99
-0.64	-2203.5 B	-2093.3	439.7	999.99	999.99	-2975.2	999.99	999.99
0.01	2203.5 B	2093.3	439.7	2.43 V	4.05 V	2975.2	2.43 V	4.05 V
3.10	2203.5 B	2093.3	439.7	2.59 V	4.31 V	2975.2	2.59 V	4.31 V
6.20	2203.5 B	2093.3	439.7	2.04 I	3.39 I	2975.2	2.04 I	3.39 I
9.29	2203.5 B	2093.3	439.7	1.58 B	2.63 B	2975.2	2.07 O	3.44 O
12.39	2203.5 B	2093.3	439.7	1.27 B	2.12 B	2975.2	1.68 O	2.80 O
15.49	2203.5 B	2093.3	439.7	1.21 B	2.02 B	2975.2	1.62 O	2.69 O

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<    FLOORBEAM  2    >
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FLOORBEAM SECTION PROPERTIES

EFFECTIVE SLAB WIDTH: 78.00 THICKNESS: 6.50

	DEPTH	GROSS AREA	MOMENT OF INERTIA	C BOTTOM	SECTION MODULUS TOP	BOTTOM	CONC OR NEG REINF
NON-COMPOSITE	36.50	56.46	12082.00	18.25	662.03	662.03	
COMPOSITE (N= 8)	43.00	119.84	26107.45	29.62	3794.87	881.40	1951.28
COMPOSITE (N=24)	43.00	77.59	19262.57	24.10	1553.94	799.14	1019.40
COMPOSITE (NEG M)	43.00	56.46	12082.00	18.25	662.03	662.03	N/A

DEAD LOADS ACTING ON FLOORBEAM

UNIFORM LOAD FLOORBEAM WEIGHT	INPUT DL1	CONCENTRATED LOADS DIST	DL1	DL2
0.192	0.000	2.060	16.948	1.061
		8.780	18.259	1.061
		15.490	18.249	1.061
		22.200	18.259	1.061
		28.920	16.948	1.061

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*  FLOORBEAM  -  LIVE LOAD  H20   *
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LIVE LOAD REACTION FROM DECK (ONE LANE) : 45.08
LIVE LOAD IMPACT FACTORS : POS MOM 1.30 NEG MOM 1.30

UNFACTORED MOMENTS AND SHEARS

X	DL1 MOMENT	DL2 MOMENT	LL+I MOMENT	DL1 SHEAR	DL2 SHEAR	LL+I SHEAR	I.F.
-0.01	0.0	0.0	0.0	-0.1	0.0	0.0	1.30
-0.32	0.0	0.0	0.0	-0.1	0.0	0.0	1.30
-0.64	0.0	0.0	0.0	0.0	0.0	0.0	1.30
0.01	0.2	0.0	0.0	47.3	2.7	66.9	1.30
3.10	128.0	7.1	207.3	29.8	1.6	66.9	1.30
6.20	219.3	12.1	355.9	29.2	1.6	57.1	1.30
9.29	299.3	16.4	457.8	10.3	0.5	37.6	1.30
12.39	330.4	18.1	548.0	9.7	0.5	31.6	1.30
15.49	359.6	19.7	556.2	-9.1	-0.5	22.5	1.30

FLEXURAL STRESSES - BEAM

X	TOP FIBER STEEL STRESS DL1	DL2	+(LL+I)	-(LL+I)	BOTTOM FIBER STEEL STRESS DL1	DL2	+(LL+I)	-(LL+I)
-0.01	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
-0.32	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
-0.64	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
0.01	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
3.10	-2.320	-0.055	-0.656	0.000	2.320	0.107	2.823	0.000

6.20	-3.975	-0.093	-1.125	0.000	3.975	0.181	4.846	0.000
9.29	-5.426	-0.127	-1.448	0.000	5.426	0.247	6.233	0.000
12.39	-5.989	-0.140	-1.733	0.000	5.989	0.272	7.460	0.000
15.49	-6.518	-0.152	-1.759	0.000	6.518	0.296	7.572	0.000

FLEXURAL STRESSES - SLAB

	CONCRETE STRESS		SLAB REINF STRESS	
X	DL2	+(LL+I)	DL2	-(LL+I)
-0.01	0.000	0.000	N/A	N/A
-0.32	0.000	0.000	N/A	N/A
-0.64	0.000	0.000	N/A	N/A
0.01	0.000	0.000	N/A	N/A
3.10	-0.003	-0.159	N/A	N/A
6.20	-0.006	-0.274	N/A	N/A
9.29	-0.008	-0.352	N/A	N/A
12.39	-0.009	-0.421	N/A	N/A
15.49	-0.010	-0.428	N/A	N/A

SHEAR STRESSES AND ALLOWABLE STRESS RATINGS

	SHEAR STRESSES				ALLOW COMPR	RATING FACTORS	
X	DL1	DL2	+(LL+I)	-(LL+I)	REDUCTION	IR	OR
-0.01	-0.005	0.000	0.000	0.000	1.000	999.99	999.99
-0.32	-0.002	0.000	0.000	0.000	1.000	999.99	999.99
-0.64	0.000	0.000	0.000	0.000	1.000	999.99	999.99
0.01	1.872	0.105	2.649	0.000	1.000	3.03 V	4.35 V
3.10	1.178	0.063	2.649	0.000	1.000	3.31 V	4.63 V
6.20	1.154	0.063	2.259	0.000	1.000	2.41 I	3.55 I
9.29	0.408	0.021	1.489	0.000	1.000	1.74 B	2.70 B
12.39	0.385	0.021	1.249	0.000	1.000	1.37 B	2.18 B
15.49	-0.361	-0.021	0.890	0.000	1.000	1.28 B	2.07 B

NOTE: THE SHEAR CAPACITIES CALCULATED HEREIN ARE BASED ON STIFFENED OR UNSTIFFENED EQUATIONS AS SPECIFIED BY INPUT REGARDLESS OF THE STIFFENER SPACINGS INPUT AND ARE NOT CHECKED AGAINST AASHTO CRITERIA.

STRENGTHS AND LOAD FACTOR RATINGS

	NON-COMP	OVERLOAD		NON-COMPACT		COMPACT	COMPACT	
	MOMENT	MOMENT	SHEAR	RATING FACTORS		MOMENT	RATING FACTORS	
X	STRENGTH	STRENGTH	STRENGTH	IR	OR	STRENGTH	IR	OR
-0.01	-1655.1 B	-1572.3	439.7	999.99	999.99	-1910.8	999.99	999.99
-0.32	-1655.1 B	-1572.3	439.7	999.99	999.99	-1910.8	999.99	999.99
-0.64	-2203.5 B	-2093.3	439.7	999.99	999.99	-2975.2	999.99	999.99
0.01	2203.5 B	2093.3	439.7	2.58 V	4.31 V	2975.2	2.58 V	4.31 V
3.10	2203.5 B	2093.3	439.7	2.75 V	4.59 V	2975.2	2.75 V	4.59 V
6.20	2203.5 B	2093.3	439.7	2.16 I	3.61 I	2975.2	2.16 I	3.61 I
9.29	2203.5 B	2093.3	439.7	1.68 B	2.79 B	2975.2	2.20 O	3.66 O
12.39	2203.5 B	2093.3	439.7	1.35 B	2.25 B	2975.2	1.79 O	2.98 O
15.49	2203.5 B	2093.3	439.7	1.29 B	2.15 B	2975.2	1.72 O	2.86 O

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*  FLOORBEAM  -  LIVE LOAD  HS20  *
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LIVE LOAD REACTION FROM DECK (ONE TRUCK) : 60.73
LIVE LOAD IMPACT FACTORS : POS MOM 1.30 NEG MOM 1.30

UNFACTORED MOMENTS AND SHEARS

X	DL1 MOMENT	DL2 MOMENT	LL+I MOMENT	DL1 SHEAR	DL2 SHEAR	LL+I SHEAR	I.F.
-0.01	0.0	0.0	0.0	-0.1	0.0	0.0	1.30
-0.32	0.0	0.0	0.0	-0.1	0.0	0.0	1.30
-0.64	0.0	0.0	0.0	0.0	0.0	0.0	1.30
0.01	0.2	0.0	0.0	47.3	2.7	90.2	1.30
3.10	128.0	7.1	279.3	29.8	1.6	90.2	1.30
6.20	219.3	12.1	479.5	29.2	1.6	76.9	1.30
9.29	299.3	16.4	616.8	10.3	0.5	50.7	1.30
12.39	330.4	18.1	738.2	9.7	0.5	42.5	1.30
15.49	359.6	19.7	749.2	-9.1	-0.5	30.3	1.30

FLEXURAL STRESSES - BEAM

	TOP FIBER STEEL STRESS				BOTTOM FIBER STEEL STRESS			
X	DL1	DL2	+(LL+I)	-(LL+I)	DL1	DL2	+(LL+I)	-(LL+I)
-0.01	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
-0.32	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
-0.64	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
0.01	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
3.10	-2.320	-0.055	-0.883	0.000	2.320	0.107	3.803	0.000
6.20	-3.975	-0.093	-1.516	0.000	3.975	0.181	6.528	0.000
9.29	-5.426	-0.127	-1.950	0.000	5.426	0.247	8.397	0.000
12.39	-5.989	-0.140	-2.334	0.000	5.989	0.272	10.050	0.000
15.49	-6.518	-0.152	-2.369	0.000	6.518	0.296	10.201	0.000

FLEXURAL STRESSES - SLAB

	CONCRETE STRESS		SLAB REINF STRESS	
X	DL2	+(LL+I)	DL2	-(LL+I)
-0.01	0.000	0.000	N/A	N/A
-0.32	0.000	0.000	N/A	N/A
-0.64	0.000	0.000	N/A	N/A
0.01	0.000	0.000	N/A	N/A
3.10	-0.003	-0.215	N/A	N/A
6.20	-0.006	-0.369	N/A	N/A
9.29	-0.008	-0.474	N/A	N/A
12.39	-0.009	-0.567	N/A	N/A
15.49	-0.010	-0.576	N/A	N/A

SHEAR STRESSES AND ALLOWABLE STRESS RATINGS

	SHEAR STRESSES				ALLOW COMPR	RATING FACTORS	
X	DL1	DL2	+(LL+I)	-(LL+I)	REDUCTION	IR	OR
-0.01	-0.005	0.000	0.000	0.000	1.000	999.99	999.99
-0.32	-0.002	0.000	0.000	0.000	1.000	999.99	999.99
-0.64	0.000	0.000	0.000	0.000	1.000	999.99	999.99
0.01	1.872	0.105	3.568	0.000	1.000	2.25 V	3.23 V
3.10	1.178	0.063	3.568	0.000	1.000	2.45 V	3.44 V
6.20	1.154	0.063	3.044	0.000	1.000	1.79 I	2.63 I
9.29	0.408	0.021	2.006	0.000	1.000	1.29 B	2.00 B
12.39	0.385	0.021	1.683	0.000	1.000	1.02 B	1.62 B
15.49	-0.361	-0.021	1.199	0.000	1.000	0.95 B	1.54 B

NOTE: THE SHEAR CAPACITIES CALCULATED HEREIN ARE BASED ON STIFFENED OR UNSTIFFENED EQUATIONS AS SPECIFIED BY INPUT REGARDLESS OF THE STIFFENER

SPACINGS INPUT AND ARE NOT CHECKED AGAINST AASHTO CRITERIA.

STRENGTHS AND LOAD FACTOR RATINGS

X	NON-COMP MOMENT STRENGTH	OVERLOAD MOMENT STRENGTH	SHEAR STRENGTH	NON-COMPACT RATING FACTORS IR	NON-COMPACT RATING FACTORS OR	COMPACT MOMENT STRENGTH	COMPACT RATING FACTORS IR	COMPACT RATING FACTORS OR
-0.01	-1655.1 B	-1572.3	439.7	999.99	999.99	-1910.8	999.99	999.99
-0.32	-1655.1 B	-1572.3	439.7	999.99	999.99	-1910.8	999.99	999.99
-0.64	-2203.5 B	-2093.3	439.7	999.99	999.99	-2975.2	999.99	999.99
0.01	2203.5 B	2093.3	439.7	1.92 V	3.20 V	2975.2	1.92 V	3.20 V
3.10	2203.5 B	2093.3	439.7	2.04 V	3.40 V	2975.2	2.04 V	3.40 V
6.20	2203.5 B	2093.3	439.7	1.61 I	2.68 I	2975.2	1.61 I	2.68 I
9.29	2203.5 B	2093.3	439.7	1.24 B	2.07 B	2975.2	1.63 O	2.72 O
12.39	2203.5 B	2093.3	439.7	1.00 B	1.67 B	2975.2	1.33 O	2.21 O
15.49	2203.5 B	2093.3	439.7	0.96 B	1.59 B	2975.2	1.28 O	2.13 O

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***********************************
*  FLOORBEAM  -  LIVE LOAD   3    *
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LIVE LOAD REACTION FROM DECK (ONE TRUCK) : 43.76
LIVE LOAD IMPACT FACTORS : POS MOM 1.30 NEG MOM 1.30

UNFACTORED MOMENTS AND SHEARS

X	DL1 MOMENT	DL2 MOMENT	LL+I MOMENT	DL1 SHEAR	DL2 SHEAR	LL+I SHEAR	I.F.
-0.01	0.0	0.0	0.0	-0.1	0.0	0.0	1.30
-0.32	0.0	0.0	0.0	-0.1	0.0	0.0	1.30
-0.64	0.0	0.0	0.0	0.0	0.0	0.0	1.30
0.01	0.2	0.0	0.0	47.3	2.7	65.0	1.30
3.10	128.0	7.1	201.3	29.8	1.6	65.0	1.30
6.20	219.3	12.1	345.5	29.2	1.6	55.4	1.30
9.29	299.3	16.4	444.4	10.3	0.5	36.5	1.30
12.39	330.4	18.1	531.9	9.7	0.5	30.6	1.30
15.49	359.6	19.7	539.9	-9.1	-0.5	21.8	1.30

FLEXURAL STRESSES - BEAM

X	TOP FIBER STEEL STRESS DL1	DL2	+(LL+I)	-(LL+I)	BOTTOM FIBER STEEL STRESS DL1	DL2	+(LL+I)	-(LL+I)
-0.01	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
-0.32	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
-0.64	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
0.01	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
3.10	-2.320	-0.055	-0.636	0.000	2.320	0.107	2.740	0.000
6.20	-3.975	-0.093	-1.093	0.000	3.975	0.181	4.704	0.000
9.29	-5.426	-0.127	-1.405	0.000	5.426	0.247	6.051	0.000
12.39	-5.989	-0.140	-1.682	0.000	5.989	0.272	7.242	0.000
15.49	-6.518	-0.152	-1.707	0.000	6.518	0.296	7.350	0.000

FLEXURAL STRESSES - SLAB

X	CONCRETE STRESS DL2	+(LL+I)	SLAB REINF STRESS DL2	-(LL+I)
-0.01	0.000	0.000	N/A	N/A
-0.32	0.000	0.000	N/A	N/A
-0.64	0.000	0.000	N/A	N/A

0.01	0.000	0.000	N/A	N/A
3.10	-0.003	-0.155	N/A	N/A
6.20	-0.006	-0.266	N/A	N/A
9.29	-0.008	-0.342	N/A	N/A
12.39	-0.009	-0.409	N/A	N/A
15.49	-0.010	-0.415	N/A	N/A

SHEAR STRESSES AND ALLOWABLE STRESS RATINGS

	SHEAR STRESSES				ALLOW COMPR	RATING FACTORS	
X	DL1	DL2	+(LL+I)	-(LL+I)	REDUCTION	IR	OR
-0.01	-0.005	0.000	0.000	0.000	1.000	999.99	999.99
-0.32	-0.002	0.000	0.000	0.000	1.000	999.99	999.99
-0.64	0.000	0.000	0.000	0.000	1.000	999.99	999.99
0.01	1.872	0.105	2.571	0.000	1.000	3.12 V	4.48 V
3.10	1.178	0.063	2.571	0.000	1.000	3.41 V	4.77 V
6.20	1.154	0.063	2.193	0.000	1.000	2.48 I	3.65 I
9.29	0.408	0.021	1.445	0.000	1.000	1.79 B	2.78 B
12.39	0.385	0.021	1.213	0.000	1.000	1.41 B	2.24 B
15.49	-0.361	-0.021	0.864	0.000	1.000	1.32 B	2.13 B

NOTE: THE SHEAR CAPACITIES CALCULATED HEREIN ARE BASED ON STIFFENED OR UNSTIFFENED EQUATIONS AS SPECIFIED BY INPUT REGARDLESS OF THE STIFFENER SPACINGS INPUT AND ARE NOT CHECKED AGAINST AASHTO CRITERIA.

STRENGTHS AND LOAD FACTOR RATINGS

	NON-COMP	OVERLOAD		NON-COMPACT		COMPACT	COMPACT	
	MOMENT	MOMENT	SHEAR	RATING FACTORS		MOMENT	RATING FACTORS	
X	STRENGTH	STRENGTH	STRENGTH	IR	OR	STRENGTH	IR	OR
-0.01	-1655.1 B	-1572.3	439.7	999.99	999.99	-1910.8	999.99	999.99
-0.32	-1655.1 B	-1572.3	439.7	999.99	999.99	-1910.8	999.99	999.99
-0.64	-2203.5 B	-2093.3	439.7	999.99	999.99	-2975.2	999.99	999.99
0.01	2203.5 B	2093.3	439.7	2.66 V	4.44 V	2975.2	2.66 V	4.44 V
3.10	2203.5 B	2093.3	439.7	2.83 V	4.72 V	2975.2	2.83 V	4.72 V
6.20	2203.5 B	2093.3	439.7	2.23 I	3.72 I	2975.2	2.23 I	3.72 I
9.29	2203.5 B	2093.3	439.7	1.73 B	2.88 B	2975.2	2.26 O	3.77 O
12.39	2203.5 B	2093.3	439.7	1.39 B	2.32 B	2975.2	1.84 O	3.07 O
15.49	2203.5 B	2093.3	439.7	1.33 B	2.21 B	2975.2	1.77 O	2.95 O

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***********************************
*  FLOORBEAM  -  LIVE LOAD  3S2   *
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LIVE LOAD REACTION FROM DECK (ONE TRUCK) : 49.53
LIVE LOAD IMPACT FACTORS : POS MOM 1.30 NEG MOM 1.30

UNFACTORED MOMENTS AND SHEARS

	DL1	DL2	LL+I	DL1	DL2	LL+I	
X	MOMENT	MOMENT	MOMENT	SHEAR	SHEAR	SHEAR	I.F.
-0.01	0.0	0.0	0.0	-0.1	0.0	0.0	1.30
-0.32	0.0	0.0	0.0	-0.1	0.0	0.0	1.30
-0.64	0.0	0.0	0.0	0.0	0.0	0.0	1.30
0.01	0.2	0.0	0.0	47.3	2.7	73.5	1.30
3.10	128.0	7.1	227.8	29.8	1.6	73.5	1.30
6.20	219.3	12.1	391.0	29.2	1.6	62.7	1.30
9.29	299.3	16.4	503.0	10.3	0.5	41.3	1.30
12.39	330.4	18.1	602.0	9.7	0.5	34.7	1.30

15.49	359.6	19.7	611.0	-9.1	-0.5	24.7	1.30

FLEXURAL STRESSES - BEAM

	TOP FIBER STEEL STRESS				BOTTOM FIBER STEEL STRESS			
X	DL1	DL2	+(LL+I)	-(LL+I)	DL1	DL2	+(LL+I)	-(LL+I)
-0.01	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
-0.32	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
-0.64	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
0.01	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
3.10	-2.320	-0.055	-0.720	0.000	2.320	0.107	3.101	0.000
6.20	-3.975	-0.093	-1.236	0.000	3.975	0.181	5.324	0.000
9.29	-5.426	-0.127	-1.591	0.000	5.426	0.247	6.848	0.000
12.39	-5.989	-0.140	-1.904	0.000	5.989	0.272	8.196	0.000
15.49	-6.518	-0.152	-1.932	0.000	6.518	0.296	8.319	0.000

FLEXURAL STRESSES - SLAB

	CONCRETE STRESS		SLAB REINF STRESS	
X	DL2	+(LL+I)	DL2	-(LL+I)
-0.01	0.000	0.000	N/A	N/A
-0.32	0.000	0.000	N/A	N/A
-0.64	0.000	0.000	N/A	N/A
0.01	0.000	0.000	N/A	N/A
3.10	-0.003	-0.175	N/A	N/A
6.20	-0.006	-0.301	N/A	N/A
9.29	-0.008	-0.387	N/A	N/A
12.39	-0.009	-0.463	N/A	N/A
15.49	-0.010	-0.470	N/A	N/A

SHEAR STRESSES AND ALLOWABLE STRESS RATINGS

	SHEAR STRESSES				ALLOW COMPR	RATING FACTORS	
X	DL1	DL2	+(LL+I)	-(LL+I)	REDUCTION	IR	OR
-0.01	-0.005	0.000	0.000	0.000	1.000	999.99	999.99
-0.32	-0.002	0.000	0.000	0.000	1.000	999.99	999.99
-0.64	0.000	0.000	0.000	0.000	1.000	999.99	999.99
0.01	1.872	0.105	2.910	0.000	1.000	2.76 V	3.96 V
3.10	1.178	0.063	2.910	0.000	1.000	3.01 V	4.21 V
6.20	1.154	0.063	2.482	0.000	1.000	2.19 I	3.23 I
9.29	0.408	0.021	1.636	0.000	1.000	1.58 B	2.46 B
12.39	0.385	0.021	1.373	0.000	1.000	1.25 B	1.98 B
15.49	-0.361	-0.021	0.978	0.000	1.000	1.16 B	1.89 B

NOTE: THE SHEAR CAPACITIES CALCULATED HEREIN ARE BASED ON STIFFENED OR UNSTIFFENED EQUATIONS AS SPECIFIED BY INPUT REGARDLESS OF THE STIFFENER SPACINGS INPUT AND ARE NOT CHECKED AGAINST AASHTO CRITERIA.

STRENGTHS AND LOAD FACTOR RATINGS

	NON-COMP	OVERLOAD		NON-COMPACT		COMPACT	COMPACT	
	MOMENT	MOMENT	SHEAR	RATING FACTORS		MOMENT	RATING FACTORS	
X	STRENGTH	STRENGTH	STRENGTH	IR	OR	STRENGTH	IR	OR
-0.01	-1655.1 B	-1572.3	439.7	999.99	999.99	-1910.8	999.99	999.99
-0.32	-1655.1 B	-1572.3	439.7	999.99	999.99	-1910.8	999.99	999.99
-0.64	-2203.5 B	-2093.3	439.7	999.99	999.99	-2975.2	999.99	999.99
0.01	2203.5 B	2093.3	439.7	2.35 V	3.92 V	2975.2	2.35 V	3.92 V
3.10	2203.5 B	2093.3	439.7	2.50 V	4.17 V	2975.2	2.50 V	4.17 V

6.20	2203.5 B	2093.3	439.7	1.97 I	3.28 I	2975.2	1.97 I	3.28 I
9.29	2203.5 B	2093.3	439.7	1.52 B	2.54 B	2975.2	2.00 O	3.33 O
12.39	2203.5 B	2093.3	439.7	1.23 B	2.05 B	2975.2	1.63 O	2.71 O
15.49	2203.5 B	2093.3	439.7	1.17 B	1.95 B	2975.2	1.56 O	2.61 O

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***********************************
*  FLOORBEAM  -  LIVE LOAD  3-3   *
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LIVE LOAD REACTION FROM DECK (ONE TRUCK) : 47.94
LIVE LOAD IMPACT FACTORS : POS MOM 1.30 NEG MOM 1.30

UNFACTORED MOMENTS AND SHEARS

X	DL1 MOMENT	DL2 MOMENT	LL+I MOMENT	DL1 SHEAR	DL2 SHEAR	LL+I SHEAR	I.F.
-0.01	0.0	0.0	0.0	-0.1	0.0	0.0	1.30
-0.32	0.0	0.0	0.0	-0.1	0.0	0.0	1.30
-0.64	0.0	0.0	0.0	0.0	0.0	0.0	1.30
0.01	0.2	0.0	0.0	47.3	2.7	71.2	1.30
3.10	128.0	7.1	220.5	29.8	1.6	71.2	1.30
6.20	219.3	12.1	378.4	29.2	1.6	60.7	1.30
9.29	299.3	16.4	486.8	10.3	0.5	40.0	1.30
12.39	330.4	18.1	582.7	9.7	0.5	33.6	1.30
15.49	359.6	19.7	591.4	-9.1	-0.5	23.9	1.30

FLEXURAL STRESSES - BEAM

	TOP FIBER STEEL STRESS				BOTTOM FIBER STEEL STRESS			
X	DL1	DL2	+(LL+I)	-(LL+I)	DL1	DL2	+(LL+I)	-(LL+I)
-0.01	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
-0.32	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
-0.64	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
0.01	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
3.10	-2.320	-0.055	-0.697	0.000	2.320	0.107	3.002	0.000
6.20	-3.975	-0.093	-1.197	0.000	3.975	0.181	5.152	0.000
9.29	-5.426	-0.127	-1.539	0.000	5.426	0.247	6.628	0.000
12.39	-5.989	-0.140	-1.842	0.000	5.989	0.272	7.933	0.000
15.49	-6.518	-0.152	-1.870	0.000	6.518	0.296	8.051	0.000

FLEXURAL STRESSES - SLAB

	CONCRETE STRESS		SLAB REINF STRESS	
X	DL2	+(LL+I)	DL2	-(LL+I)
-0.01	0.000	0.000	N/A	N/A
-0.32	0.000	0.000	N/A	N/A
-0.64	0.000	0.000	N/A	N/A
0.01	0.000	0.000	N/A	N/A
3.10	-0.003	-0.169	N/A	N/A
6.20	-0.006	-0.291	N/A	N/A
9.29	-0.008	-0.374	N/A	N/A
12.39	-0.009	-0.448	N/A	N/A
15.49	-0.010	-0.455	N/A	N/A

SHEAR STRESSES AND ALLOWABLE STRESS RATINGS

	SHEAR STRESSES				ALLOW COMPR	RATING FACTORS	
X	DL1	DL2	+(LL+I)	-(LL+I)	REDUCTION	IR	OR
-0.01	-0.005	0.000	0.000	0.000	1.000	999.99	999.99

-0.32	-0.002	0.000	0.000	0.000	1.000	999.99	999.99
-0.64	0.000	0.000	0.000	0.000	1.000	999.99	999.99
0.01	1.872	0.105	2.816	0.000	1.000	2.85 V	4.09 V
3.10	1.178	0.063	2.816	0.000	1.000	3.11 V	4.35 V
6.20	1.154	0.063	2.402	0.000	1.000	2.27 I	3.34 I
9.29	0.408	0.021	1.583	0.000	1.000	1.63 B	2.54 B
12.39	0.385	0.021	1.329	0.000	1.000	1.29 B	2.05 B
15.49	-0.361	-0.021	0.946	0.000	1.000	1.20 B	1.95 B

NOTE: THE SHEAR CAPACITIES CALCULATED HEREIN ARE BASED ON STIFFENED OR UNSTIFFENED EQUATIONS AS SPECIFIED BY INPUT REGARDLESS OF THE STIFFENER SPACINGS INPUT AND ARE NOT CHECKED AGAINST AASHTO CRITERIA.

