ADDENDUM #2

Skagit County Parks and Recreation

February 1, 2021

Pressentin Park Side Channel Restoration and Recreational Improvements Project #RCO 16-1730

NOTICE TO PROSPECTIVE BIDDERS

NOTICE IS HEREBY GIVEN BY SKAGIT COUNTY that the Contract Provisions and Plans are modified and supplemented as follows:

The plans are revised as follows:

- **Drawing L-3.1 Trail and Access Road Details 2** is replaced with the attached updated drawing, revised as noted.
- **Drawing L-3.5 Site Details 4** is replaced with the attached updated drawing, revised as noted.

The Special Provisions and Appendices are revised as follows:

- **Appendix E Permits** is supplemented to include the Skagit County Flood Area Development Permit FP19-0002, the Skagit County Building Permit # BP19-0960, the Washington State Department of Ecology Letter of Coverage under the Construction Stormwater General Permit (Permit number WAR309726), and the Washington State Department of Ecology Transfer of Coverage Form under the Construction Stormwater General Permit.
- **Appendix J Prefabricated Bridge Plans** is supplemented to include the Big R Bridge Pedestrian Bridge Installation Guide and the Big R Bridge Design calculations for Bridges 1, 2, and 3.
- **Special Provisions pg. 22, Section 1-02.14 Disqualification of Bidders, Lines 38 and 39 are revised to read:** "The same projects may be used to meet Criteria 8 and 9 if the project had both channel construction and park construction of similar size and scope."
- **Special Provision pg. 63, Section 2-03.2 Materials, the following is added after line 13:** "5. Gravel Borrow/ Common Borrow".
- **Special Provision pg. 63, Section 2-03.2 Materials, the following is added at the end of this section:** "Gravel Borrow for use in areas calling for Gravel Borrow as described herein or shown on the Contract Plans shall meet the requirements of Section 9-03.14(1) Gravel Borrow or as approved by the Engineer. Common Borrow for use in areas calling for Common Borrow as described herein or shown on the Contract Plans shall meet the requirements of Section 9-03.14(3) Common Borrow or as approved by the Engineer."
- **Special Provisions pg. 69, Section 4-04.4 Measurement, Line 18 is revised to read:** "Crushed Surfacing Top Course: 3/8" – 0" shall be measured by the ton."
- **Special Provisions pg. 69, Section 4-04.5 Payment, Line 24 is revised to read:** "Crushed Surfacing Top Course: 3/8" – 0" per ton."
- **Special Provisions pg. 85, Section 8-01.4 Measurement, Line 18,** ""Hydroseeding", per acre", **is removed.**

- **Special Provisions pg. 85, Section 8-01.5 Payment, Lines 29 through 31,** "The unit cost per cubic yard for "Hydroseeding", shall be full compensation for furnishing all labor, materials, tools, equipment, and incidentals, and for completing all work involved in delivering and placing hydroseeding and hydromulch as shown in the Contract Plans."**, are removed.**
- **Special Provisions pg. 85 and 86, Section 8-02.3(2)B Weed and Pest Control Plan, is revised to read:**

8-02.3(2)B Weed and Pest Control Plan

Replace this section with the following:

(******)
All work to implement the Weed and Pest Control Plan shall be incidental to and included in the other bid items of work. Prior to drafting the Weed and Pest Control Plan, the Contractor shall meet on site with the Engineer to discuss target weeds and unwanted vegetation on site and the methods for controlling the species. Target weeds may include County-listed noxious weeds or naturalized non-native plants. Methods for controlling each unwanted species shall be proposed in the Weed and Pest Control Plan. The Weed and Pest Control Plan shall include a narrative describing methods and timing of control efforts. Additionally, a hand-marked plan sheet shall be included to show locations of described methods and corresponding schedule for each location. Work shall not commence until the Weed and Pest Control Plan has been approved in writing by the Engineer.

The **Weed and Pest Control Plan** shall identify how the Contractor will address the following requirements:

1. The Weed and Pest Control submittal shall be submitted within 30 days of contract start date.
2. The Contractor shall visually inspect all areas disturbed by construction activity monthly, or as determined by the Engineer to identify potential pest problems. Pest problems include insect, disease, and weed infestations. The presence of a pest does not necessarily mean there is a problem. The Contractor shall keep written records of pests identified and zones where problems may be developing and submit these records to the Engineer. The Contractor shall identify strategies for non-chemical integrated pest management control methods as part of soil management, earthwork, stockpile monitoring, equipment cleaning and maintenance, encroachment of invasive vegetation from neighboring adjacent areas, and clearing activities.
3. Means and methods of mechanical weed control.
4. Schedule for weed control.
5. All weed populations outside of construction activity that threaten