STRENGTHS AND LOAD FACTOR RATINGS

	NON-COMP OVERLOAD			NON-COMPACT		COMPACT	COMPACT	
	MOMENT	MOMENT	SHEAR	RATING FACTORS		MOMENT	RATING FACTORS	
X	STRENGTH	STRENGTH	STRENGTH	IR	OR	STRENGTH	IR	OR
-0.01	-1655.1 B	-1572.3	439.7	999.99	999.99	-1910.8	999.99	999.99
-0.32	-1655.1 B	-1572.3	439.7	999.99	999.99	-1910.8	999.99	999.99
-0.64	-2203.5 B	-2093.3	439.7	999.99	999.99	-2975.2	999.99	999.99
0.01	2203.5 B	2093.3	439.7	2.43 V	4.05 V	2975.2	2.43 V	4.05 V
3.10	2203.5 B	2093.3	439.7	2.59 V	4.31 V	2975.2	2.59 V	4.31 V
6.20	2203.5 B	2093.3	439.7	2.04 I	3.39 I	2975.2	2.04 I	3.39 I
9.29	2203.5 B	2093.3	439.7	1.58 B	2.63 B	2975.2	2.07 O	3.44 O
12.39	2203.5 B	2093.3	439.7	1.27 B	2.12 B	2975.2	1.68 O	2.80 O
15.49	2203.5 B	2093.3	439.7	1.21 B	2.02 B	2975.2	1.62 O	2.69 O

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+                                          +
+        R A T I N G   S U M M A R Y       +
+                                          +
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MEMBER: FLOORBEAM

		ALLOWABLE STRESS RATING				LOAD FACTOR RATING			
LOAD		FACTOR	TONS	X	FLBM	FACTOR	TONS	X	FLBM
H20	IR (CRITICAL)	1.28 B	25.6	15.49	2	1.72 O	34.4	15.49	2
	OR (CRITICAL)	2.07 B	41.4	15.49	2	2.86 O	57.3	15.49	2
	IR (POS MOM)	1.28 B	25.6	15.49	2	1.72 O	34.4	15.49	2
	OR (POS MOM)	2.07 B	41.4	15.49	2	2.86 O	57.3	15.49	2
HS20	IR (CRITICAL)	0.95 B	34.2	15.49	2	1.28 O	45.9	15.49	2
	OR (CRITICAL)	1.54 B	55.4	15.49	2	2.13 O	76.5	15.49	2
	IR (POS MOM)	0.95 B	34.2	15.49	2	1.28 O	45.9	15.49	2
	OR (POS MOM)	1.54 B	55.4	15.49	2	2.13 O	76.5	15.49	2
3	IR (CRITICAL)	1.32 B	32.9	15.49	2	1.77 O	44.3	15.49	2
	OR (CRITICAL)	2.13 B	53.4	15.49	2	2.95 O	73.8	15.49	2
	IR (POS MOM)	1.32 B	32.9	15.49	2	1.77 O	44.3	15.49	2
	OR (POS MOM)	2.13 B	53.4	15.49	2	2.95 O	73.8	15.49	2
3S2	IR (CRITICAL)	1.16 B	41.9	15.49	2	1.56 O	56.3	15.49	2
	OR (CRITICAL)	1.89 B	67.9	15.49	2	2.61 O	93.8	15.49	2
	IR (POS MOM)	1.16 B	41.9	15.49	2	1.56 O	56.3	15.49	2
	OR (POS MOM)	1.89 B	67.9	15.49	2	2.61 O	93.8	15.49	2
3-3	IR (CRITICAL)	1.20 B	48.1	15.49	2	1.62 O	64.6	15.49	2
	OR (CRITICAL)	1.95 B	77.9	15.49	2	2.69 O	107.7	15.49	2
	IR (POS MOM)	1.20 B	48.1	15.49	2	1.62 O	64.6	15.49	2
	OR (POS MOM)	1.95 B	77.9	15.49	2	2.69 O	107.7	15.49	2

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      RATING FACTOR CODES:
      T - TOP STEEL STRESS/STRENGTH GOVERNS
      B - BOTTOM STEEL STRESS/STRENGTH GOVERNS
      C - CONCRETE STRESS/STRENGTH GOVERNS
      R - REINFORCEMENT STRESS/STRENGTH GOVERNS
      V - SHEAR STRESS/STRENGTH GOVERNS
      blank - COMPACT MOMENT STRENGTH GOVERNS
      O - OVERLOAD PROVISIONS GOVERN
      I - MOMENT-SHEAR INTERACTION GOVERNS
      F - SECTION DOES NOT MEET FLANGE PROJECTION/THICKNESS RATIO CRITERIA
      W - SECTION DOES NOT MEET WEB DEPTH/THICKNESS RATIO CRITERIA

      NON-COMPACT MOMENT STRENGTH CODES:
      B - SECTION IS BRACED
      U - SECTION IS UNBRACED

  NOTE: ALL RATINGS ARE BASED ON THE NUMBER OF DESIGN LANES OR THE ACTUAL
        TRAFFIC LANES AS DEFINED BY "D" OR "L" ENTERED FOR LANES IN THE
        PROJECT IDENTIFICATION.

BAR7 v7.13.0.1 PROGRAM WAS EXECUTED COMPLETELY AND SUCCESSFULLY.
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APPENDIX F

Field Review Notes & Photographs

FIELD REVIEW NOTES

Floor Beams	
FB0	Dimensions- bottom flange thickness (8.64mm below stringer 5), (9.35mm below stringer 4), (11.0mm below stringer 3), connection angle to stringer 2 both sides repaired, (8.80mm below stringer 2), FB web thickness .5-in full length, (beginning below stringer 1 extending 40" along floor beam there is a welded angle connection 40" long, the bottom flange plate thickness is 1-3/16" thickness (includes angle leg and weld bead -plate prob 3/4" thick), the vertical and horizontal leg thickness is 1/2", the vertical leg 4-1/2" high, horizontal leg 4-1/4" long, L4x4x1/2" section is 40" long (there is an additional strengthening plate below horizontal leg of angle attached to the bottom flange). Photos MDD- 95-98.
FB1	
FB2	
FB3	
FB4	
FB5	Pitting in web at connection to south truss, area up to 5/16" deep pitting x4"w x 6" h at connection angle to stronger 1 (124). Bottom face of bottom flange 3/26" deep pitting at interface with LLB gusset at south truss.
FB6	Below stringer 1(6.8 mm) (9.2mm below stringer 2) (11.1mm stringer 3) (stringer 4 11.55mm) (stringer 5 8.4mm) pitting in the web adjacent to stringer 5 connection up to 1/4" deep pitting . End two ft of web has 3/16" section loss in the bottom 6" (125).
Pier 2 - pier beam	Light less than 1/16" painted over pitting in bottom flange of PB and span 3 beam ends (bottom flange). Pier 2, PB, up to 1/8" deep pitting in the top flange (mdd-083) and up to 1/8" deep pitting in the bottom 6" of the web intermittent along the full length (mdd-084).
Stringers FB0-FB1	
S1	36" long angle repair only on north face, angle dimensions same as floor beam zero note. Additional vertical strengthening angle at the stringer to FB connection 4"x4"x1/2". Mdd-99&100. Stringer 1 only connected to FB0 on the north face, south face of connection to FB0 is severed (mdd-101&102). Stringer 1 to FB0 connection , north face, pitting typically 1/16" deep but up to 1/8" deep full height of plate, (south connection severed). Stringer 1, knife edging in stringer top exterior flange full length.
S2	No significant section loss
S3	No sig section loss
S4	No significant section loss
S5	Less than 1/16" section loss, connection plates to FB0 intact (mdd-103).
Stringers FB1-FB2	
S1	

S2	
S3	
S4	
S5	
Stringers FB2-FB3	
S1	
S2	
S3	
S4	
S5	
Stringers FB3-FB4	
S1	
S2	
S3	
S4	
S5	
Stringers FB4-FB5	
S1	
S2	
S3	
S4	
S5	
Stringers FB5-FB6	
S1	100 percent section loss (122&123)
S2	
S3	
S4	
S5	End two ft of Stringer 5 has 1/16" section loss in the web at FB 6.
Typical stringer to FB connection (107)	
LLB angle section 2 1/2 L" x 2-3/4 H" x 3/16"	

Bearings

LO Bearing	Bent to the west, slot fully expanded (mdd-104).
L5 Bearing	

Truss Members

L0-L1	Up to 1/8" pack rust between bearing plates at L0 bearing (mdd-105). Gusset plate -NSD.
L1-L2	
L2-L3	
L3-L4	
L4-L5	
L0-U1	
U1-U2	
U2-U3	
U3-U4	
U4-L5	
U1-L1	Surface corrosion on exterior gusset plate. Up to 1/8" section loss on the edge of the interior gusset plate (east end) mdd-106.
U1-L2	
U2-L2	
U2-L3	
L2-U3	
U3-L3	
L3-U4	
U4-L4	
GP L2	South truss L2, (108 & 109), no significant deficiciencies or section loss (110)
M2.5	South truss M2.5, (111&112).

L4,GP (117)

L5 gusset plate 65" long x 42" high x 25.5" vert x 16" taper

L5 gusset plate 118-119(int) & 120-121(ext)

Photos 115-116: Typical Floor Beam to Vertical Connection

Photos 113-114: Lower Chord Web Plate at splice

Bearings

LO Bearing Anchor bolts are bent to the west, slot fully expanded

L5 Bearing

Truss Members

L0-L1
L1-L2
L2-L3
L3-L4
L4-L5

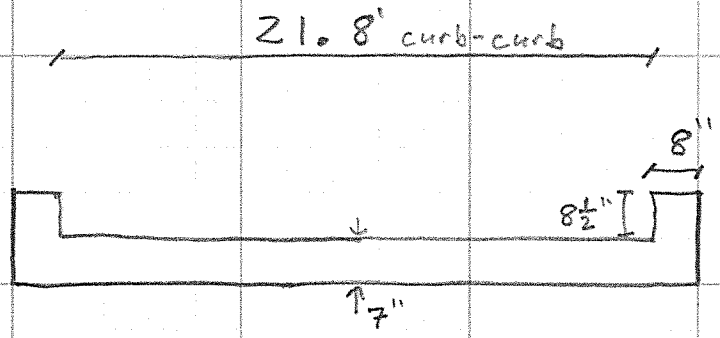
L0-U1
U1-U2
U2-U3
U3-U4
U4-L5

U1-L1
U1-L2
U2-L2
U2-L3
L2-U3
U3-L3
L3-U4
U4-L4

L5 gusset plate good condition
L4 gusset plate 1/8" pack rust along edge of inboard gusset
L3 GP 126-128
L1 GP 129&130
L0 GP131&132

U1, south truss 134
U2 s truss, 135&136
137, west approach.
138 north elevation . Looking se

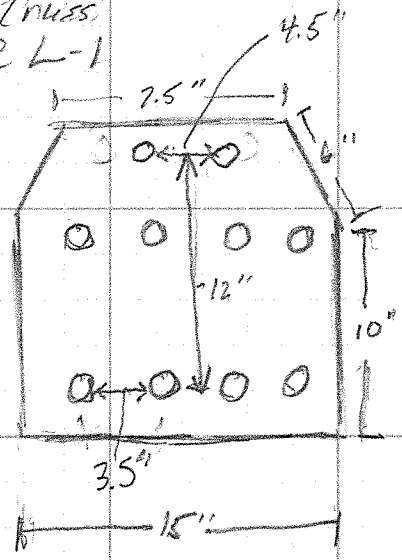
INFRASTRUCTURE ENGINEERS, INC.	Made By: MOD	Date: 10-16-14	Job No: 14186 OK00.00
	Chckd By:	Date:	
66B over Captain Creek	Bkched By:	Date:	Sheet No:

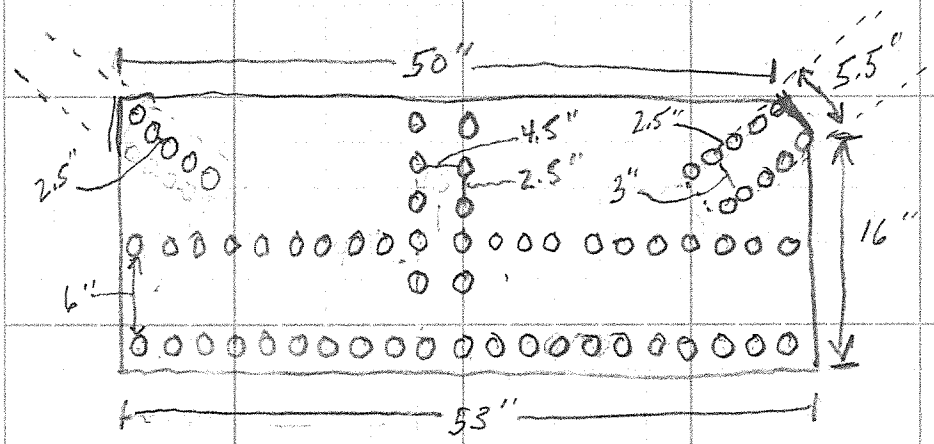


Deck Cross Section

INFRASTRUCTURE ENGINEERS, INC.	Made By:	Date:	Job No:
	Chckd By:	Date:	
	Bkched By:	Date:	Sheet No:

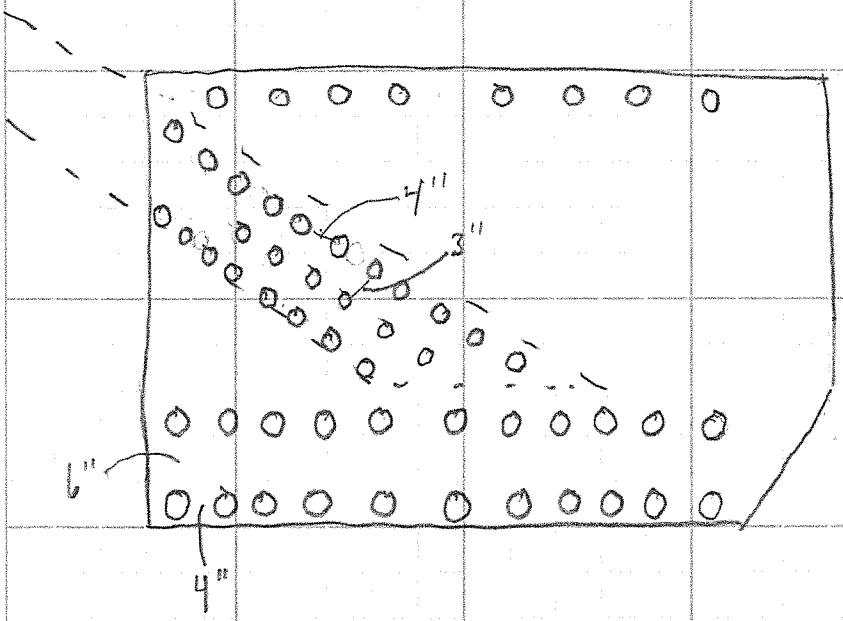
South Truss
gusset plate @ L-1
and L-4





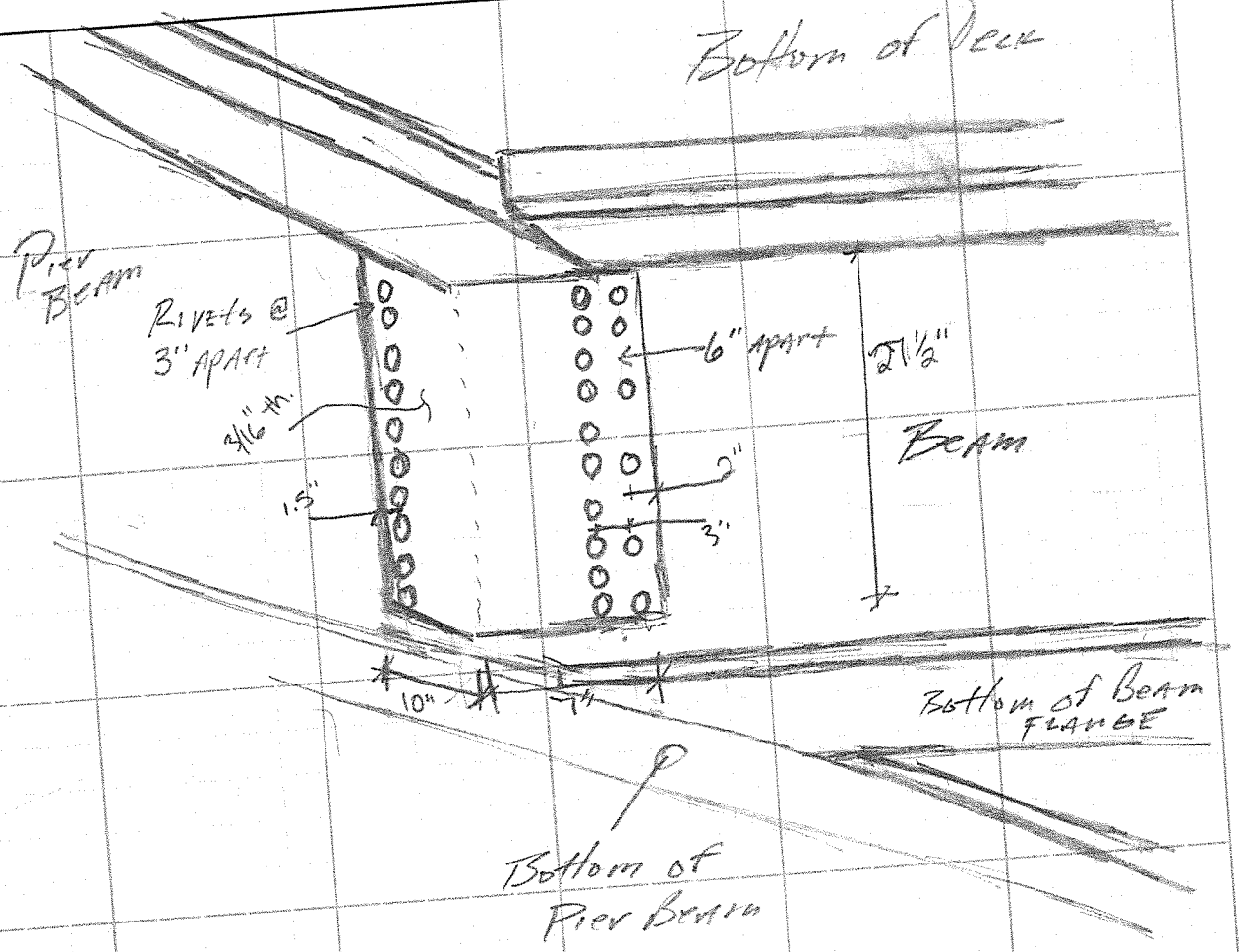
South Truss
gusset plate @ L-2
and L-3

Plate thickness 3/8"



South Truss
gusset plate @ L-0
and L-5

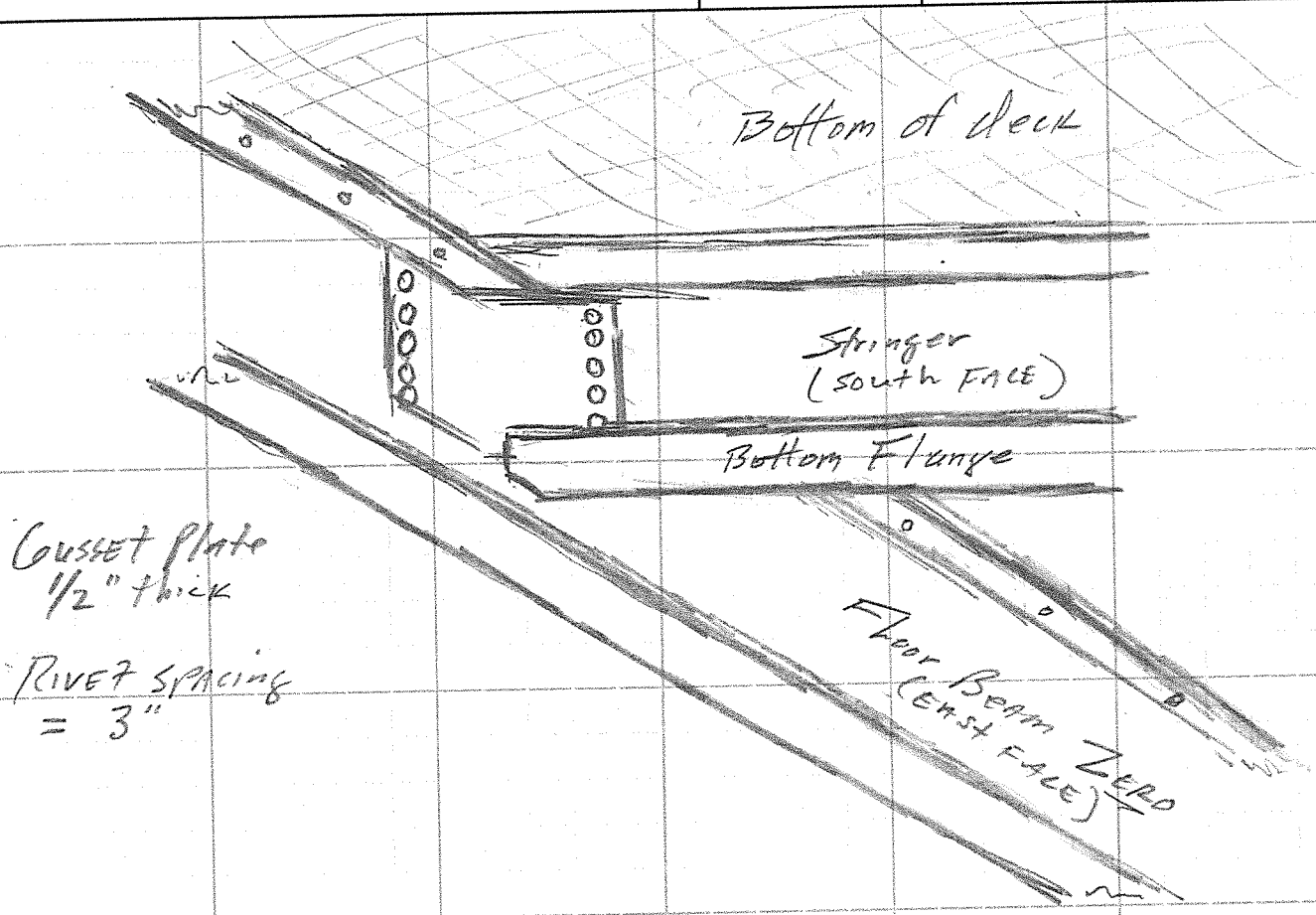
INFRASTRUCTURE ENGINEERS, INC.	Made By:	Date:	Job No:
	Chckd By:	Date:	Sheet No:
	Bkched By:	Date:	



Span 3, Pier Beam @ P.2. EAST FACE

Detail of Gusset Plate

INFRASTRUCTURE ENGINEERS, INC.	Made By:	Date:	Job No:
	Chckd By:	Date:	
	Bkched By:	Date:	Sheet No:



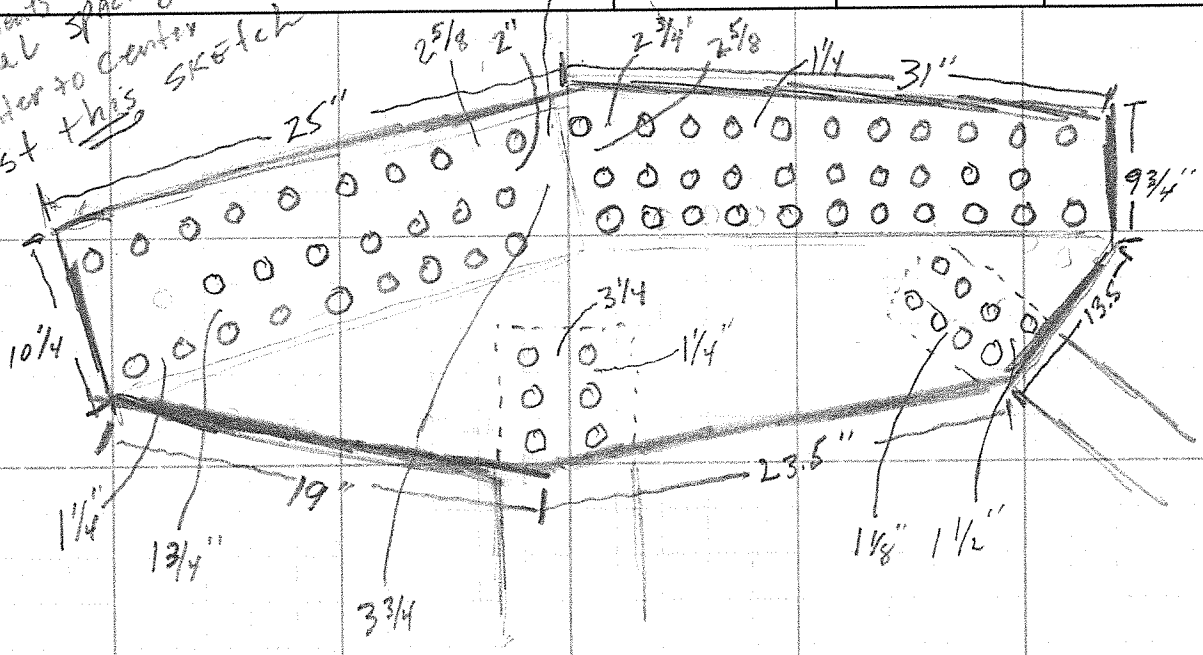
Gusset Plate
1/2" thick

Rivet spacing
= 3"

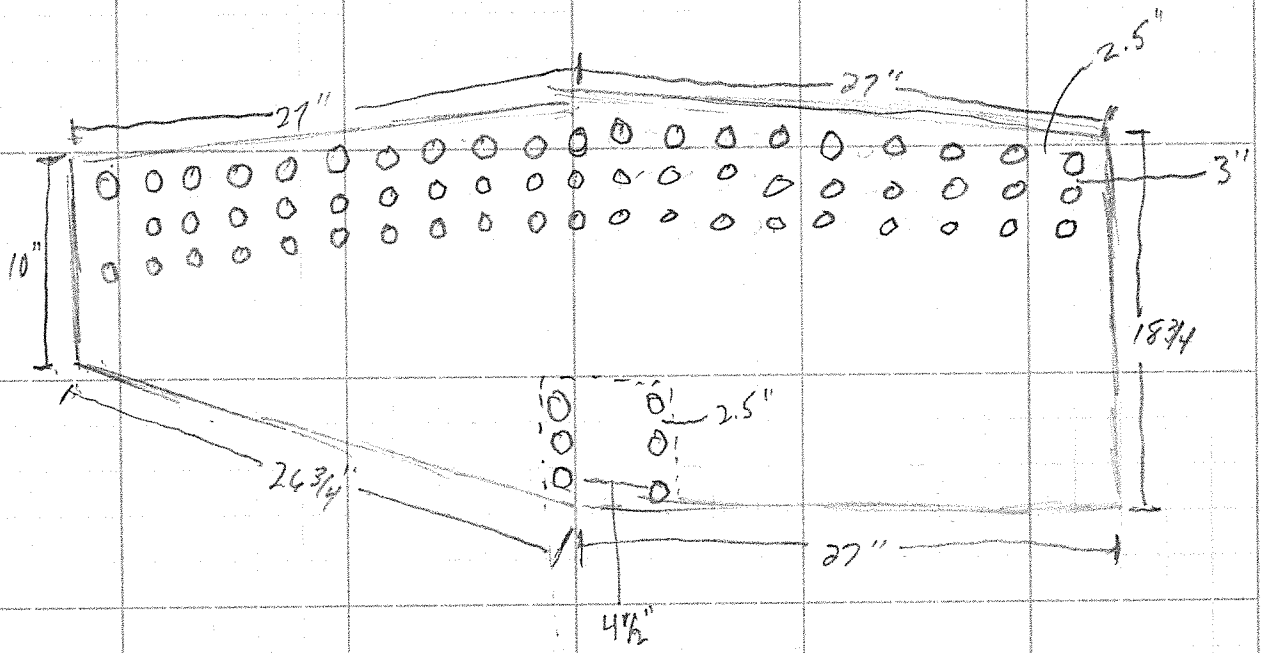
INFRASTRUCTURE ENGINEERS, INC.	Made By:	Date:	Job No:
	Chckd By:	Date:	
	Bkched By:	Date:	Sheet No:

All measurements are actual spacing NOT center to center
Just this sketch

Rivet Diameter = 1 1/8"



Top truss @ U1 and U4



Top truss @ U2 and U3

FIELD REVIEW PHOTOGRAPHS

APPENDIX G
SUPPLEMENTARY PHOTOS
S.H. 66-B OVER CAPTAIN CREEK

Structure # 4124 057 X Date: 2/24/2015

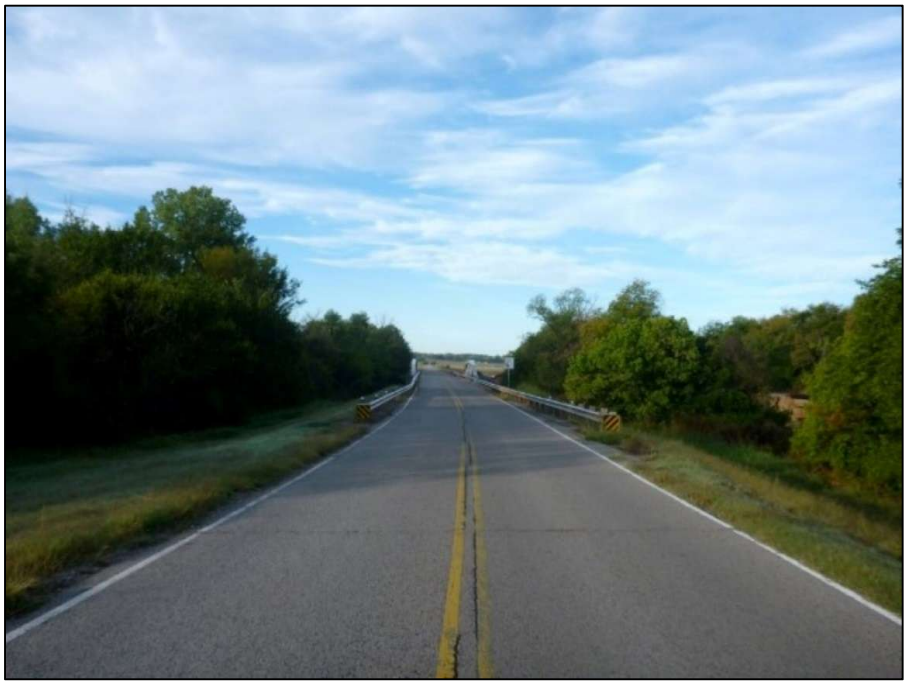
South Elevation

APPENDIX G
SUPPLEMENTARY PHOTOS
S.H. 66-B OVER CAPTAIN CREEK

Structure # 4124 057 X Date: 2/24/2015

North Elevation

West Approach



East Approach

Pier 2, North Footing, 27-in high exposure

Typical stringer to pier beam connection

Pier Beam, South Bearing

Pier Beam, South Bearing, Section loss to west anchor bolt

East Abutment

Span 1, Bay 4 diaphragm connection at Pier 1, 2-in long crack in connection angle

West Abutment

Span 2, Floor Beam 0, welded plate repair

Span 2, Stringer 1 connection to Floor Beam 0, welded plate repair

Span 2, Floor Beam 0, welded plate repair

Span 2, Stringer 1 connection to Floor Beam 0, 100 percent section loss

Span 2, Stringer 1 connection to Floor Beam 0, 100 percent section loss

South Truss, L0 bearing, bent to the west

South Truss, L0 gusset plates, 1/8-in pack rust

South Truss, U1, up to 1/8-in section loss along edge of I.B. gusset plate

Vertical 2 Overview 080

South Truss, L2, minor surface corrosion.

South Truss, L2 gusset plates

South Truss, M2.5

South Truss, L5 gusset plate

South Truss, L5 gusset plate

typical floor beam to truss vertical connection

typical floor beam to truss vertical connection

South Truss,, typical lower chord web splice plate surface corrosion

South Truss, Floor Beam 5 connection, 5/16-in deep pitting adjacent to Stringer 1

Span 2, Floor Beam 6 adjacent to stringer 5, ¼-in D pitting

Span 2, Stringer 1 between Floor Beam 5 and 6, 100 percent section loss

North Truss, L3 gusset plate

North Truss, L1 gusset plate

North Truss, L0 gusset plate

North Truss, U1 gusset plate

South Truss, U2 gusset plate

APPENDIX G

March 2016 Bridge Inspection Report & 2015 Traffic Data

MARCH 2016 BRIDGE INSPECTION REPORT

OKLAHOMA DEPARTMENT OF TRANSPORTATION - Bridge Inspection Report

NBI No.: **03800** Structure No.: 4124 0157 X Local ID:-1 Suff. Rating: 30.3 ND Health Index : 69.1

IDENTIFICATION

Description:
100' PONY TRUSS & 2-60' I-BM. SPANS SK. 50 DEG. 46'30'

1. State: Oklahoma 2. SHD District: Division 3
3. County Code: LINCOLN 4. Place Code: Unknown
Admin. Area: Unknown
5. Inventory Route (Route On Structure) : 1 - 3 - 6 - 0066B - 0
6. Feature Intersected: CAPTAIN CREEK
7. Facility Carried: S.H. 66 BUS. S.H. 66 BUS.
9. Location: 1.5 MI NE JCT SH 66 11. Mile Post: 1.570 mi
13. LRS Inv. Route./ Subroute.: -1 -1
16. Latitude: 35 41 35.04 17. Longitude: 097 04 17.92
98. Border Br. Code: Unknown (P) % Resp. : 0 99. Border Br. #: Unknown

INSPECTION

Type	Insp Req.	Insp Done	Freq:	Insp. Date:	Next Insp.:
NBI:		Y	24	3/28/2016	3/28/2018
FC Freq.:	Y	Y	24	**3/28/2016**	**3/28/2018**
UW Freq.:	N	N	NA	**NA**	**NA**
OS Freq.:	Y	N	24	**1/1/1901**	**3/28/2017**

CLASSIFICATION

12. Base Hwy Network : Not on Base Network 20. Toll Facility: 3 On free road
21. Custodian: 01 State Highway Agency 22. Owner: 01 State Highway Agency
26. Functional Class: 07 Rural Mjr Collecto 37. Historical Sig.: 4 Hist sign not determin
100. Defense Highway: 0 Not a STRAHNET h 101. Parallel Structure: No || bridge exists
102. Dir. of Traffic: 2 2-way traffic 103. Temp. Structure: Not Applicable (P)
104. Highway System: 0 Not on NHS 105. Fed. Land Hwy 0 N/A (NBI)
110. National Truck Network: 0 Not part of na 112. NBIS Length: Long Enough

STRUCTURE TYPE AND MATERIALS

43. Main Span Material and Design Type
Steel Truss-Thru
44. Approach Span Material and Design Type
Steel Stringer/Girder
45. No. of Spans Main Unit: 1 46. No. of Approach Spans: 2
107. Deck Type: 1 Concrete-Cast-in-Place
108A. Wearing Surface: 1 Monolithic Concrete
108B. Membrane: 8 Unknown
108C. Deck Protection: 8 Unknown

CONDITION

58. Deck: 7 Good 59. Super.: 4 Poor 60. Sub.: 4 Poor
62. Culvert: N N/A (NBI) 61. Channel/Channel Protection: 6 Bank Slumping
Flowline Notes:

NOTE:32' T.O.R.

AGE AND SERVICE

27. Year Built: 1932 106. Year Reconstructed: 2008
28A. Lanes on: 2 28B. Lanes Under: 0 19. Detour Length: 3.1 mi
29. ADT: 580 30. Year of ADT: 2014 109. Truck ADT %: 15
42A. Type of Service on: 1 Highway
42B. Type of Service under: 5 Waterway

LOAD RATING AND POSTING

31. Design Load: 2 M 13.5 (H 15) 41. Posting status: P Posted for load
63. Op. Rating Method: 1 LF Load Factor-Tor Alt. Op. Rating Meth.: 1 LF Load Factor-To
64. Operating Rating (H / HS / 3-3): 19.0 25.0 42.0
66. Inventory Rating (H / HS / 3-3) : 11.4 15.0 25.2
65. Inv. Rating Method: 1 LF Load Factor-Tor Alt. Inv. Rating Meth.: 1 LF Load Factor-Tor
70. Posting: 3 10.0-19.9%below Date Rated : 4/15/2014

GEOMETRIC DATA

10. Inv. Rte. Min. Vert. Clr.: 328.1 ft
32. Approach Roadway Width (W/ Shoulders): 20.0 ft
Deck Area: 5,675. sq. ft 33. Median: 0 No median
34. Skew: 39 35. Structure Flared: 0 No flare
47. Inv. Rte. Total Horiz. Clr.: 22.0 ft
48. Length Maximum Span: 100.1 ft 49. Structure Length: 227.0 ft
50A. Curb/Sdwlk Wdth L: 1.5 ft 50B. Curb/Sidewalk Width R: 1.5 ft
51. Width Curb to Curb: 22.0 ft 52. Width Out to Out: 25.0 ft
53. Minimum Vertical Clearance Over Bridge: 328.1 ft
54A/54B. Min. Vert. Underclearance : N Feature not hwy or RR 0.0 ft

	N/E			S/W		
Meas.	-1	-1	-1	-1	-1	-1
Post.	DO NOT U	DO NOT U	DO NOT U	DO NOT U	DO NOT U	-1

55A/55B. Minimum Lateral Undrclearance R: N Feature not hwy or RR 0.0 ft
56. Minimum Lateral Undrclearance L: 0.0 ft

PROPOSED IMPROVEMENTS

94. Bridge Cost: $774,042 75. Type of Work: 31 Repl-Load Capacity
95. Roadway Cost: $1,277,169 76. Lgth. of Improvment: 315.6 ft
96. Total Cost: $2,167,317 114. Future ADT: 928
97. Year of Cost Est.: 2009 115. Year of Future ADT: 2034

NAVIGATION DATA

38. Navigation Control: Permit Not Required
39. Vertical Clearance: 0.0 ft 40. Horizontal Clearance: 0.0 ft
111. Pier Protection: 1 Not Required 116. Lift Bridge Vert. Clear.: 0.0 ft

APPRAISAL

36A. Bridge Rail: 0 Substandard 36C. Approach Rail: 0 Substandard
36B. Transition: 0 Substandard 36D. Approach Rail Ends: 1 Meets Standards
67. Str. Evaluation: 4 Minimum Tolerable 68. Deck Geometry: 4 Tolerable
69. Underclearance, Vertical and Horizontal: N Not applicable (NBI)
71. Waterway Adequacy: 6 Equal Minimum
72. Approach Alignment: 6 Equal Min Criteria
113. Scour Critical: 5 Stable w/in footing

200c. Temperature: 65
200d. Weather: CLEAR
201. Structural Steel ASTM Desig.: -1 -1
202. Waterproof Membrane : -1
Date Installed : 1/1/1901
203. Type Exp. Dev. : Other Type
Pourable
204. Type of Handrail: Metal Railing (other)
205. Material and Quantity : 1125.0
208. Type of Abutment : Skeleton
Type of Foundation : Concrete Piling
209. Type of Pier / Found.: 2 Piers Yes
Timber Piling
210. Foundation Elev. -1.0 -1.0
8210.0 8301.0 -1.0
211. Wear. Surf. Prot. System : None
Date Installed : 1/1/1901
213. Utilities Attached : -1
-1 -1 -1
-1 -1 -1

214a. Posted Weight Limit: 192542
b. Posted Speed Limit : 35
c. Narrow/One Lane Bridge sign : -1
d. Vertical Clearance Sign: _
Advanced Warning Sign : _
Min. Measured Clearance : -1
Max. Measured Clearance : -1
e. Navigation Lights : NO
Working/Not Working : _
215. Overpass : B - State Highway
221. Substructure Cond. (U/W) : -
222. Fill over RCB: -1
223. Appr. Slab/Rdwy Cond.: Satisfactory
224. Critical Feature Type: 1
225. Paint Type : Not Applicable
Overcoat : 0
226. Date Painted: 3201
227. Paint Coloring: Gray
233. Deck Forming: Conventional Forming
236. Deck Cleaning : -1
238. School Bus Rte: Current and Desired Route
240. Appr. Roadway Type: Asphalt/Bituminous

243. Girder Spacing/Number : -1.0 / 6
244. Span Lengths :
-1 -1 -1
-1 -1 -1
-1 -1
245. Girder Depth : -1.000
246. Type of Overlay : _
246. Overlay Thickness : 0
246. Overlay Date : 1/1/1901
246. Overlay Depth Changed > 1"? No
247. Protective Systems : 1: _
2: _ 3: _
4: _ 5: _
248. No. of Field Splices w/ Corrosion : 0
249. Scour Crit. POA exists?: No
250. Culvert Headwall Dist.: -1.0
254. Thru Truss Type : Pony
256. Chan. Profile Up/Down Stream?: Up
257a. OkiePROS Auto. Truck Routing Yes
258. Plans w/ found. are in file at ODOT
259. Scour Eval. is in file at ODOT
263. Interchange at Intersection N
264. Interstate Milepoint -1.00

OKLAHOMA DEPARTMENT OF TRANSPORTATION - Bridge Inspection Report

NBI No.: **03800** Structure No.: 4124 0157 X Local ID:-1 Suff. Rating: 30.3 ND Health Index : 69.1

Inspection Date: 3/29/2016 Reported By: WKELLOGG

Invoice No.: -1 Inspected With: Josh Pogue

Agency :

Wesley D. Kellogg, PE
wkellogg@odot.org

Structure / Inspection Notes

PIER 1 HAS PILING UNDER SPREAD FOOTINGS. PIER 2 HAS NO PILING UNDER SPREAD FOOTINGS (SEE PLANS).

INSPECTED VIA ROPE ACCESS

Elm.	Env.	Description	Un.	Qty.	Qty.St. 1	% 1	Qty.St. 2	% 2	Qty.St. 3	% 3	Qty.St. 4	% 4	Qty.St. 5	% 5
12	4	Reinforced Concrete Deck	(SF)	4,994	4,495	90 %	499	10 %	0	0 %	0	0 %	0	0 %
107	4	Steel Open Girder Beam	(LF)	499	0	0 %	459	92 %	40	8 %	0	0 %	0	0 %
113	4	Steel Stringer/Floorbeam	(LF)	250	0	0 %	215	80 %	35	14 %	0	0 %	0	0 %
120	4	Steel Truss (Pony)	(LF)	200	0	0 %	200	100 %	0	0 %	0	0 %	0	0 %
152	4	Steel Floor Beam	(LF)	233	1	0 %	232	100 %	0	0 %	0	0 %	0	0 %
162	4	Steel Gusset Plate	(EA)	40	0	0 %	20	50 %	20	50 %	0	0 %	0	0 %
205	4	Reinforced Conc Column or Pile Extension	(EA)	19	0	0 %	19	100 %	0	0 %	0	0 %	0	0 %
210	4	Reinforced Conc Pier Wall	(LF)	50	0	0 %	45	90 %	5	10 %	0	0 %	0	0 %
215	4	Reinforced Conc Abutment	(LF)	59	0	0 %	41	70 %	18	30 %	0	0 %	0	0 %
300	4	Strip Seal Expansion Joint	(LF)	24	24	100 %	0	0 %	0	0 %	0	0 %	0	0 %
311	4	Moveable Bearing (roller, sliding, etc.)	(EA)	6	0	0 %	4	67 %	2	33 %	0	0 %	0	0 %
313	4	Fixed Bearing	(EA)	12	0	0 %	10	83 %	2	17 %	0	0 %	0	0 %
330	4	Metal Bridge Railing	(LF)	440	0	0 %	440	100 %	0	0 %	0	0 %	0	0 %
515	4	Steel (Superstructure) Protective Coating	(SF)	11	0	0 %	11	100 %	0	0 %	0	0 %	0	0 %
859	4	Soffit of Concrete Decks and Slabs	(EA)	1	0	0 %	1	100 %	0	0 %	0	0 %	0	0 %
863	4	Steel Pier Beam	(LF)	64	0	0 %	64	100 %	0	0 %	0	0 %	0	0 %
865	4	Steel Open Girder/Beam End (5 Ft.)	(LF)	98	0	0 %	98	100 %	0	0 %	0	0 %	0	0 %
877	4	Steel Stringer End (5 Ft.)	(LF)	250	0	0 %	215	80 %	35	14 %	0	0 %	0	0 %
909	4	Pourable Fixed Joint Seal	(LF)	72	72	100 %	0	0 %	0	0 %	0	0 %	0	0 %
956	4	Steel Cracking/Fatigue	(EA)	1	0	0 %	1	100 %	0	0 %	0	0 %	0	0 %
957	4	Pack Rust	(EA)	1	0	0 %	1	100 %	0	0 %	0	0 %	0	0 %
958	4	Concrete Cracking	(EA)	1	0	0 %	1	100 %	0	0 %	0	0 %	0	0 %
961	4	Scour	(EA)	1	1	100 %	0	0 %	0	0 %	0	0 %	0	0 %
962	4	Superstructure Traffic Impact	(EA)	1	0	0 %	1	100 %	0	0 %	0	0 %	0	0 %
963	4	Steel Section Loss	(EA)	1	0	0 %	1	100 %	0	0 %	0	0 %	0	0 %

Additional Elements

Elem.	Element Notes (Include Size and Location of Deterioration
12	NOTE: NEW DECK 2008. MODERATE CRACKING IN DECK (DENSITY)
107	NOTE: ELEMENTS HAVE RUST SHOWING UP MOSTLY @ JTS & FACIAS. OLD SEC LOSS & PACK RUST WAS PAINTED OVER SOME AREAS ARE NOW ACTIVE - THE UNDERSIDE ELEMENTS ARE WORST - THIS IS DUE TO LEACHING THRU DECK . SPOT PAINTING NEEDED. ALSO OUTSIDE BMS. ARE WORST. CRACKING PRESENT IN SPAN 3 CONNECTION ANGLES. SPAN 1 CRACKING REPAIRED.
113	FX: CORR.ON EXT STRINGERS. MODER. SECTION LOSS TO BOT. FLANGE OF S. STRINGER, W. PANEL. SHORT STRINGERS ARE COMPLETE LOSS.
120	FX: MOD.CORR. @ FLOOR BEAM CONNECTIONS. 50% REMAINING SECTION @ SPAN2 FB4 SS LOWER LEG OF CHANNEL. MINOR SECTION LOSS AT BATTEN PLATES TO LOWER CHORD. 1.5" DEFORMATION TO SPAN 2, NORTH TRUSS, L2U2.
152	FX: MOD.CORR. @ FL.BM.CONN. THROUGHOUT. END FLOOR BEAM IS LIGHTER SECTION THAN INTERIOR FLOOR BEAMS.
162	FX: Some plates have considerable rust and sec. loss and pack rust, minor swelling.
205	NOTE:ABUT. CONC. PILES EXPOSED UP TO 3' UNDER EACH BRIDGE SEAT. A FEW LIGHT VERT. CRACKS TO TOPS OF ALL PIER COLS
210	FX:MOD.SPALL W/EXPOSED REBAR WITH SECTION LOSS @ P.#1.
215	FX: HZ. CRACKING TO FACES OF BOTH BRIDGE SEATS WITH EXPOSED REBAR WITH SECTION LOSS. EXPOSED CON. PILES @ BOTH ABUTS.
300	NOTE: DEBRIS IN JOINTS.
311	NOTE: ANCHOR BOLTS @ W. ROCKERS ARE BENT. IN EXP.W/MIN.CORR.
313	PX:SPAN1 BM1 BEARING SPLIT FX:SOME MOD.CORR. THROUGHOUT. CORNER OF BEARING FOR PB2 SHEARED DUE TO MOVEMENT OF PIER BEAM.
330	NOTE: FLEXRAIL ACROSS BRIDGE.
515	NOTE: ELEMENTS HAVE RUST SHOWING UP MOSTLY @ JTS & FACIAS. OLD SEC LOSS & PACK RUST WAS PAINTED OVER SOME AREAS ARE NOW ACTIVE - THE UNDERSIDE ELEMENTS ARE WORST - THIS IS DUE TO LEACHING THRU DECK . SPOT PAINTING NEEDED. ALSO OUTSIDE BMS. ARE WORST.
859	FX: A FEW LIGHT TRANSVERSE CRACKS WITH EFFL. ALL SPANS.

Elem.	Element Notes (Include Size and Location of Deterioration
863	FX: PIER BEAMS HAVE PAINTED OVER SECTION LOSSES. MINOR AT THIS TIME.
865	PX: SPAN 3 HAS CRACKING IN PB TO BM CONNECTION ANGLES. BM 1, SOUTH SIDE HAS 2" CRACK, BM 1, NORTH SIDE HAS 10" CRACK.
877	FX: STRINGERS HAVE MODERATE SECTION LOSSES TO TOP FLANGES. POOR COPE RADII PRESENT THROUGHOUT.
909	< none >
956	PX: SEE FC REPORT FOR LIST OF FATIGUE CRACKS
957	FX: MOD.PACK RUST @ CONN.EXT.BMS AS WELL AS BATTEN PLATES.
958	NOTE:MINOR CRACKS HAVE BEEN SEALED DURING CON. SOME NEW UNSEALED CRACKS IN DECK
961	FX: E. PIER: N. FTG. EXPOSED MAX. 30" AT SOUTHWEST PIER. 12" NORTHWEST PIER (03.28.2016).
962	PX: N.TRUSS: I.S. FLANGE OF L2U2 BENT 1.5 IN. MINOR DAMAGE TO U4L5.
963	FX: MOD.SECT.LOSS @ BM, BM.ENDS, CONN. & BATTEN PLATES.

Channel Profile

	Baseline	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Distance	0	0	60.0	110.0	160.0	220.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0
Profile		8.3	20.1	32.0	15.1	8.4	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0
Event		Abutment	Pier	Flowline	Pier	Abutment	_	_	_	_	_	_	_	_	_	_

OKLAHOMA DEPARTMENT OF TRANSPORTATION

To: Division III Division Engineer

From: Field Service Engineer

Date: 03/31/2016

Subject: Routine/Fracture Critical Bridge Inspection
NBI 03800, Structure 4124 0157 X, SH 66 Bus/Captain Creek

On 03/28/2016 an ODOT Bridge Division Rope Access Team inspected SH 66 Bus/Captain Creek as part of the routine/fracture critical bridge inspection program. The structure is a 3 span structure with the following configuration (West to East):

Span 1 – 60' Simply Supported Rolled I-Beam (Standard IB-4(2) + Special)
Span 2 – 100' Pony Truss Span (Standard C-100(4&5) + Special)
Span 3 – 60' Simply Supported Rolled I-Beam (Standard IB-4(2) + Special)

The inspection was performed by the following Bridge Division Personnel:

Wes Kellogg, PE – Team Leader
Daniel Knickmeyer, PE – Bridge Inspector
Josh Pogue, EI – Bridge Inspector

The bridge is properly load posted 19/25/42 tons.

The current NBI ratings for this structure versus the last inspection are as follows:

NBI Item	2014 Rating	2016 Rating
58 Deck	7, Good	7, Good
59 Super	4, Poor	4, Poor
60 Sub	5, Fair	4, Poor
61 Channel	6, Good	5, Fair
Sufficiency	30.3 **SD**	30.3, **SD**

In order of decreasing priority, the recommended action for this structure is as follows:

CX – There was no condition at the bridge site which warranted this level of follow-up.

PX – Weld 2 ½” crack in connection angle, Span 3, Beam 1, South Angle
PX – Weld 10” crack in connection angle, Span 3, Beam 1, North Angle
PX – Remove debris from gutter line of deck.
PX – Remove debris from expansion joint at pier 2.

FX – Monitor previously repaired crack locations for crack initiation
FX – Monitor section losses to lower chord at batten plates
FX – Monitor section losses to lower chord at chord splices
FX – Monitor section losses to lower chord gusset plates
FX – Monitor section losses to floor beam ends at truss to floor beam connection locations
FX – Monitor bearings with section losses and cracking issues

In addition to these recommendations it is recommended that this structure remain on a 24 month Routine/NBI/FC inspection frequency as well as a 24 month Other Special (OS) inspection. The OS inspections are to occur in the interim year between the Routine/NBI/FC inspections and shall focus on previously identified repair locations and section losses.

Wesley Kellogg, PE
Field Service Engineer

WK/wk

CC: Steve Jacobi
Walt Peters
Ali Salami
Brian Windsor
Daniel Knickmeyer
Josh Pogue
Shelly Williams

NBI Item 36 – Traffic Safety (6, Satisfactory Condition) – The traffic safety features are in satisfactory condition with locations exhibiting superficial rust. No traffic impact of the traffic safety features was noted.

NBI Item 58 – Deck

Driving Surface (7, Good Condition) – The driving surface of the deck is in good condition with no pot holes. Moderate, unsealed cracks are present. The deck gutter line is filled with debris that should be removed (PX).
Soffit (7, Good Condition) – The soffit of the deck is in good condition with moderate cracking with efflorescence.
Joints (6, Satisfactory Condition) – The joints are in satisfactory condition. Minor leakage is noted at fixed joints near deck edges. The strip seal joint is filled with debris and should be cleaned (PX).

NBI Item 59 - Superstructure

Fracture Critical Member Summary	
Floor Beams	5, Fair
Truss Lower Chord	4, Poor
Truss Web Members	5, Fair
Pier Beams	5, Fair

Beams (4, Poor Condition) PX – The approach span beams are in poor condition due to cracking present in the beam to pier beam connection angles (See table below for locations of unrepaired locations.). The approach span beams also have minor rust and insignificant losses to the top flanges at beam end locations. The approach span beams appear to have excessive camber.

FX/PX/CX	Span	Beam	Floor Beam	Face	Stringer	Comments
FX	1	4	N/A	N/A	N/A	Full length crack repaired
FX	1	5	N/A	N/A	N/A	Cracks repaired
PX	3	1	N/A	N/A	N/A	2.5" crack in south connection angle.
PX	3	1	N/A	N/A	N/A	10" crack in north connection angle.

Stringers (5, Fair Condition) FX – The stringers are in fair condition with moderate section losses to stringer ends in isolated locations as well as painted over section losses. All stringers have poor cope radii at the stringer to floor beam connections. Previously identified cracks and through holes in stringer ends have been repaired. The short exterior stringers between floor beams 0 and 1, as well as floor beams 5 and 6 have significant deterioration and no longer provide structural capacity.

[FCM] Floor Beams (5, Fair Condition) FX – The floor beams are in fair conditions with minor to moderate section losses to floor beam ends at the truss connections as well as painted over section losses. Previously identified through holes have been repaired. It should be noted that the end floor beams are of a lighter section than interior floor beams and are much more sensitive to section losses and out of plane bending.

[FCM] Pier Beams (5, Fair Condition) FX – The approach span pier beams are in fair condition with minor section losses to the top flanges. Previously noted out of plane bending of the approach span pier beams could not be detected.

Floor Bracing System (5, Fair Condition) FX – The floor bracing system is in fair condition with no broken hanger bolts and minor section losses at floor beam connection gusset plates. The floor bracing system does exhibit member eccentricities which are an indication of possible "racking" in the floor system.

Truss Upper Chord (6, Satisfactory Condition) – The truss upper chord is in satisfactory condition. The upper chord was struck in the past at U4L5. The force of impact did not result in any eccentricity. All gusset plates are sound with no signs of distortion or cracking. All fasteners are present and functional.

[FCM] Truss Lower Chord (4, Poor Condition) FX – The truss lower chord is in poor condition with moderate section losses at floor beam connections, lower chord splice plates, and batten plate locations. No through holes were noted. Batten plates at gusset plate locations are holding moisture and debris which results in deterioration of some lower chord gusset plates. No distortion or cracking of the gussets were noted. All gusset plate fasteners were present and functional.

[FCM] Truss Web Members (5, Fair Condition) FX – The truss web members are in fair condition with minor surface rust at lower chord connections. L2U2 has been struck in the past which has resulted in 1 ½" deformation of the flange over 10".

Truss End Posts (6, Satisfactory Condition) – The truss end posts are in satisfactory condition with isolated locations of freckled surface rust.

Paint/Coating System (5, Fair Condition) – The paint system is in fair condition with chalking and peeling throughout. Locations of complete coating failure are present on the floor system.

Load Deflection (5, Fair Condition) FX – The structure does not exhibit excessive deflection under the restricted traffic of the current load posting.

NBI Item 60 - Substructure

Abutments (4, Poor Condition) FX – The abutments are in poor condition with cracking, spalling, and exposed rebar with section losses.

Piers (4, Poor Condition) FX – The piers are in poor condition with cracking throughout. The web wall at pier 1 has spalling with exposed rebar with section loss. The spread footings at pier 1 have been exposed due to channel migration.

Bearings (4, Poor Condition) FX – The bearings are in poor condition with moderate corrosion with section losses. The bearing device at Span 1, Beam 1 has cracked and split. The bearing at pier 2, north pile, span 3, pier beam 2 has a sheared corner due to movement of the superstructure.

NBI Item 61 – Channel and Channel Protection

Channel Scour (4, Poor Condition) – The channel flow line has dropped 1 foot since the previous inspection.

Embankment Erosion (4, Poor Condition) – The channel has migrated to the west and has exposed the spread footings at pier 1. The spread footing at pile 1 is exposed 30”, pile 2 is exposed 12”.

Debris (6, Satisfactory Condition) – Debris does not restrict the channel at this time.

Vegetation (6, Satisfactory Condition) – The banks are well vegetated at this time.

Approaches

Approach Roadway Condition (6, Satisfactory Condition) – The approach roadway pavement has no shoving or rutting that would affect impact loading of the structure.

Approach Roadway Settlement (6, Satisfactory Condition) – The approach roadway has not settled and does not affect impact loading of the structure.

NBI Item 113 – Scour Rating (5, Stable Within Footing) – No change in the scour rating is recommended at this time.


2016.03.28


WEIGHT
LIMIT
19 T
25 T
42 T
2016.03.28


2016.03.28


2016.03.28


2016.03.28


NBI 03800
Str. 4124 0157 X
Lincoln Co.
St66 Bus. over Captain Creek
03/282016


NBI 03800
Str. 4124 0157 X
Lincoln Co.
SH66 Bus. over Captain Creek
03/282016


NBI 03800
Str. 4124 0157 X
Lincoln Co.
SH66 Bus. over Captain Creek
03/282016


NBI 03800
Str. 4124 0157 X
Lincoln Co.
SH66 Bus. over Captain Creek
03/282016
Span 1
Beam 5


NBI 03800
Str. 4124 0157 X
Lincoln Co.
SH66 Bus. over Captain Creek
03/282016
Span 2
Str. 5
FBO


NBI 03800
Str. 4124 0157 X
Lincoln Co.
SH66 Bus. over Captain Creek
03/282016


NBI 03800
Str. 4124 0157 X
Lincoln Co.
SH66 Bus. over Captain Creek
03/282016
Sp2
FBO
Str.2


NBI 03800
Str. 4124 0157 X
Lincoln Co.
SH66 Bus. over Captain Creek
03/282016


NBI 03800
Str. 4124 0157 X
Lincoln Co.
SH66 Bus. over Captain Creek
03/282016


NBI 03800
Str. 4124 0157 X
Lincoln Co.
SH66 Bus. over Captain Creek
S1
@
Pier1
N. face


Lincoln Co.
SH66 Bus. over Captain Creek
03/282016


Sp2
South Truss
LS
2016.03.28


Sp3
PB2
BM1
2½"
2016.03.28


1-5-12 M.A
2016.03.28


Poor Core Radii
Typical
2016.03.28


Unused
Rivet
Holes
2016.03.28

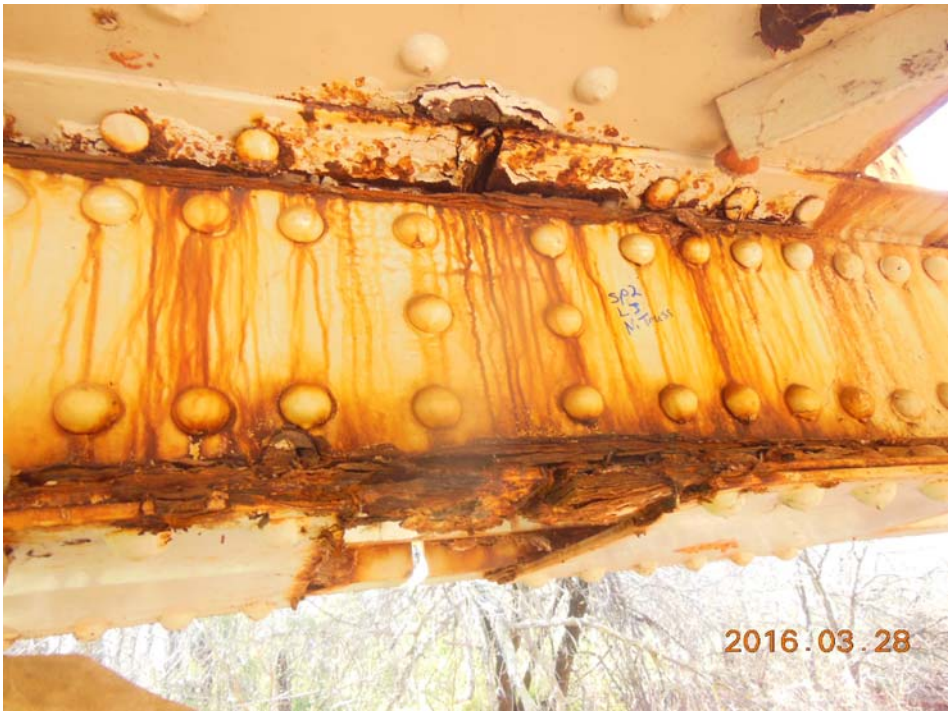

SP3
PB2
BEARING2
2016.03.28


2016.03.28


Sp2
FBS,SF
Str 1
2016.03.28


2016.03.28


2016.03.28

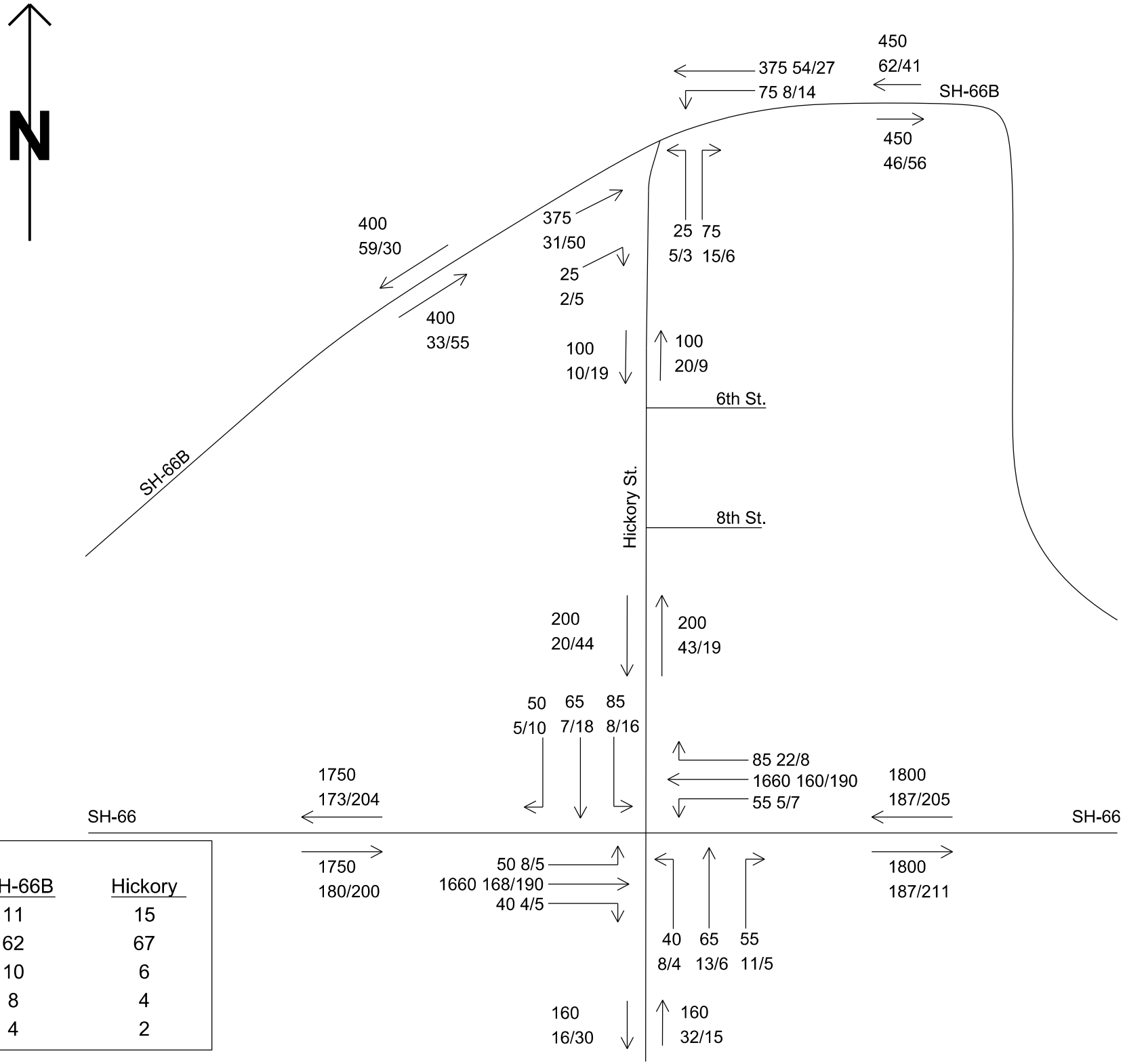

2016.03.28


2016.03.28

2015 TRAFFIC DATA

SH-66/SH-66B
Wellston
Lincoln Co.
current alignment

2015 AADT
AM/PM DHV

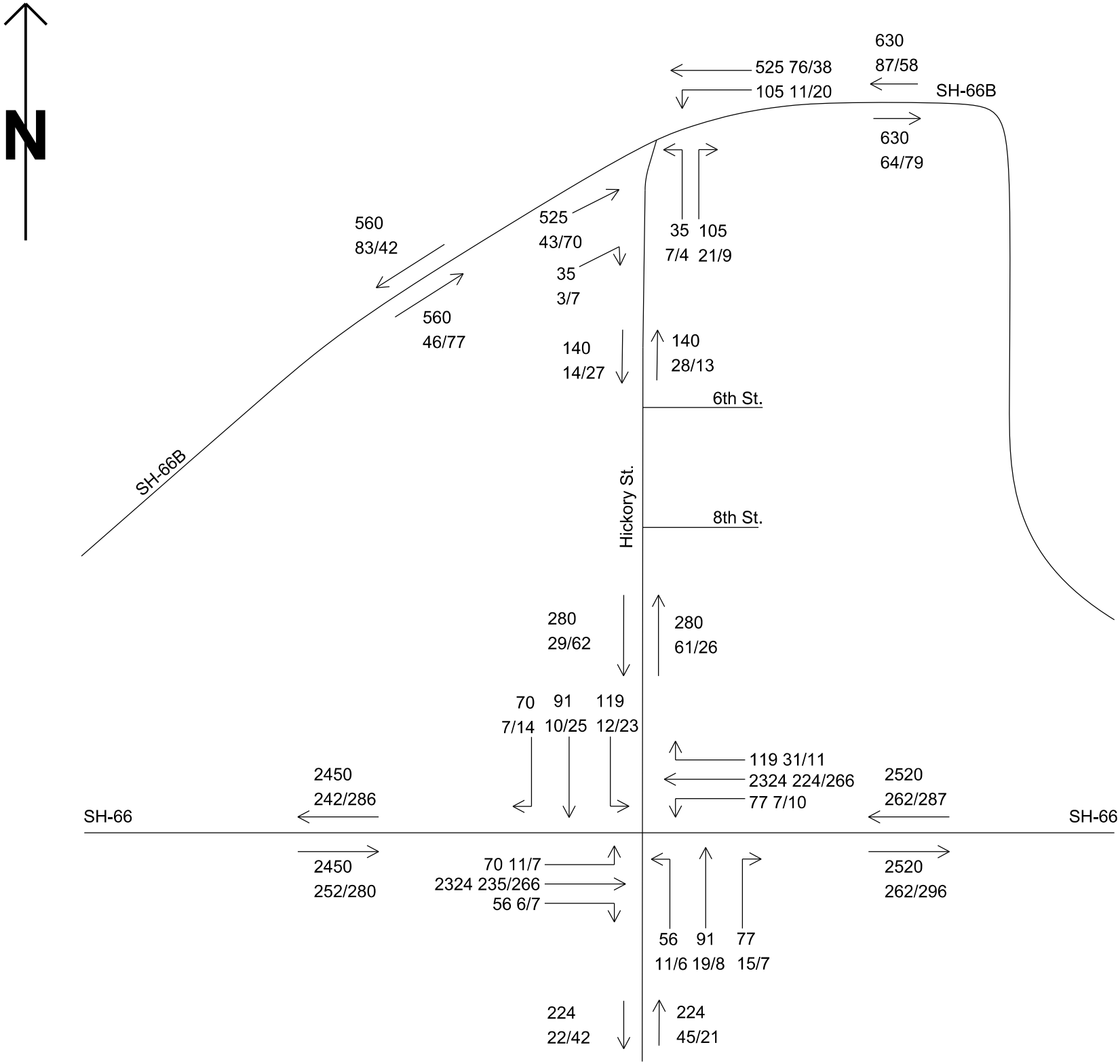


Design Traffic Data

	SH-66	SH-66B	Hickory
K	11%	11	15
D	52	62	67
T(AADT)	11	10	6
T(DHV)	8	8	4
T(3)	4	4	2

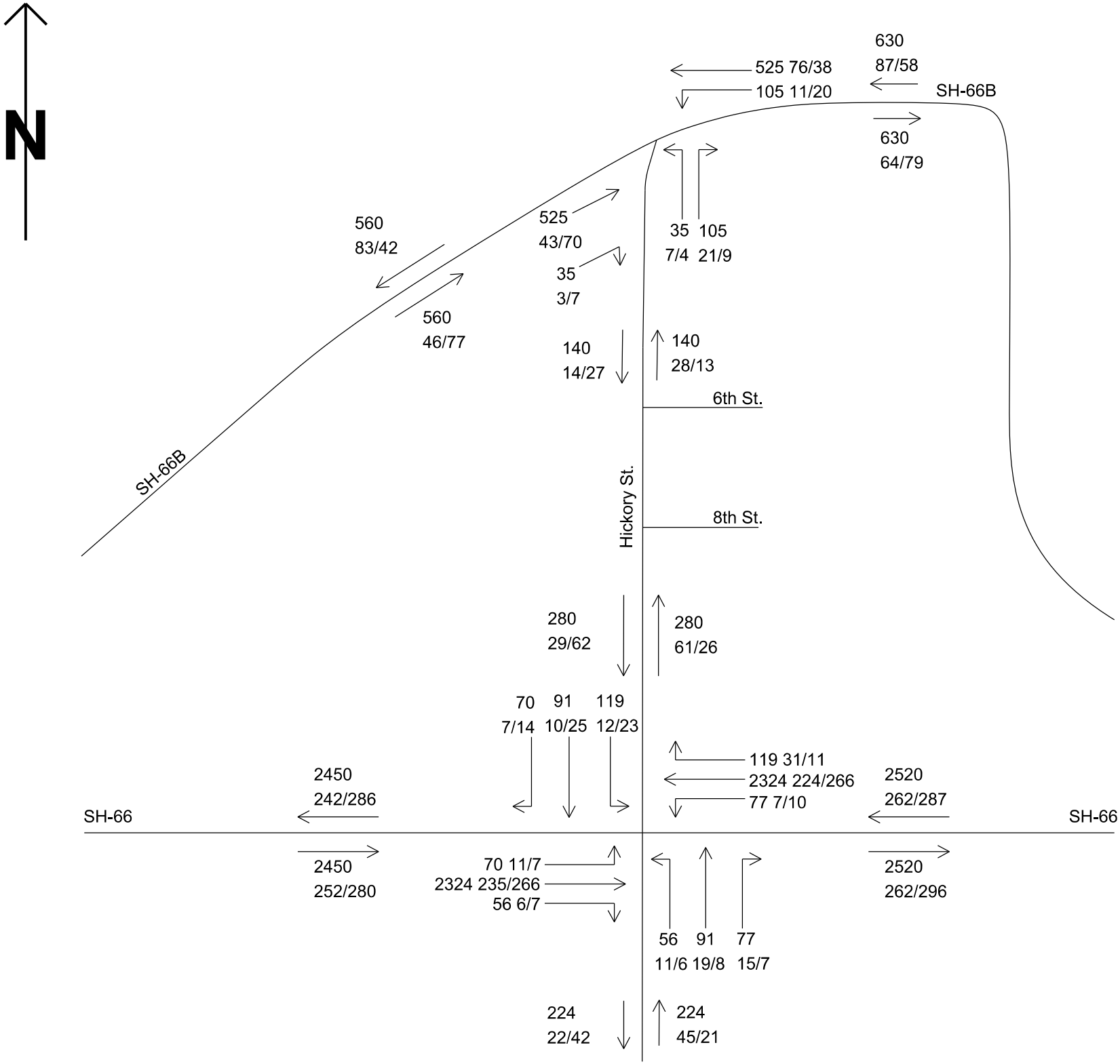
SH-66/SH-66B
Wellston
Lincoln Co.
current alignment

2035 AADT
AM/PM DHV



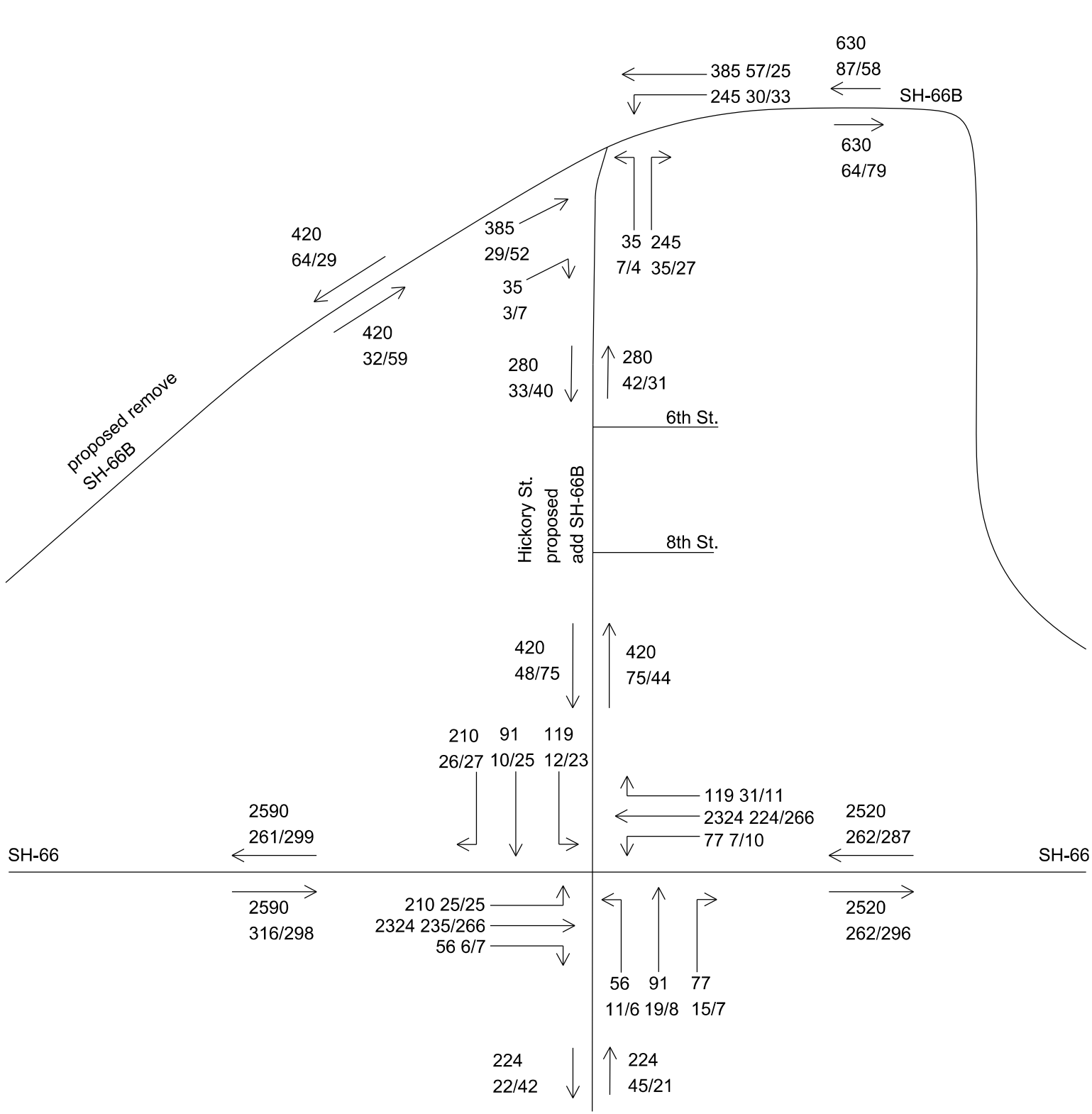
SH-66/SH-66B
Wellston
Lincoln Co.
current alignment

2035 AADT
AM/PM DHV



SH-66/SH-66B
Wellston
Lincoln Co.
proposed alignment

2035 AADT
AM/PM DHV



APPENDIX H

Select Plan Sheets and Obsolete Bridge Standards

SELECT ORIGINAL BRIDGE PLAN SHEETS

LINE DRAFTSM.	LOCATING ENG'R.	BRIDGE ENG'R.	DIVISION ENG'R.	P. P. R.
MPK 3/24/32	HSE	HXW	HDB.	

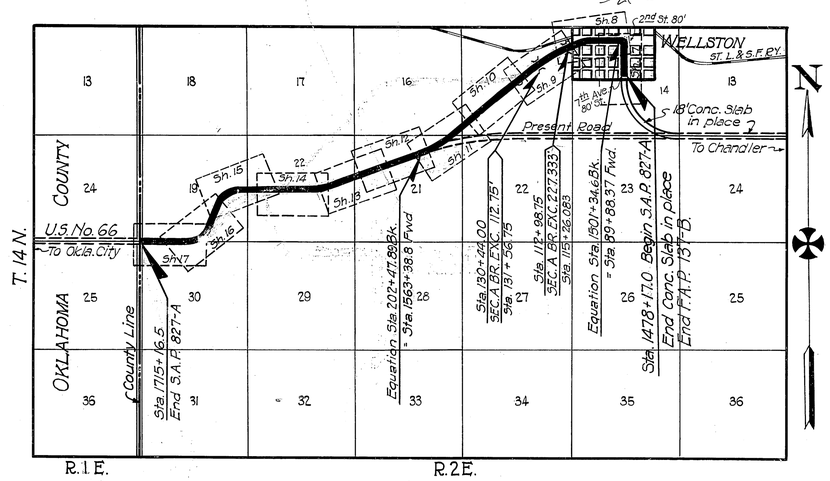
FED. ROAD DIS. NO.	STATE	STATE AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
6	OKLA.	827-A	1931	1	47

Grade Crossings Eliminated_____0
By Separation { Overhead_____0 / Underpass____0 }
By Relocation_____0
Grade Crossings Remaining____0
Revised As Built
Paving

STATE OF OKLAHOMA
DEPARTMENT OF HIGHWAYS

PLAN AND PROFILE OF PROPOSED
STATE HIGHWAY
STATE AID PROJECT No. 827-A
LINCOLN COUNTY
U.S. HIGHWAY NO. 66 -41-06 -21-24

INDEX OF SHEETS



SCALES

PLAN 1"=100'
PROFILE { HOR. 1"=100' / VER. 1"=10' }
CROSS SECTIONS 1"=5'
LAYOUT 1½"=1 MILE.

CONVENTIONAL SIGNS

- PROPOSED ROAD
- RAILROADS
- RANGE & TOWNSHIP LINES
- SECTION LINES
- QUARTER SECTION LINES
- FENCES
- BASE LINE
- RIGHT-OF-WAY LINES
- GROUND LINE
- GRADE LINE
- TRAVELLED ROADS
- CULVERTS & BRIDGES
- TELEPHONE & TELEGRAPH
- POWER LINES
- BUILDINGS
- UNLOADING POINTS
- OIL WELLS

Roadway Length_____28414.737 Ft.___5.381 Mis.
Bridge Length_____340.083 Ft.___.064 Mis.
Project Length_____5.445 Mis.
Exceptions_____None
Equations { Sta. 1501+34.6 Bk. = Sta. 89+88.37 Fwd. / Sta. 202+47.89 Bk. = Sta. 1563+38.8 Fwd. }

EXAMINED AND APPROVED
This [redacted] Day of [redacted] 1932
[redacted]
DIVISION ENGINEER

EXAMINED AND APPROVED
This [redacted] Day of [redacted] 1932
[redacted]
STATE HIGHWAY ENGINEER

EXAMINED AND APPROVED
This [redacted] Day of [redacted] 1932
[redacted]
ENGINEER OF DESIGN

EXAMINED AND APPROVED
This [redacted] Day of [redacted] 1932
[redacted]
CHAIRMAN
STATE HIGHWAY COMMISSION

RECOMMENDED FOR APPROVAL
This [redacted] Day of [redacted] 1932
[redacted]
SENIOR HIGHWAY ENGINEER
BUREAU OF PUBLIC ROADS

RECOMMENDED FOR APPROVAL
This [redacted] Day of [redacted] 1932
[redacted]
DISTRICT ENGINEER
BUREAU OF PUBLIC ROADS

RECOMMENDED FOR APPROVAL
[redacted]
CHIEF ENGINEER
BUREAU OF PUBLIC ROADS

APPROVED
[redacted]
CHIEF OF BUREAU OF PUBLIC ROADS

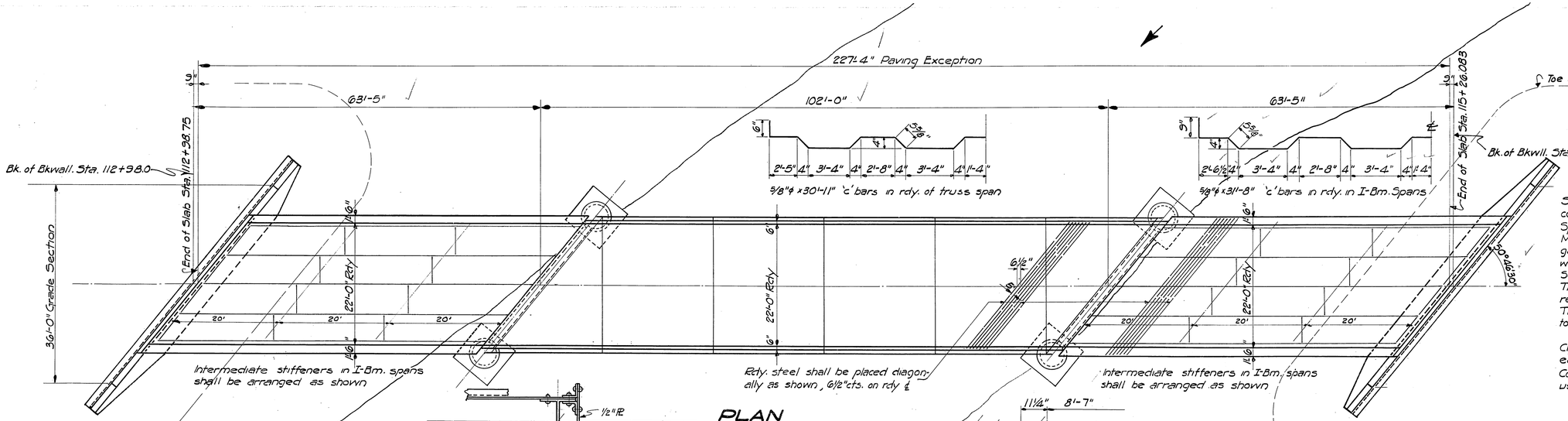
STATE STANDARD SPECIFICATIONS GOVERN 1931 REVISED

S.A.P. No. 827 Sec. "A" Sh. 1

AMBLUCO

STATE
827A Br. 1932 22 47

Revised 1-2-34

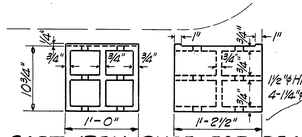


PLAN

NOTES

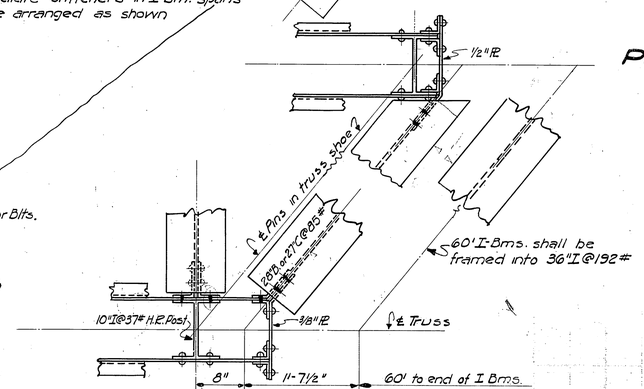
SPECIFICATIONS: This work shall be constructed according to the Okla. Std. Specifications 1931.
Measurement of fine and coarse aggregate shall be by weight in accordance with the second and third paragraphs of Sec. No. 71.07.
The concrete mixer shall conform to the requirements of Sec. No. 71.08
The untreated Timber Piling shall conform to the requirements of Sec. No. 82

Channel shall be excavated 50' on each side of roadway ℄ by the bridge Contractor, and the channel excavation used in the roadway.
D.A = 45 Sq. Mi
C = .8

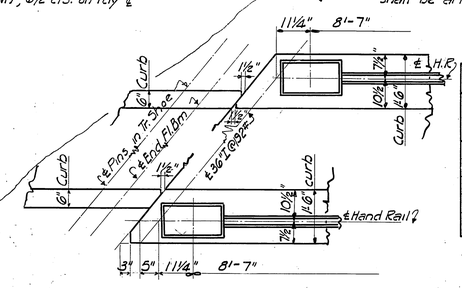


CAST IRON SHOE FOR BEAM SUPPORTING 60' I's OVER PIERS

B.M. 40d Nail in top stump 39' Lt. Sta. 115+93 Elev. 850.01



DETAIL OF END FL. BM. CONN. OVER PIERS



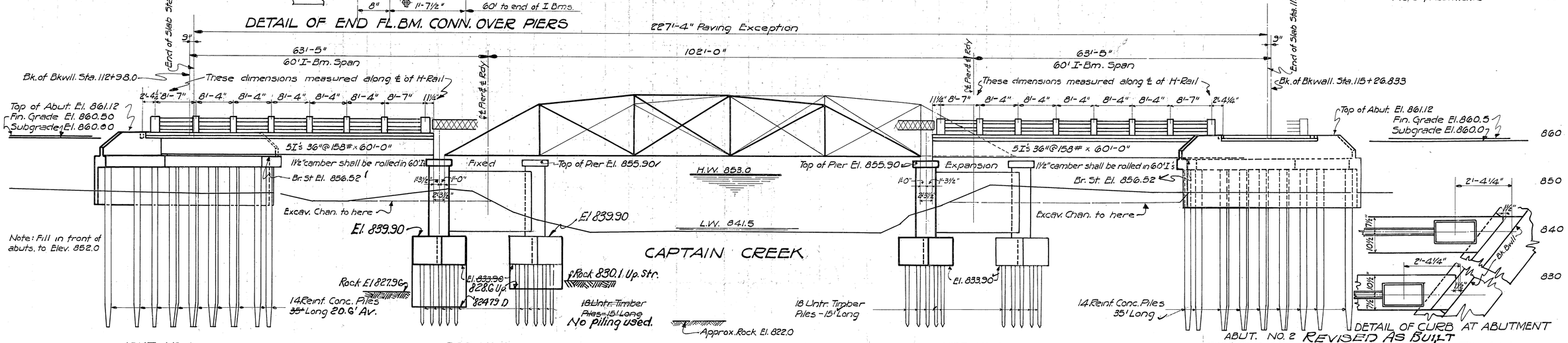
DETAIL OF CURBS OVER PIERS

SUMMARY OF QUANTITIES

Location	Class A Excavation Cu. Yds.	Concrete Cu. Yds 1:2:4	Per Bases 1:2:4	1:2:3	Reinforcing Steel Lbs.	Reinf. Conc. Hand Rail Lin. Ft.	Structural Steel Lbs.	Untr. Timber Piling Lin. Ft.	Reinf. Conc. Piling Lin. Ft.
Abutments		101.6			10,940				~~980~~
Piers		69.4	~~50.3~~		~~7,500~~	8,227	107,817	~~540~~	
1-100' Truss				53.7	10,750		~~102,300~~	117,130	
2-60' I-Bms.			63.16	84.5	13,160	242.5	~~117,200~~	270	879.18
TOTALS	~~500~~ 92	171.0	~~56.8~~	138.2	~~42,350~~ 43,077		~~224,000~~ 224947	~~5,410~~	~~980~~

All exposed concrete surfaces shall have a carborundum finish.

For Details not shown see:-
Standard I-B4₂ -Sheet No. 26
" C-100₄ " " 24
" C-100₅ " " 25
Piers ℄ Abutments " " 23



GENERAL ELEVATION
SCALE 1" = 10'-0"

DETAIL OF CURB AT ABUTMENT

Drawn By J.M.B. May 1932
Checked by H.B.S. May 1932
As built G.N.

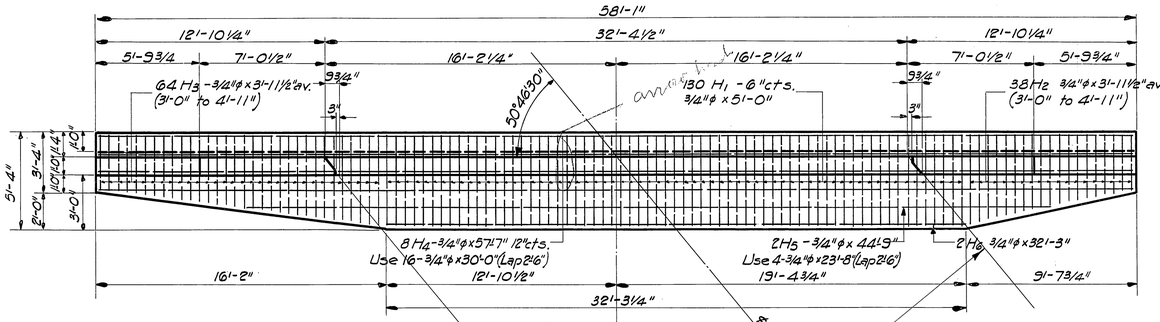
REVISED AS BUILT

GENERAL ELEVATION & PLAN
SUMMARY QUANTITIES
1-100' TRUSS & 2-60' I-BMS.-22' RDY.
SKEWED 50° 46' 30"
℄ STA. 114+12.417
STATE AID PROJ. NO. 827-A-BR.

A 22

FED. ROAD DIST. NO.	STATE	STATE AID PROJ. NO.	FISCAL YEAR	SHEET NO	TOTAL SHEETS
6	OKLA	827 A Bridge	1932	23	47

Revised 7-19-33

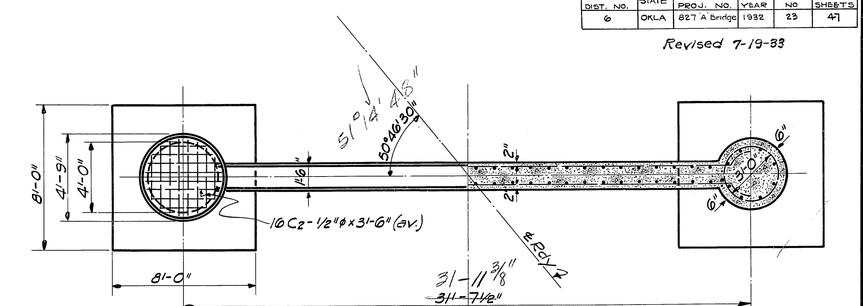


PLAN OF ABUTMENT

BAR LIST - 1 ABUT.				
Mark	No.	Size	Form	Length
H1	130	3/4"φ	Str.	51'-0"
H2	38	"	"	3'-11½" av.
H3	64	"	"	3'-11½" av.
H4	16	"	"	30'-0"
H5	4	"	"	23'-8"
H6	2	"	"	32'-3"
BH1	2	1/2"φ	"	7'-3"
BH2	2	"	"	9'-2"
BH3	2	"	"	6'-9"
BH4	2	"	"	8'-8"
BH5	2	"	"	28'-4"
BH6	4	"	"	29'-9"
BV1	32	"	"	4'-2"
BV2	16	"	"	5'-10"
BV3	12	"	"	4'-1½" av.
WH	36	3/4"φ	"	30'-0"
WV	59	"	"	101'-0"

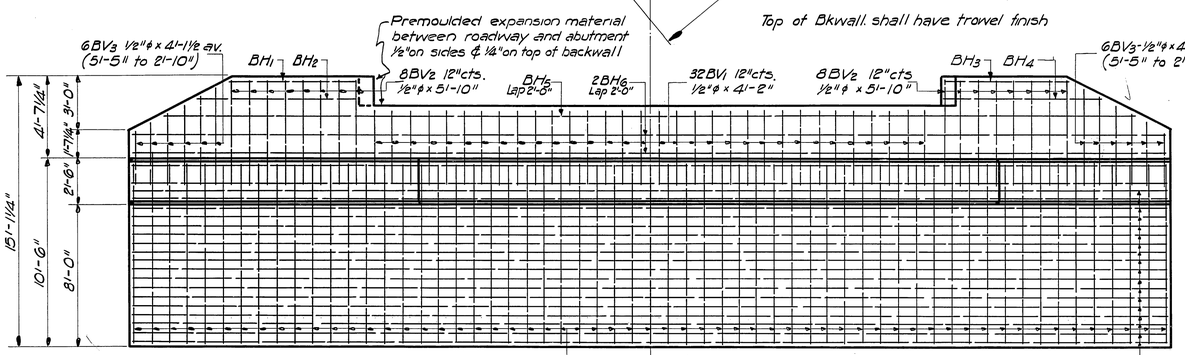
1:2:4 Conc. in 1 Abut. 50.8 C.Y.
Reinf. Steel " " " 5,470. Lbs.
Conc. Piling " " " #2 490. Lin. Ft.
" " " " #1 288.35 " "

Built as planned

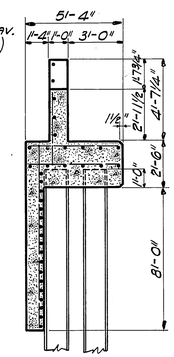


HALF PLAN

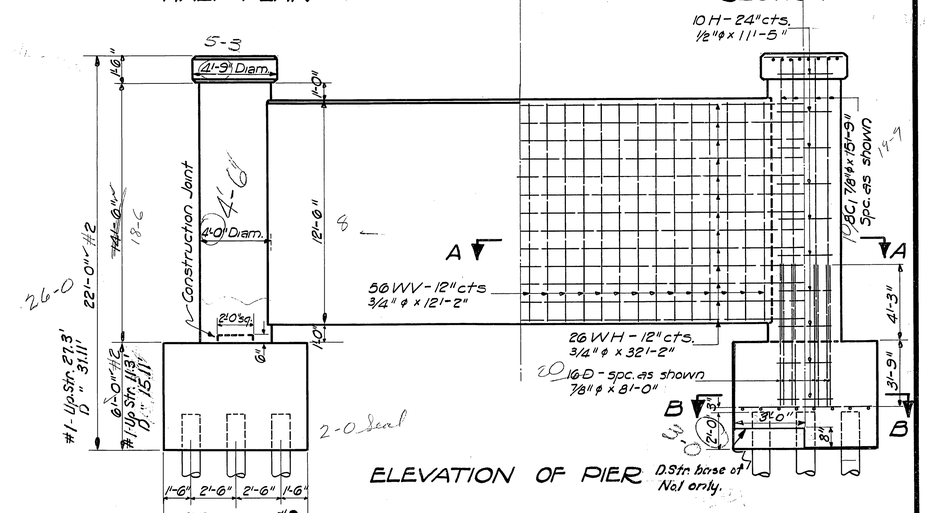
SECTION A-A



ELEVATION

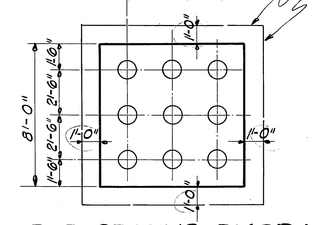


SECTION ON ℄



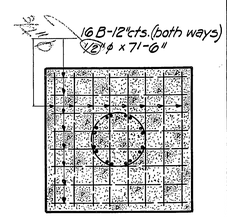
ELEVATION OF PIER

NOTE:— Excavation for pier base must not disturb original ground outside this line

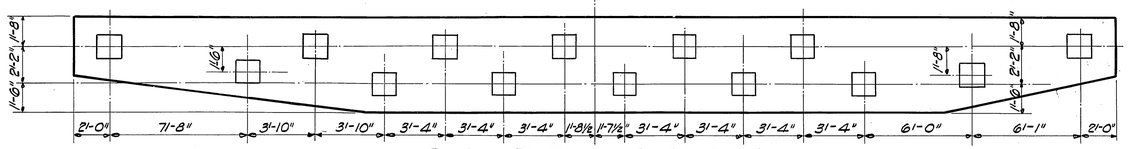


PILE SPACING DIAGRAM

H - 1/2"φ x 11'-5"

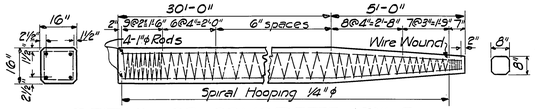


SECTION B-B



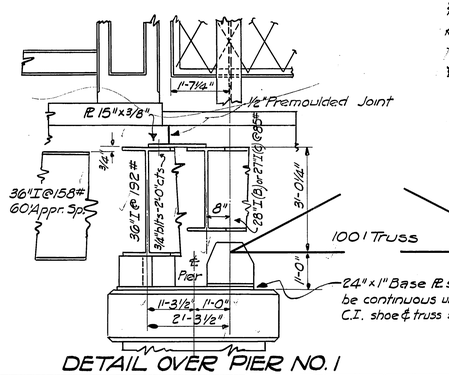
PILE SPACING DIAGRAM

14 Conc. Piles in one abutment

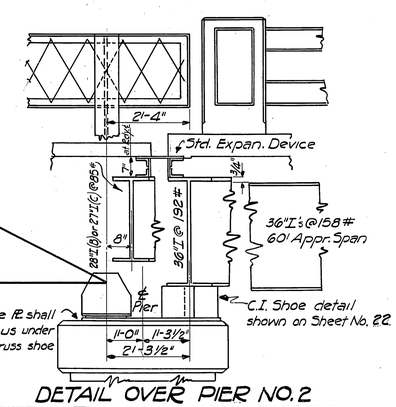


DETAIL OF CONCRETE PILE

NOTE: Equipment required for driving piles - No. 1 Vulcan hammer or equivalent, pump and equipment sufficient to furnish 125 lbs. pressure at two 3/4" nozzles.
1:2:3 Concrete to be used in piling. Max. aggregate 1½"φ



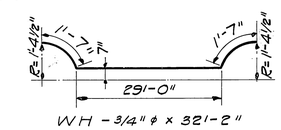
DETAIL OVER PIER NO. 1



DETAIL OVER PIER NO. 2

BAR LIST - 1 PIER				
Mark	No.	Size	Form	Length
C1	16	7/8"φ	Str	15'-9"
C2	32	1/2"φ	"	3'-6" av.
D	32	7/8"φ	"	8'-0"
H	20	1/2"φ	Bnt.	11'-5"
B	32	1/2"φ	Str.	7'-6"
WV	56	3/4"φ	"	121'-2"
WH	26	3/4"φ	Bnt	321'-2"

1:2:4 Conc. in 1 Pier Top 34.7 C.Y.
1:2:4 " " #2 " Base 28.4 C.Y. #1 = 34.76
Reinf. Steel in #1 Pier 3,750. Lbs. #2 = 4477#
Untr. Tim. Piling in #2 Pier 270 Lin. Ft.
No " " " " " #1



WH - 3/4" φ x 321'-2"

REVISED AS BUILT

DETAILS OF PIERS & ABUTMENTS
1-100' TRUSS & 2-60' I-BMS. - 221'-0" RDY.
SKEWED 50° 46' 30" ℄ STA. 114 + 12.417
STATE AID PROJ. NO. 827 A-Br.

Drawn by J.M.B. May 1932
Checked by H.B.S. May 1932
✓ As Built G.M. 7-19-33

OBSOLETE BRIDGE STANDARDS

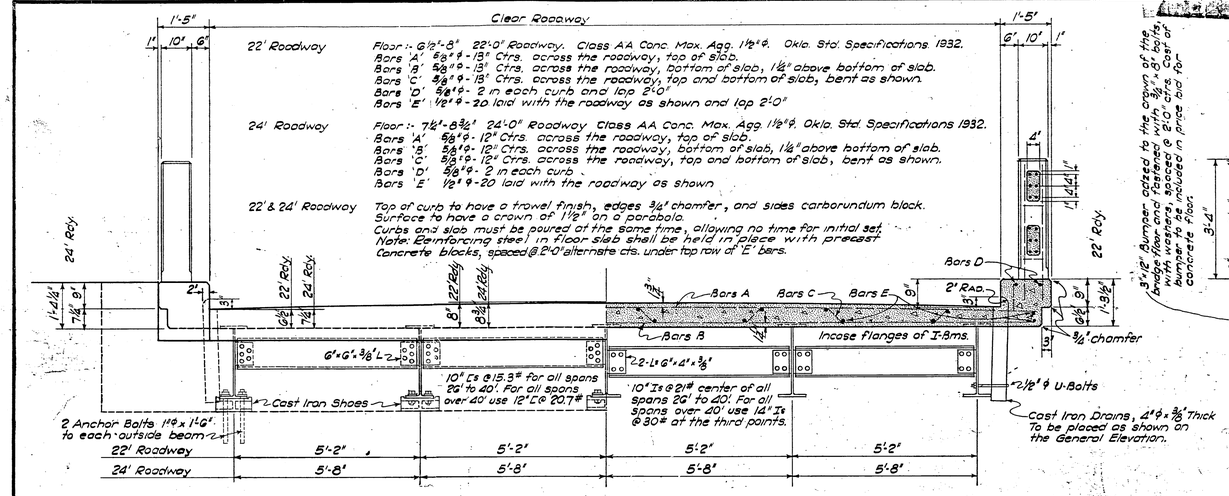
FED. ROAD DIST. NO.	STATE	AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
G	OKLA.				

REV.-2-11-38

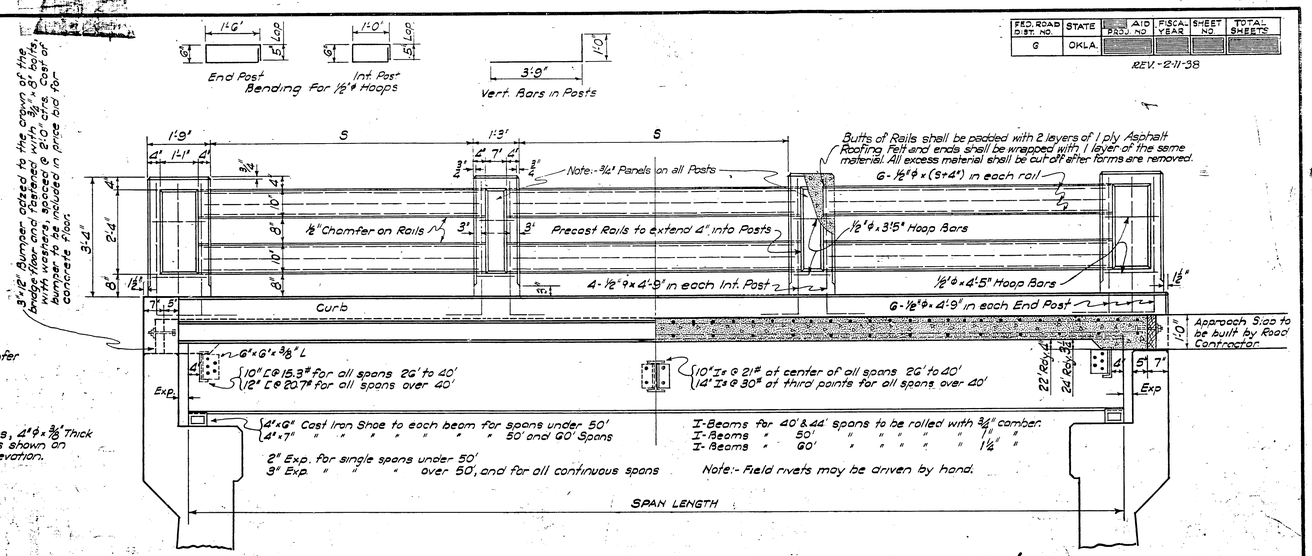
22' Roadway — Floor :- 6½"-8" 22'-0" Roadway. Class AA Conc. Max. Agg. 1½"ϕ. Okla. Std. Specifications. 1932.
Bars 'A' ⅝"ϕ - 15" Ctrs. across the roadway, top of slab.
Bars 'B' ⅝"ϕ - 13" Ctrs. across the roadway, bottom of slab, 1½" above bottom of slab.
Bars 'C' ⅝"ϕ - 13" Ctrs. across the roadway, top and bottom of slab, bent as shown.
Bars 'D' ⅝"ϕ - 2 in each curb and lap 2'-0"
Bars 'E' ½"ϕ - 20 laid with the roadway as shown and lap 2'-0"

24' Roadway — Floor :- 7½"-8¾" 24'-0" Roadway Class AA Conc. Max. Agg. 1½"ϕ. Okla. Std. Specifications 1932.
Bars 'A' ⅝"ϕ - 12" Ctrs. across the roadway, top of slab.
Bars 'B' ⅝"ϕ - 12" Ctrs. across the roadway, bottom of slab, 1½" above bottom of slab.
Bars 'C' ⅝"ϕ - 12" Ctrs. across the roadway, top and bottom of slab, bent as shown.
Bars 'D' ⅝"ϕ - 2 in each curb
Bars 'E' ½"ϕ - 20 laid with the roadway as shown

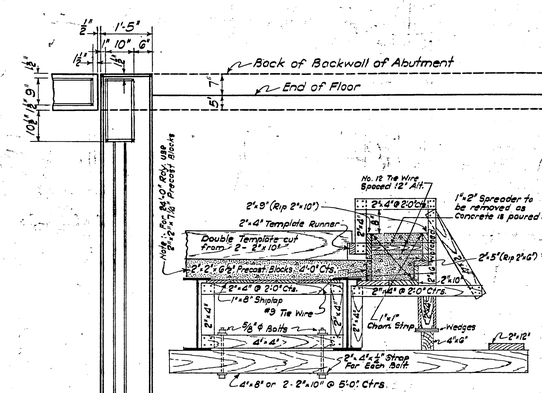
22' & 24' Roadway — Top of curb to have a trowel finish, edges ¾" chamfer, and sides carborundum block. Surface to have a crown of 1½" on a parabola. Curbs and slab must be poured at the same time, allowing no time for initial set. Note: Reinforcing steel in floor slab shall be held in place with precast concrete blocks, spaced @ 2'-0" alternate ctrs. under top row of 'E' bars.



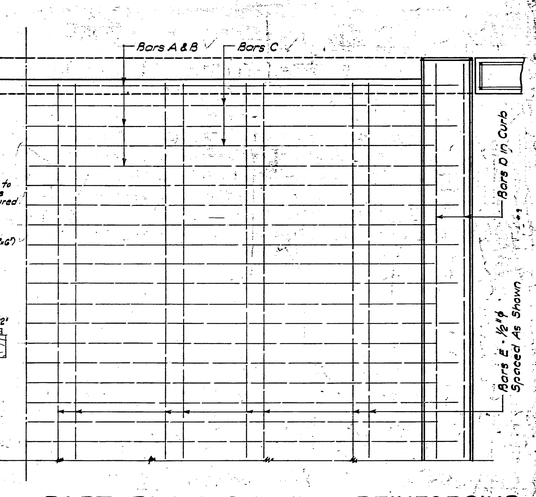
HALF END ELEVATION — HALF TRANSVERSE SECT.



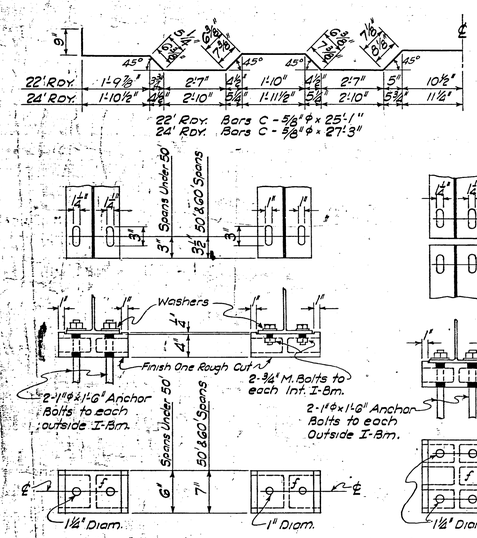
HALF SIDE ELEVATION — HALF LONG. SECT. AT ℄

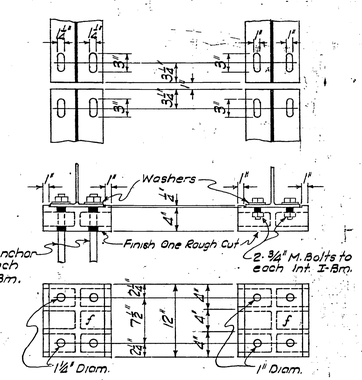


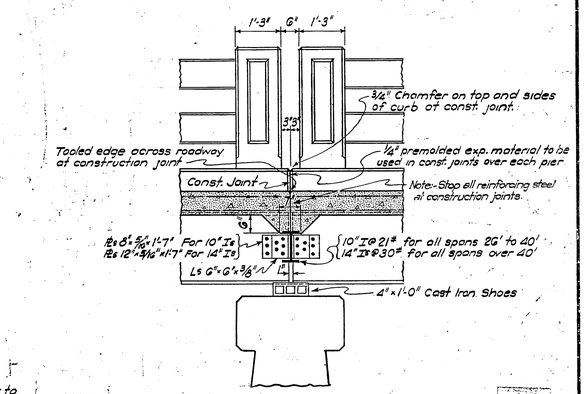
DETAIL OF FORMS FOR FLOOR AND CURBS



PART PLAN — PART PLAN SHOWING REINFORCING







DETAIL FOR CONTINUOUS SPANS

GENERAL NOTES

All construction to conform to Oklahoma Standard Specifications of 1932 as approved by the U.S. Bureau of Public Roads.
The measurement of fine and coarse aggregate shall be by weight in accordance with the second and third paragraphs of section No. 81.07.
The concrete mixer shall comply with the requirements of section No. 81.08.
Concrete materials shall be handled as specified in section 62.20.
All concrete in superstructure to be Class AA. All reinforcing to be deformed bars, cold bent; no welds permitted. All dimensions relating to reinforcing spacing are to center of bars. When splicing is necessary, bars are to be lapped 40 diameters.
All exposed concrete surfaces to have a carborundum finish. All exposed corners to have ¾" chamfer. All chamfer strips shall be sized lumber.
Finish as per specifications in section 81.24. Finish for floor as per specifications in section 73.05.
Second field coat shall be aluminum paint.

GENERAL NOTES FOR SHOES

All webs to be ¾" thick. Bearing surfaces of all shoes to be finished. Bottom of all shoes to be finished with One Rough Cut. Width of all shoes to equal flange width of beam plus 2½". Minimum 3"x¼" washers for all 1"ϕ anchor bolts. Minimum 2"x⅛" washers for all ¾" Mach. Bolts. Bevel all washers for Beth. Beams. All dimensions for castings shown or noted are minimum and no undermin is permitted.

Live Load :- Truck loading as per specifications, Fig. 1, Sec. 87. Impact, 30% of Live Load.

TABLE OF DIMENSIONS AND QUANTITIES

Span Length	22'-0" Roadway I-Beams No.	Size	Spacing	Weight of Bms. Per Lin. Ft.	Weight of Bms. Total	Weight Stiffners and Drains	Weight of Shoes	Total Weight	Floor Class 'AA' Concrete	Floor Reinf. Steel	Conc. Hand Rail Lineal Feet	Post Spacing Length S.	Paving Except. Lineal Feet	24'-0" Roadway I-Beams No.	Size	Spacing	Weight of Bms. Per Lin. Ft.	Weight of Bms. Total	Weight Stiffners and Drains	Weight of Shoes	Total Weight	Floor Class 'AA' Concrete	Floor Reinf. Steel
26'	5	21" B. @ 63# - 21" C. @ 63#	5'-2"	315	8,190	1,690	420	10,300	18.20	2,400	56.0	7'-4¼"	27.17	5	21" B. @ 68# - 21" C. @ 68#	5'-8"	340	8,840	1,790	420	11,050	21.05	2,735
30'	5	24" B. @ 74# - 24" C. @ 74#	5'-2"	370	11,100	1,700	450	13,250	20.75	2,755	64.0	6'-2½"	31.17	5	24" B. @ 74# - 24" C. @ 74#	5'-8"	370	11,100	1,800	450	13,350	24.00	3,140
36'	5	27" B. @ 91# - 27" C. @ 91#	5'-2"	455	16,380	1,840	480	18,700	24.55	3,290	76.0	7'-8½"	37.17	5	27" B. @ 98# - 27" C. @ 98#	5'-8"	490	17,640	1,930	480	20,050	28.45	3,750
40'	5	27" B. @ 98# - 27" C. @ 98#	5'-2"	490	19,600	1,870	480	21,950	27.10	3,650	84.0	6'-8¾"	41.17	5	30" B. @ 108# - 30" C. @ 108#	5'-8"	540	21,600	2,000	500	24,100	31.40	4,160
44'	5	30" B. @ 108# - 30" C. @ 108#	5'-2"	540	23,760	3,290	500	27,550	29.65	4,040	92.0	7'-6¼"	45.17	5	30" B. @ 116# - 30" C. @ 116#	5'-8"	580	25,520	3,480	500	29,500	34.40	4,600
50'	5	33" B. @ 125# - 33" C. @ 125#	5'-2"	625	31,250	3,450	600	35,300	33.55	4,590	104.0	7'-1"	51.33	5	33" B. @ 132# - 33" C. @ 132#	5'-8"	660	33,000	3,650	600	37,250	39.95	5,230
60'	5	36" B. @ 160# - 36" C. @ 160#	5'-2"	800	48,000	3,470	630	52,100	39.90	5,485	124.0	7'-3⅞"	61.33	5	36" B. @ 170# - 36" C. @ 170#	5'-8"	850	51,000	3,670	630	55,300	46.40	6,350

Note :- The basis of payment for structural steel will be the weight of the lightest section specified. Sections of equivalent strength will be approved, but no allowance will be made for increased weight.
Note :- All beams for end spans are to be ½" shorter than nominal span length. All beams for interior spans are to be 1" shorter than nominal span length.

OKLAHOMA STATE HIGHWAY COMMISSION STANDARD I-BM. BRIDGES 22'-0" & 24'-0" CONCRETE ROADWAY SPAN LENGTHS 26 FT. TO 60 FT.

IB-42

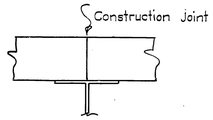
Designed by H.A. Whitley under Supervision of H.A. White and D.I. McCullough
Drawn By L.E. Acker
Checked By

C-1004

FED. ROAD DIST. NO.	STATE	AID PROJ. NO	FISCAL YEAR	SHEET NO	TOTAL SHEETS
6	OKLA			4	5

Revised 4-14-32.
Revised 10-10-32
" 11-25-32
" 6-6-33
" 12-9-33

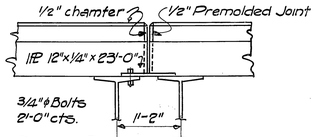
Revised Jan. 27, 1934
" May 24, 1934
" July 12, 1934



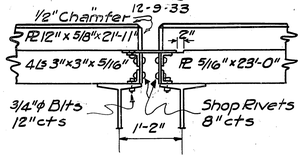
LONGITUDINAL SEC.
DETAIL OF JOINT

NOTE: The contractor shall make a construction joint in the floor and curbs at each panel point by pouring the floor slab in alternate panels.

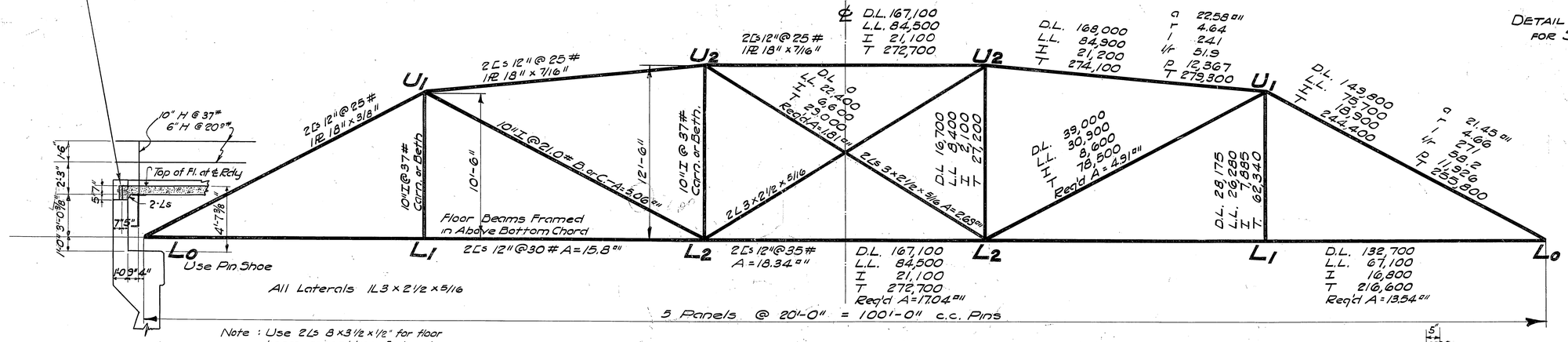
Note: 3"×12" bumper adzed to camber of slab and bolted to slab as shown, with washers & 3/4"φ × 8" bolts spaced 2'-0" cts. Cost of bumper to be included in price bid for floor concrete.



DETAIL BETWEEN TRUSSES AT FIXED JOINT



DETAIL OF EXPANSION JOINT FOR SERIES OF SPANS



Note: Use 2 Ls 8×3 1/2×1/2" for floor beam connection. Extend both Ls up approx. to handrail.

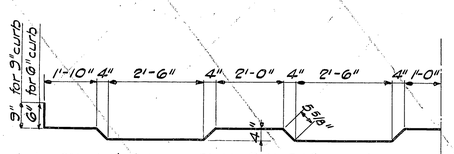
GENERAL ELEVATION
SCALE 1/4" = 1'

FLOOR

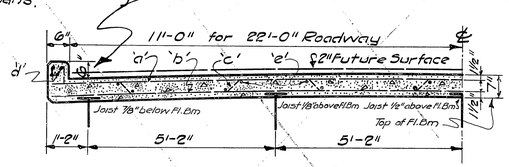
7" Concrete Roadway; Class AA; Maximum Aggregate 1 1/2"; Oklahoma Standard Specifications for Construction. Top of curb to have trowel finish, edges 1/2" chamfer and sides carborundum block.

Surface of slab to have crown of 1 1/2" on a parabola. Floor figured for 2" wearing surface of 22.5 lbs per sq. ft.

Rods:
'a' - 5/8"φ, 13" cts. - across road, top of slab, encased 1 1/2"
'b' - 5/8"φ, 13" cts. - " " bottom " " 1 1/2"
'c' - 5/8"φ, 13" cts. - " " top & bottom of slab.
'd' - 20 - 5/8"φ - 2 5/8"φ × 19'-6" Str. in curb in ea. panel, placed as shown.
'e' - 1/2"φ with roadway as shown.



NOTE: Curb to be 9" high when truss is used with I-Bm. spans. } 'c' bars, 5/8"φ × 24'-5" (6" curb) {24'-11" (9" curb)



HALF SECTION THRU FLOOR
7" CONCRETE - 2" FUTURE SURFACE

TRUSS LOADING

7" Concrete Floor - 2" Future Surface

7" Conc. Floor	.583 × 150 × 23	=	2012 Lbs. per ft. of br.
Curbs	2 × .5 × .5 × 150	=	75 " " " "
Surface	22.5 × 22	=	495 " " " " "
Steel		=	900 " " " " "
	Total D.L.	=	3482 " " " " "

PANEL LOADING

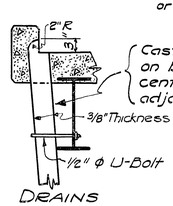
Live Load = 80 Lbs. per sq. ft. or concentrated loading as shown in Fig. No. 1, Okla. Std. Spec., Part V.

Panel D.L. = 1/2 × 20 × 3482 = 34,820 Lbs.
Panel L.L. = 80 × 11 × 20 = 17,600 "
Impact on truss = 100 S ÷ (L + 300)
Impact on floor & hangers = 30% of Live Load Stress

STRINGER LOADING

Floor & Surface (.583 × 150 + 22.5) 5.167 = 568.3 Lbs./Ft.
Stringer = 47.0 " "
Total D.L. = 615.3 " "

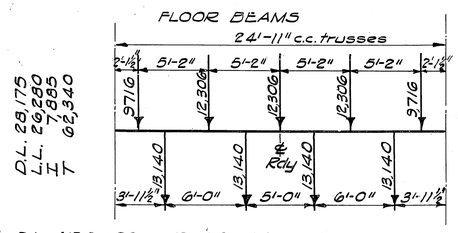
D.L.M. = 6153 × 9 - 615.3 × 9²/8 = 30,460' Lbs.
L.L.M = 6820 × 9 = 61,380 "
Impact = 30% L.L.M = 18,410 "
Total Moment = 110,250 "
Req'd. S = 82.7
Use 18" I @ 47# {Beth. S = 82.3 or {Carn. S = 82.3



Cast Iron Drains, 4"φ × 4'-2", placed on both sides of roadway at the center of each panel, except panels adjacent to the abutments.

DRAINS

FLOOR BEAMS

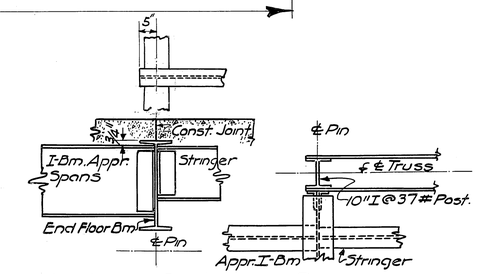


D.L. 615.3 × 20 = 12,306 Interior Stringer
485.8 × 20 = 9,716 Outside Stringer
L.L. 6600 + 16/20 × 6600 + 6/20 × 4200 = 13,140 Lbs.

D.L.M. of Bm. 1/8 × 1/16 × 24.917² = 9,000 Ft. Lbs.
D.L.M. = 28,175 × 12.458 - 9716 × 10.33 - 12,306 × 5.167 = 187,030 "
L.L.M. = 26,280 × 9.958 - 13,140 × 6 = 182,860 "
Impact = 30% L.L.M. = 54,860 "
Total Moment = 433,750 "
Req'd. S = 325.3
Use 30" I @ 116# {Beth. S = 327.9 {Carn. S = 327.9

END BEAMS

D.L.M. of Bm. = 1/8 × 91 × 24.917² = 7,060 Ft. Lbs.
D.L.M. = 93,520 " "
L.L.M. = 23,760 × 3.958 - 11,880 × 6 = 165,330 " "
Impact = 30% L.L.M. = 49,600 " "
Total Moment = 315,510 " "
Req'd S = 236.6
Use 27" Beth. I @ 91# S = 233.2
or 27" Carn. I @ 91# S = 233.2



SEC. THRU END FL. BM. PLAN

DETAILS OF END FLOOR BEAM CONN. WHERE I-BM. APPR. SPANS ARE FRAMED IN

GENERAL NOTES

All steel structural grade. All reinforcing, deformed bars, cold bent. No welds permitted. Oklahoma Standard Specifications as approved by the Bureau of Public Roads, 1932.

Rivets: All 3/4"φ except in 2 1/2" legs of angles and rails, which may be 5/8"φ. All field rivets to be driven with a pneumatic hammer.

The basis for payment of structural steel will be the weight of the specified section. Sections of equivalent strength will be approved if requested, but no allowance will be made for increased or decreased weight.

Paint: 1932 Specifications for Shop & Field. Second field coat shall be aluminum paint. All painting shall be done without the use of mechanical equipment.

OKLAHOMA STATE STANDARD GENERAL DESIGN 100 FT. RIVETED TRUSS 22 FT. ROADWAY

C-100 4

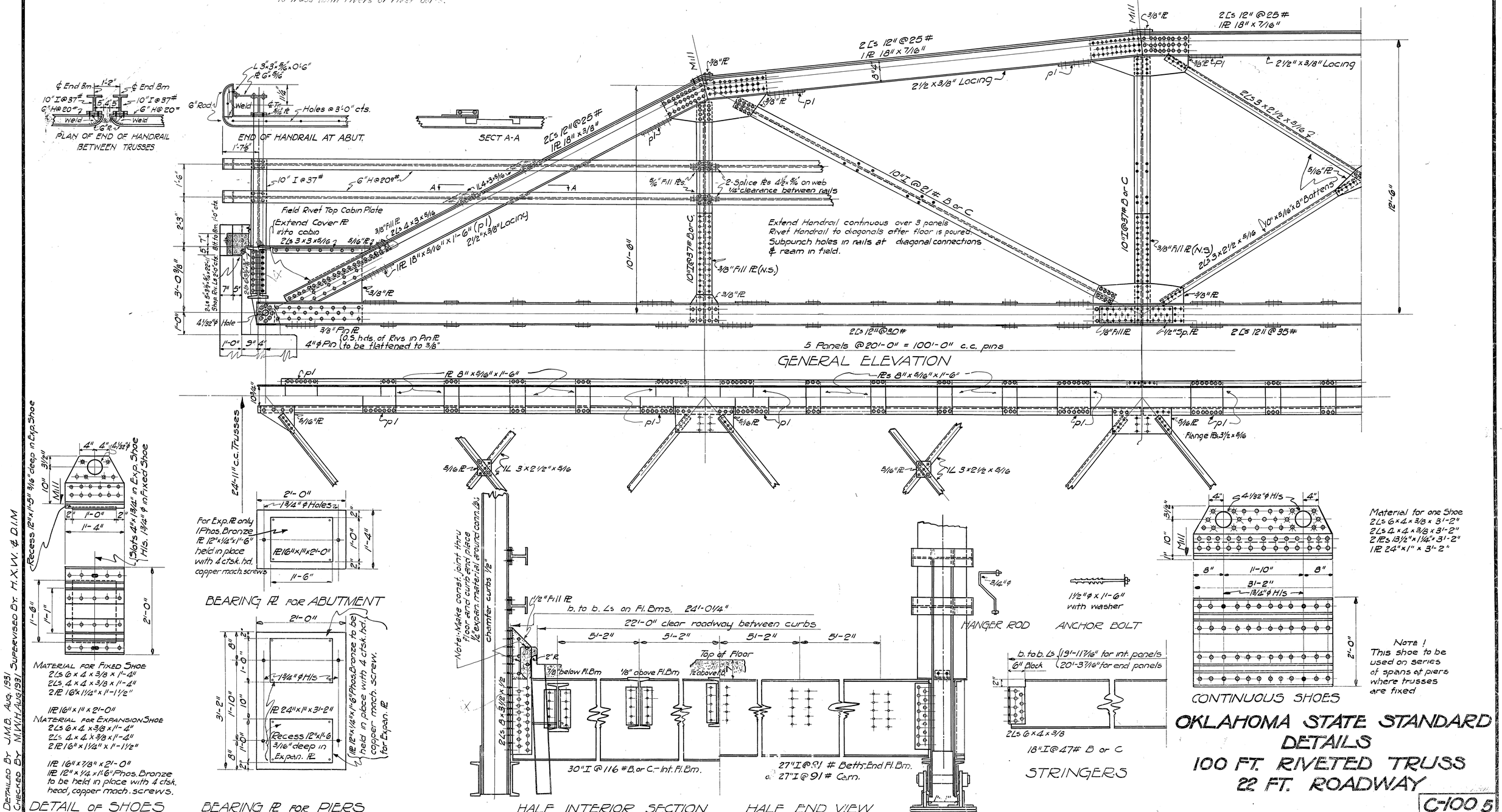
Designed By M.W.H. June 1931 Supervised By H.X.W. & D.I.M.
Chkd. & Drawn By J.M.B. July 1931

Sheet No. 4 Proj. No. X-469

FED. ROAD DIST. NO	STATE	AID PROJ. NO	FISCAL YEAR	SHEET NO	TOTAL SHEETS
6	OKLA.			5	5

Revised 4-15-32
Revised 6-17-32
Revised 10-11-32
" 6-6-33
" 12-5-33
" 5-24-34
" 7-12-34

Note: Existing Handrail Lattice Type shall be secured to Truss with rivets or rivet bolts.



Detailed By J.M.B. Aug. 1931 Superviseed By H.X.W. & D.I.M.
Checked By M.W.H. Aug. 1931

Sheet No. 5 Proj. No. X-460

2007 BRIDGE REHABILITATION PLANS

Sub 3-23-07

03800(2007-03-22)BR.pdf

Lincoln

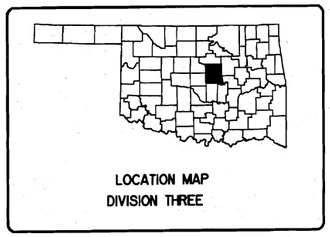
OKLAHOMA DEPARTMENT OF TRANSPORTATION

DESCRIPTION	REVISIONS	DATE

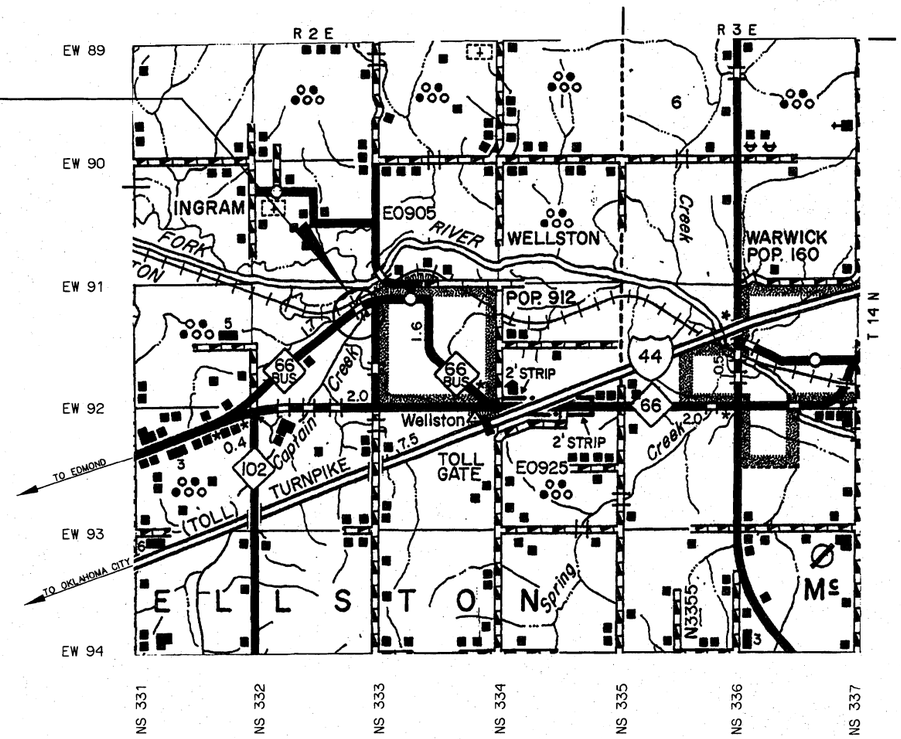
4124-0157X

STATE OF OKLAHOMA
DEPARTMENT OF TRANSPORTATION

PLAN OF PROPOSED
STATE HIGHWAY
PROJECT NO. SBR-141C(162)SB
BRIDGE REDECKING AND REHABILITATION
LINCOLN COUNTY
CONTROL SECTION NO. 66B-41-24
STATE JOB NO. 23208(04)
SH-66B OVER CAPTAIN CREEK
BRIDGE "A" LOCATION NO. 4124-0157X
N.B.I. NO. 03800



BEGIN BRIDGE STA 112+98.75
BRIDGE LENGTH = 227.33'
END BRIDGE STA 115+26.08
BRIDGE "A"



CONVENTIONAL SYMBOLS

- PROPOSED ROAD
- RAILROADS
- RANGE & TOWNSHIP
- SECTION LINES
- QUARTER SECTION LINES
- FENCES
- GROUND LINE
- EXISTING ROADS
- BASE LINE
- GRADE LINES
- TELEPHONE & TELEGRAPH
- POWER LINES
- BUILDINGS
- DRAINAGE STRUCTURES - IN PLACE
- DRAINAGE STRUCTURES - NEW
- RIGHT-OF-WAY LINES - EXISTING
- RIGHT-OF-WAY LINES - NEW
- RIGHT-OF-WAY MARKERS - IN PLACE
- RIGHT-OF-WAY MARKERS - REMOVE & REPLACE
- RIGHT-OF-WAY MARKERS - NEW
- CONTROLLED ACCESS
- RIGHT-OF-WAY FENCE

BRIDGE DESIGN
ENGINEERING MANAGER: Annie Lombardo SQUAD SUPERVISOR: Keven Mayfield SQUAD MEMBERS: E. Ludwig G. Thomas, D. Knickmeyer, M. Janes, J. Broyles

P.E. NO. 23208(01)

INDEX OF SHEETS

STANDARDS

THE FOLLOWING STANDARD DRAWINGS WILL BE REQUIRED.

ROADWAY	TRAFFIC	BRIDGE
BGC1-1-00E	TCS1-1-02E	EJ-SK-01E
GET-2-01E	TCS2-1-00E	EJ-DTL-00E
GRH-3-01E	TCS3-1-00E	
GRAU1-1-01E	TCS4-1-00E	
TBTU-2-02E	TCS5-1-00E	
	TCS6-1-00E	
	TCS7-1-00E	
	TCS8-1A-00E	
	TCS8-1B-00E	
	TCS8-1C-00E	
	TCS8-1D-00E	
	TCS9-1A-00E	
	TCS9-1B-00E	
	TCS9-1C-00E	
	TCS9-1D-00E	
	TCS10-1-00E	
	TCS11-1-00E	
	TCS47-1-00E	
	PM2-1-01E	

PREPARED BY:
OKLAHOMA DEPARTMENT OF TRANSPORTATION
BRIDGE DIVISION

3/22/07
DATE

ANNIE LOMBARDO
OKLA. REG. NO. 16004

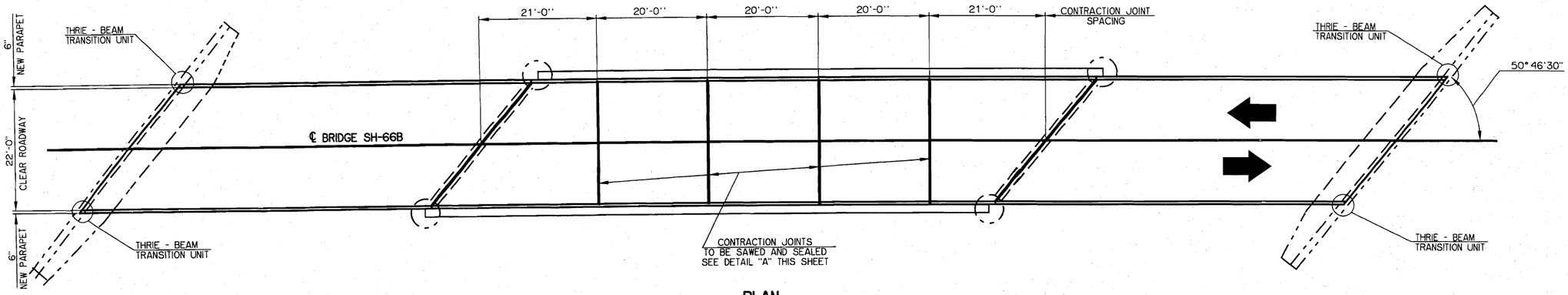
REGISTERED PROFESSIONAL ENGINEER
ANNIE LOMBARDO
16004
OKLAHOMA

OKLAHOMA DEPARTMENT OF TRANSPORTATION	DEPARTMENT OF TRANSPORTATION FEDERAL HIGHWAY ADMINISTRATION
DATE APPROVED	DATE APPROVED
BY	BY
CHIEF ENGINEER	DIVISION ADMINISTRATOR

PROJECT NO. SBR-141C(162)SB SHEET NO. 1

1999 OKLAHOMA STANDARD SPECIFICATIONS FOR HIGHWAY CONSTRUCTION (ENGLISH) GOVERN. APPROVED BY THE U.S. DEPARTMENT OF TRANSPORTATION, FEDERAL HIGHWAY ADMINISTRATION, SEPTEMBER 21, 1999.

REVISIONS		
REV. NO.	DESCRIPTION	DATE



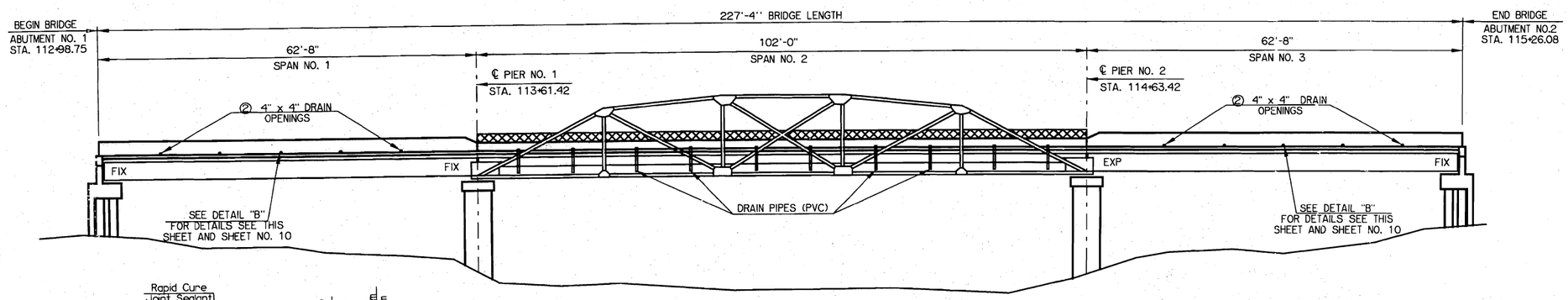
PLAN

DESIGN DATA

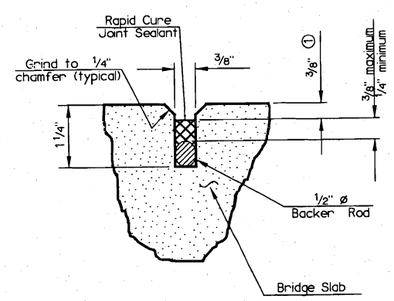
DESIGN: 1999 OKLAHOMA STANDARD SPECIFICATIONS FOR HIGHWAY CONSTRUCTION, 17TH EDITION

REINFORCING STEEL: fy = 60 ksi

CLASS AA CONCRETE: f'c = 4 ksi

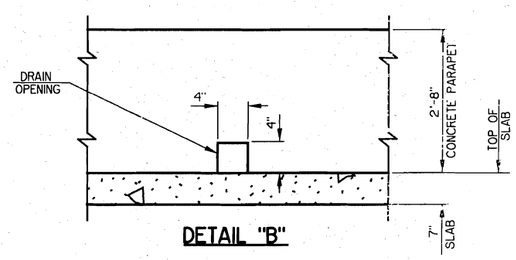


ELEVATION



DETAIL "A"

① This dimension shall taper from 3/8" at edge of driving lane/shoulder to 1/8" at rail for transverse joints only.



DETAIL "B"

② FIELD CUT REINFORCING TO ACCOMODATE DRAIN OPENINGS

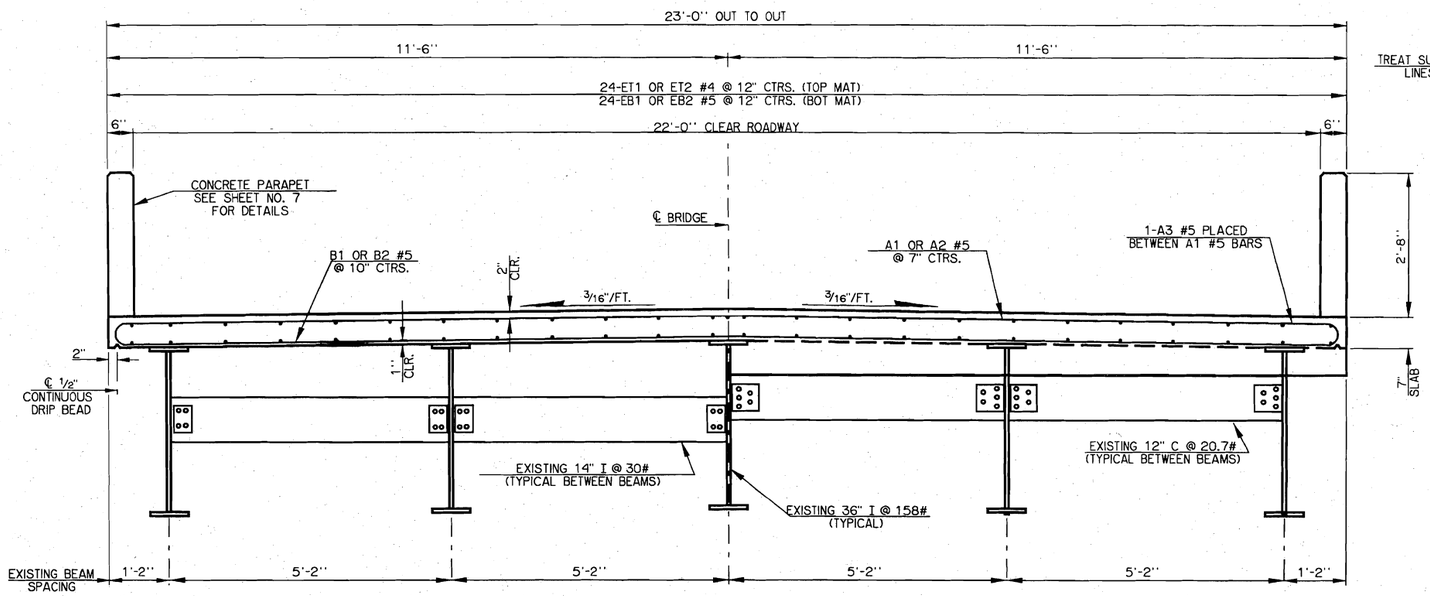
SH-66B OVER CAPTAIN CREEK — LINCOLN COUNTY
BRIDGE "A"

GENERAL PLAN AND ELEVATION
℄ BRIDGE STATION 114+12.42

Design		
Detail	MLJ	05/06
Check	RAS	05/06
Squad: MAYFIELD		
Engr. LOMBARDO		

STATE OF OKLAHOMA — DEPARTMENT OF TRANSPORTATION
STATE JOB NO. 23208(04) — SHEET NO. 7

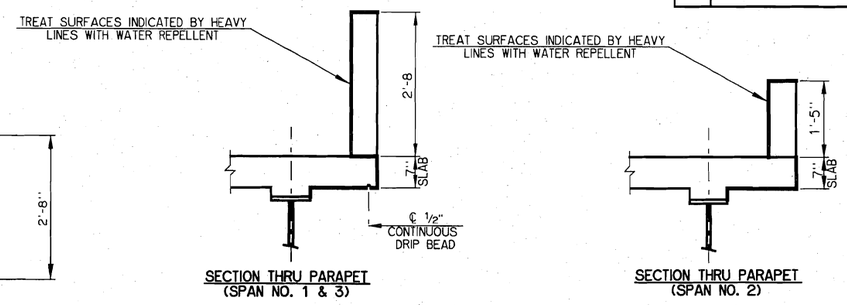
BRG.A00 - BDS4L7



HALF MID SECTION

HALF END SECTION

TYPICAL SECTION - SPANS NO 1 & 3

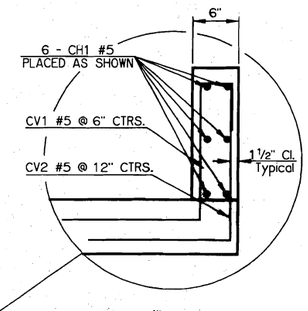


SECTION THRU PARAPET
(SPAN NO. 1 & 3)

SECTION THRU PARAPET
(SPAN NO. 2)

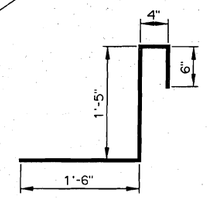
WATER REPELLENT TREATMENT DETAILS

REVISIONS		
REV. NO.	DESCRIPTION	DATE

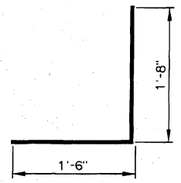


BAR LIST					
EPOXY COATED					
MARK	NO.	SIZE	FORM	LENGTH	VARIANCE
A1	296	#5	BNT	23'-10"	———
A2	144	#5	BNT	14'-4 1/2" AVG.	6'-2" TO 22'-7"
A3	724	#5	BNT	6'-1"	———
A4	60	#5	BNT	4'-2" AVG.	2'-7" TO 5'-9"
AT	14	#5	STR	29'-4"	———
B1	207	#5	STR	22'-8"	———
B2	120	#5	STR	11'-11" AVG.	2'-2" TO 21'-8"
CV1	410	#5	BNT	3'-9"	———
CV2	206	#5	BNT	3'-2"	———
③ ① EB1	24	#5	STR	166'-6"	———
② EB2	24	#5	STR	64'-6"	———
③ ② ET1	24	#4	STR	166'-0"	———
① ET2	24	#4	STR	64'-0"	———
PV1	12	#5	BNT	3'-9 1/2" AVG.	3'-4" TO 4'-3"
PV2	244	#5	BNT	4'-5"	———
PV3	44	#5	BNT	4'-4 1/2" AVG.	3'-9" TO 5'-0"
PV4	524	#5	BNT	5'-0"	———
UD	62	#4	BNT	8'-10"	———

① LENGTH INCLUDES LAP LENGTH OF 1'-6"
② LENGTH INCLUDES LAP LENGTH OF 2'-0"
③ CONTINOUS THRU JOINT AT PIER NO. 1



CV1 #5 X 3'-9"

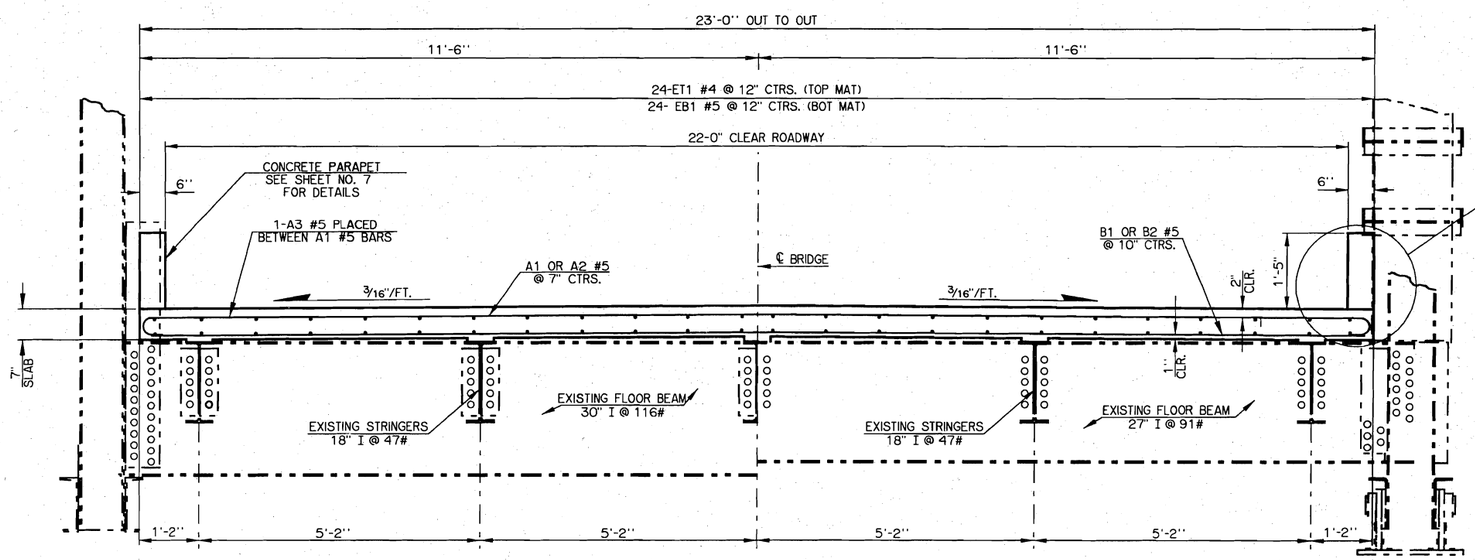


CV2 #5 X 3'-2"

BAR BEND DETAILS

SUMMARY OF QUANTITIES		
ITEM	UNIT	TOTAL
SEALED EXPANSION JOINTS	LF	30.00
CONCRETE PARAPET	LF	454.70
STRUCTURAL STEEL	LB	2,900.00
④ CLASS AA CONCRETE	CY	120.90
EPOXY COATED REINFORCING STEEL	LB	37,410.00
PAINTING EXISTING STRUCTURES	LSUM	1.00
COLLECTION AND HANDLING OF WASTE	LSUM	1.00
4" POLYVINYL CHLORIDE (PVC) PIPE	LF	80.00
WATER REPELLENT (VISUALLY INSPECTED)	SY	195.00

④ INCLUDES HAUNCHES FOR ALL SPANS



HALF MID SECTION

HALF END SECTION

TYPICAL SECTION - SPAN NO 2

SH-66B OVER CAPTAIN CREEK LINCOLN COUNTY
BRIDGE "A"

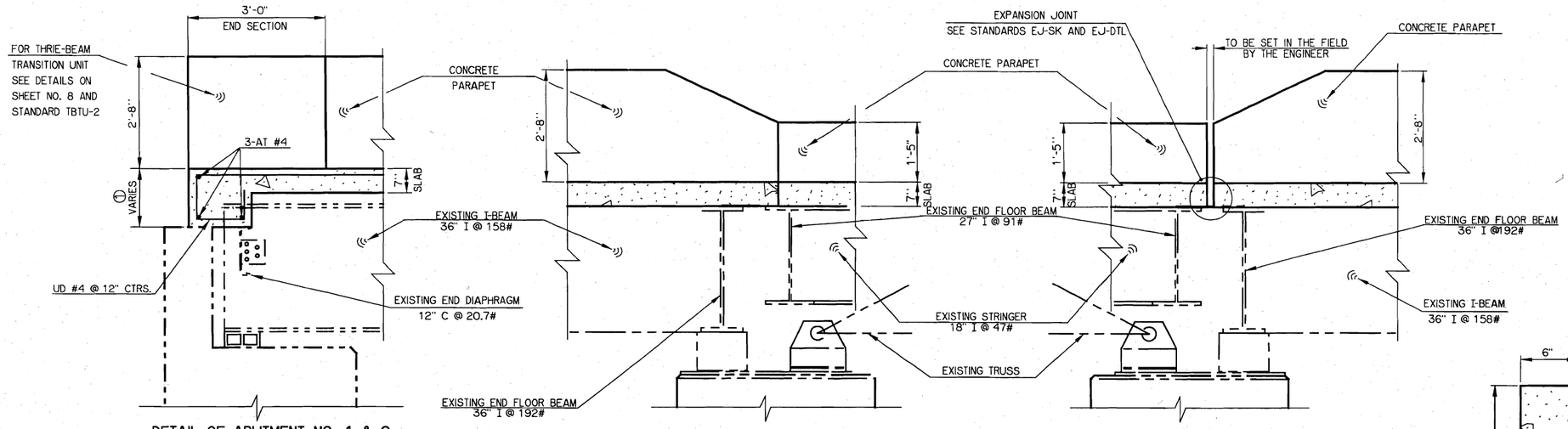
DETAILS OF SUPERSTRUCTURE
(SHEET 1 OF 3)

Design	RN	05/06
Detail	ERL	07/06
Check	RAS	07/06
Squad : MAYFIELD		
Engr. LOMBARDO		

STATE OF OKLAHOMA DEPARTMENT OF TRANSPORTATION
STATE JOB NO. 23208(04) SHEET NO. 9

BRCADD - BDS4L7

REVISIONS		
REV. NO.	DESCRIPTION	DATE



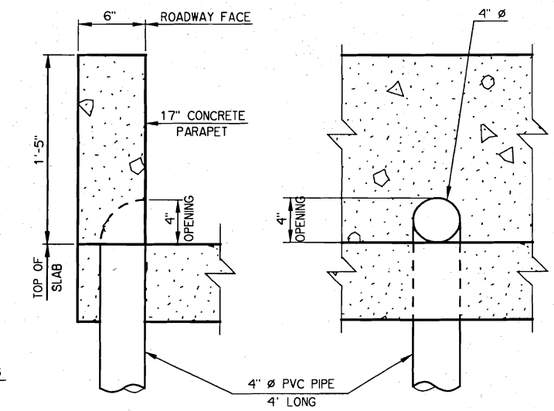
DETAIL OF ABUTMENT NO. 1 & 2
(FIXED)

DETAILS OVER PIER NO. 1
(FIXED)

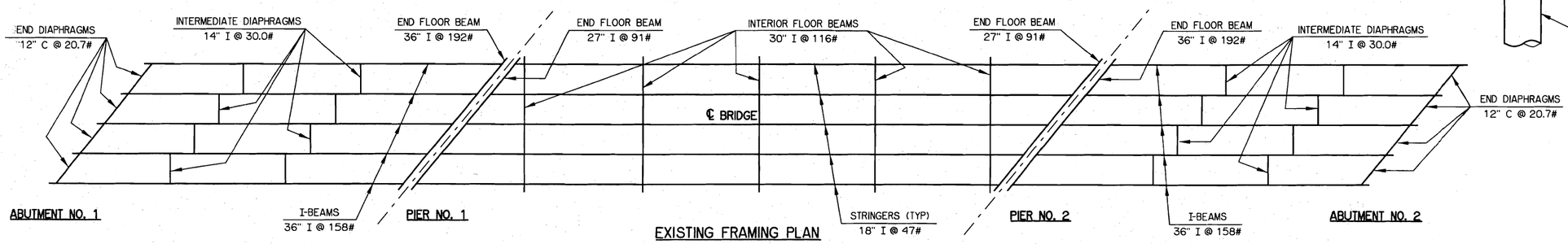
DETAILS OVER PIER NO. 2
(EXPANSION)

① SLAB THICKNESS AT ABUTMENT VARIES FROM 1'-0" TO 1'-2 3/16"

LONGITUDINAL SECTION



DETAILS OF DRAIN PIPES
(SPAN NO. 2 ONLY)

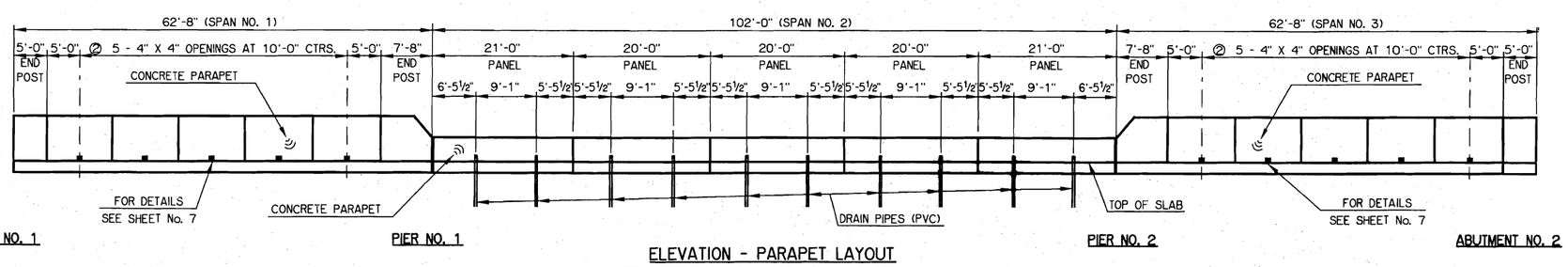


EXISTING FRAMING PLAN

DECK SLAB NOTES

THE DECK SLAB SHALL BE POURED ONE SPAN AT A TIME. NO ADJACENT SPAN AT A FIXED PIER SHALL BE POURED UNTIL AT LEAST 48 HOURS AFTER ANY ADJACENT POUR HAS BEEN COMPLETED.

CONSTRUCTION JOINTS AT THE FIXED PIERS SHALL NOT BE KEYED. IN THE EVENT OF AN EMERGENCY, POURING OF DECK SLAB MAY BE HALTED WITH A CONSTRUCTION JOINT MADE PERPENDICULAR TO THE DIRECTION OF TRAFFIC AS DIRECTED BY THE ENGINEER. NO HEAVY EQUIPMENT WILL BE PERMITTED ON THE FINISHED DECK SLAB WITHIN 5' OF ANY CONSTRUCTION JOINT UNTIL THE DECK SLAB IS IN PLACE ON BOTH SIDES OF THE RESPECTIVE JOINT. DO NOT TINE WITHIN 6" OF ANY CONSTRUCTION JOINT.



ELEVATION - PARAPET LAYOUT
(SEE SHEET NO. 8 & 9 FOR ADDITONAL DETAILS)
② FIELD CUT REINFORCING TO ACCOMODATE DRAIN OPENINGS

SH-66B OVER CAPTAIN CREEK LINCOLN COUNTY
BRIDGE "A"

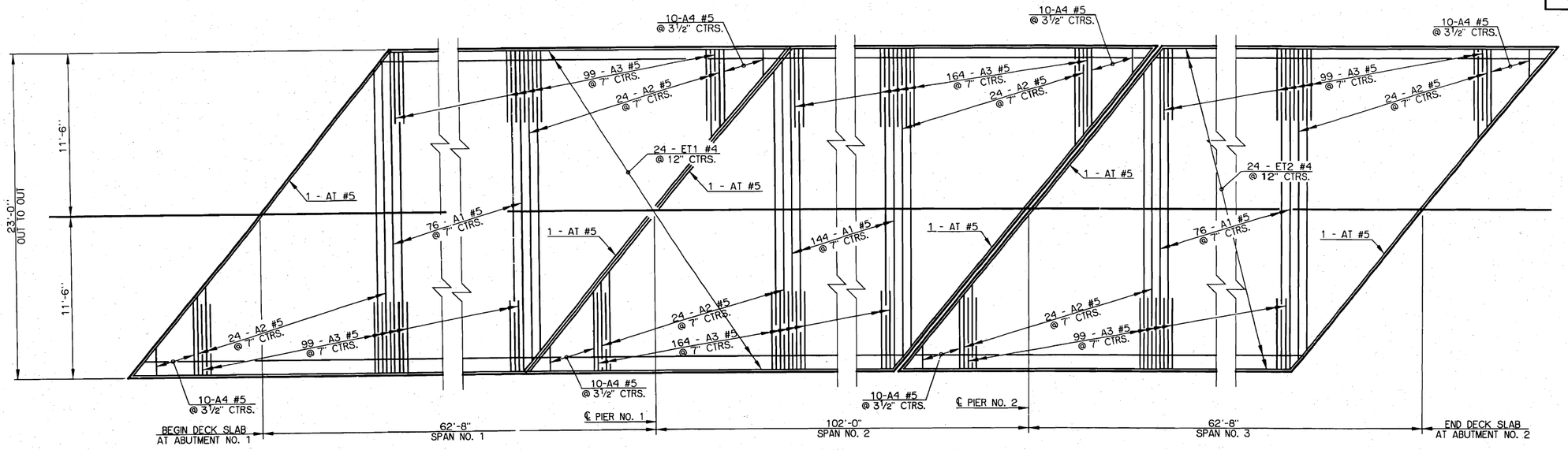
DETAILS OF SUPERSTRUCTURE
(SHEET 2 OF 3)

Design	RN	06/06
Detail	KWP	05/06
Check	RAS	06/06
Squad : MAYFIELD		
Engr. LOMBARDO		

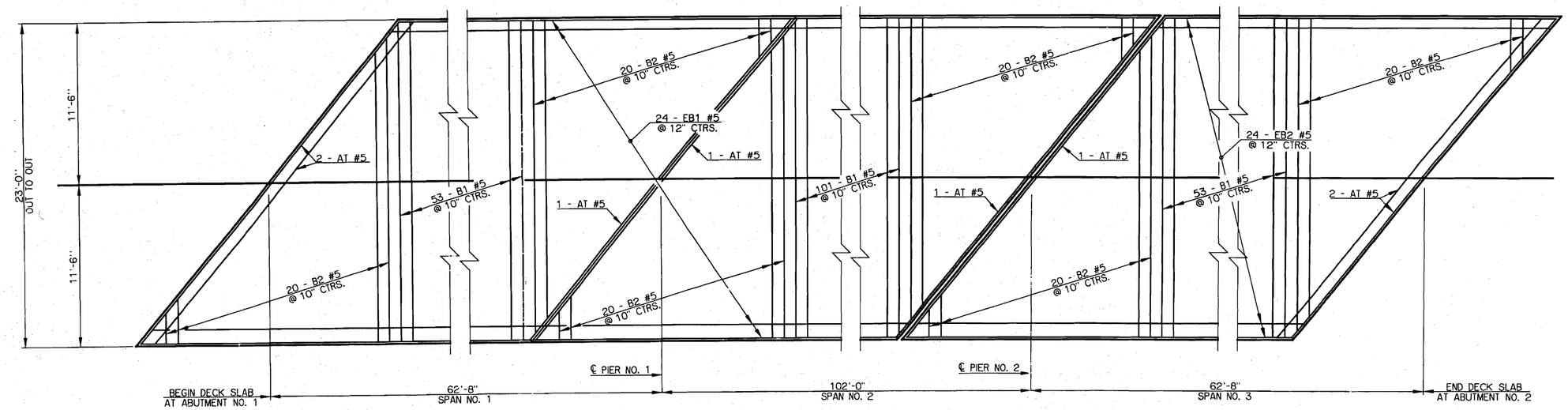
STATE OF OKLAHOMA DEPARTMENT OF TRANSPORTATION
STATE JOB NO. 23208(04) SHEET NO. 10

BRCADD - 6/05-4L7

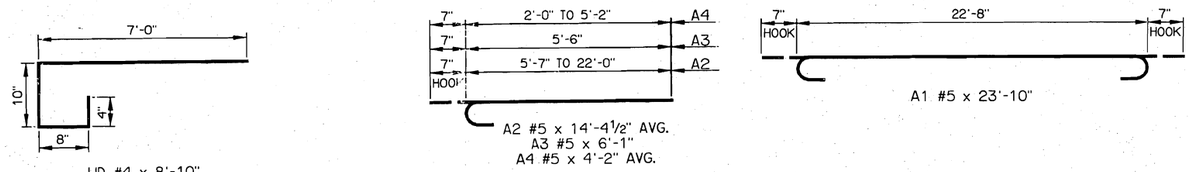
REVISIONS		
REV. NO.	DESCRIPTION	DATE



TOP OF SLAB REINFORCING LAYOUT



BOTTOM OF SLAB REINFORCING LAYOUT



BAR BEND DETAILS

NOTE: FOR BAR LIST SEE SHEET NO. 9

NOTE: PARAPETS HAVE BEEN OMITTED FOR CLARITY. SEE TYPICAL SECTION SHEETS FOR PLACEMENT OF THE OMITTED REINFORCING.

SH-66B OVER CAPTAIN CREEK — LINCOLN COUNTY
BRIDGE "A"

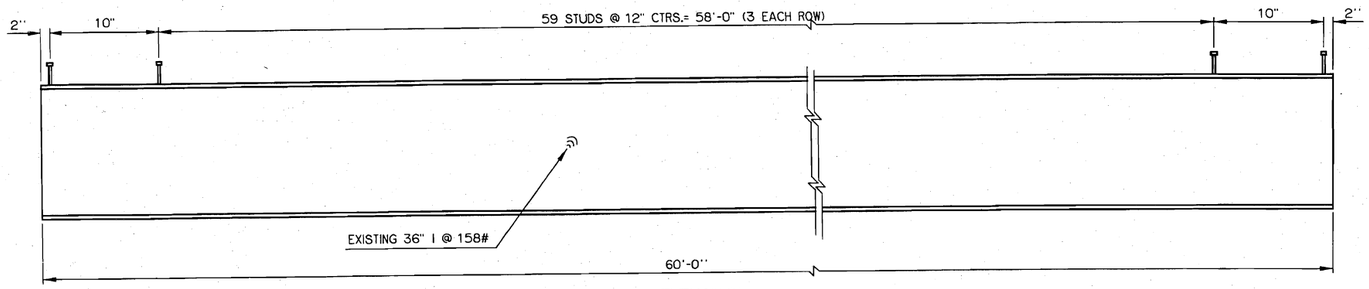
DETAILS OF SUPERSTRUCTURE
(SHEET 3 OF 3)

Design	RN	05/06
Detail	KWP	06/06
Check	RAS	07/06
Squad: MAYFIELD		
Engr. LOMBARDO		

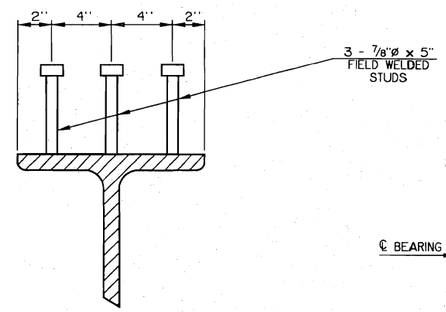
STATE OF OKLAHOMA — DEPARTMENT OF TRANSPORTATION
STATE JOB NO. 23208(04) — SHEET NO. 11

BRC400 - BDS4L7

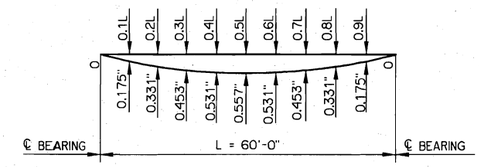
REVISIONS		
REV. NO.	DESCRIPTION	DATE



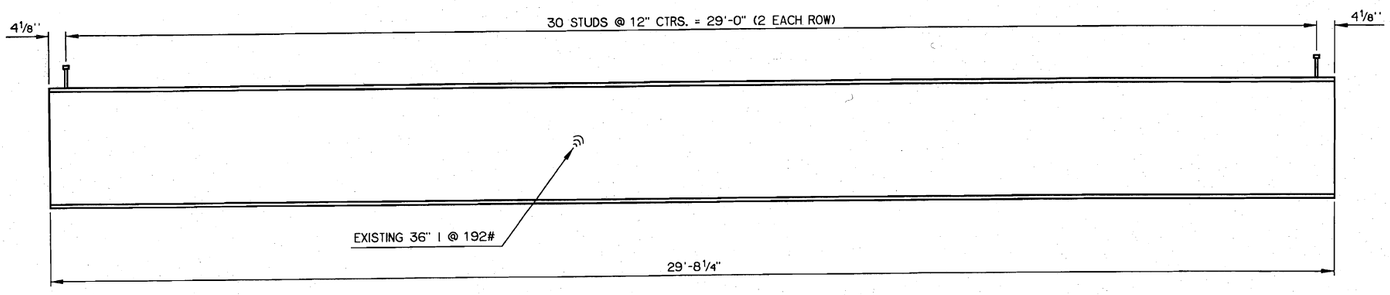
ELEVATION



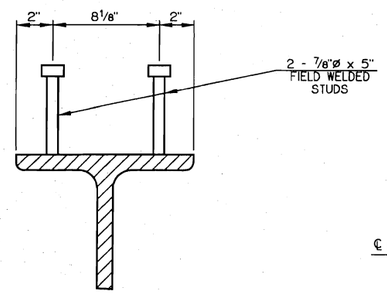
SHEAR CONNECTOR DETAIL
INTERIOR FLOOR BEAM



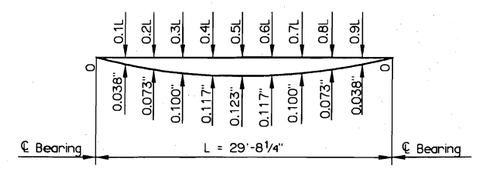
DEAD LOAD DEFLECTIONS
I-BEAMS



ELEVATION



SHEAR CONNECTOR DETAIL
END FLOOR BEAM



DEAD LOAD DEFLECTIONS
END FLOOR BEAM

NOTE: THE DEAD LOAD DEFLECTIONS SHOWN ABOVE AT THE TENTH POINTS ARE THE INITIAL DEFLECTIONS DUE TO DECK SLAB + HAUNCH + 5 P.S.F. SIP + CONCRETE PARAPET. IT DOES NOT INCLUDE THE BEAM WEIGHT OR FUTURE WEARING SURFACE.

SH-66B OVER CAPTAIN CREEK — LINCOLN COUNTY
BRIDGE "A"

DETAILS OF STRUCTURAL STEEL (SPANS NO. 1 & 3)

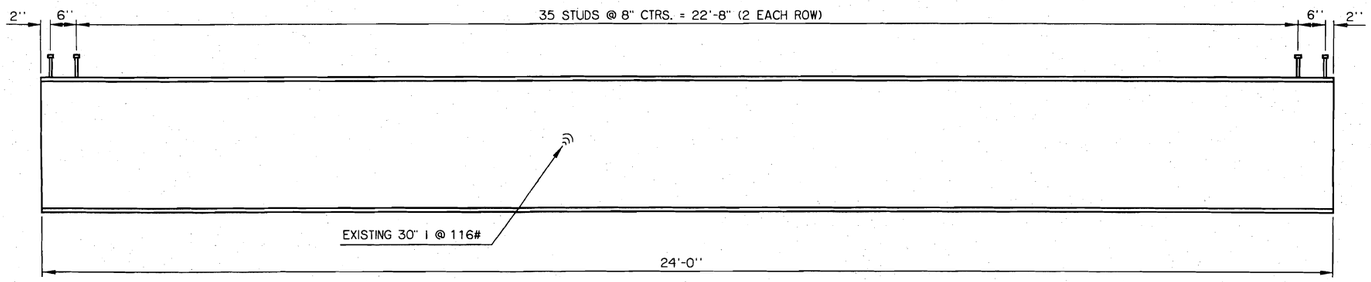
Design	RN	05/06
Detail	ERL	06/06
Check	RAS	07/06
Squad : MAYFIELD		
Engr. LOMBARDO		

STATE OF OKLAHOMA — DEPARTMENT OF TRANSPORTATION
STATE JOB NO. 23208(04) — SHEET NO. 12

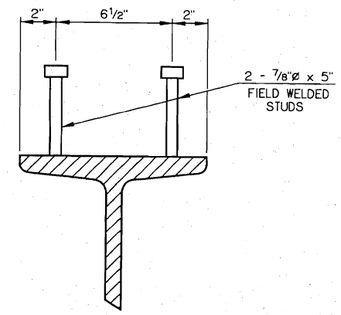
BRCADD - BDS4L7

REV. NO.	DESCRIPTION	DATE

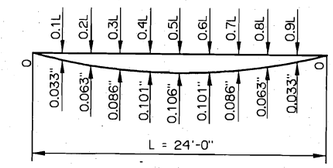
REVISIONS



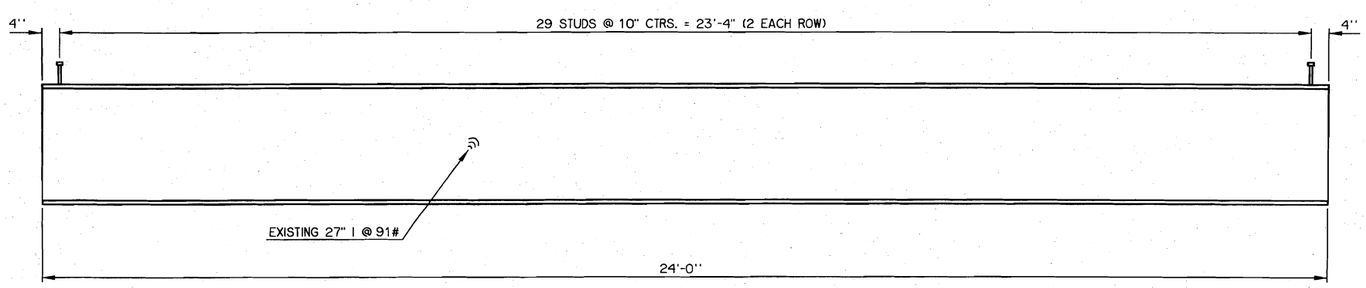
ELEVATION
INTERIOR FLOOR BEAM



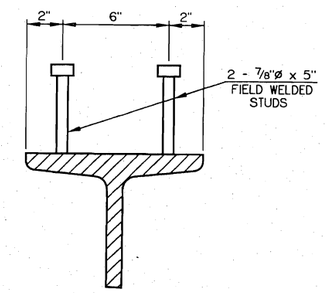
SHEAR CONNECTOR DETAIL
INTERIOR FLOOR BEAM



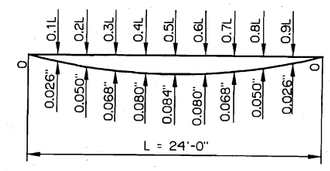
DEAD LOAD DEFLECTIONS
INTERIOR FLOOR BEAM



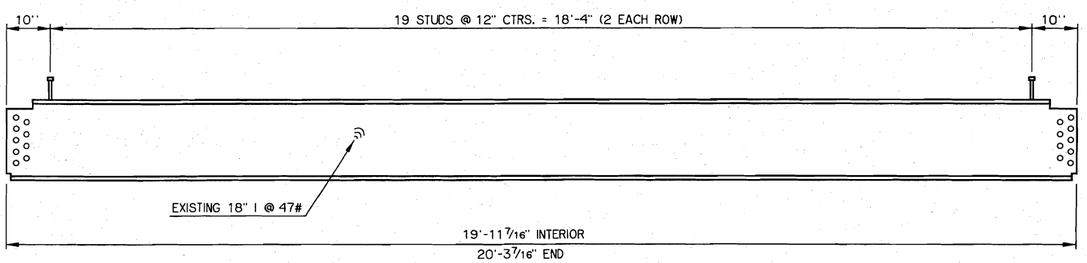
ELEVATION
END FLOOR BEAM



SHEAR CONNECTOR DETAIL
END FLOOR BEAM

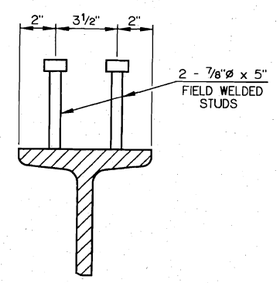


DEAD LOAD DEFLECTIONS
END FLOOR BEAM

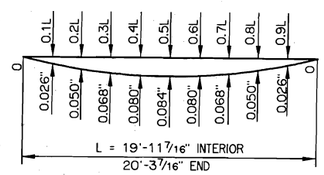


ELEVATION
STRINGER BEAM

NOTE: FOR VARIABLE LENGTH STRINGER BEAMS, STUD ROWS SHALL BE SPACED AT 12" CENTERS.



SHEAR CONNECTOR DETAIL
STRINGER BEAM



DEAD LOAD DEFLECTIONS
STRINGER BEAM

NOTE: THE DEAD LOAD DEFLECTIONS SHOWN ABOVE AT THE TENTH POINTS ARE THE INITIAL DEFLECTIONS DUE TO DECK SLAB + HAUNCH + 5 p.s.f. SIP + CONCRETE CURB. IT DOES NOT INCLUDE THE BEAM WEIGHT OR FUTURE WEARING SURFACE.

SH-66B OVER CAPTAIN CREEK LINCOLN COUNTY
BRIDGE "A"

DETAILS OF STRUCTURAL STEEL
(SPAN NO. 2)

Design	RN	05/06
Detail	KWP	06/06
Check	RAS	07/06

Squad : MAYFIELD
Engr. LOMBARDO

STATE OF OKLAHOMA DEPARTMENT OF TRANSPORTATION
STATE JOB NO. 23208(04)
SHEET NO. 13

BRCADD - B394L7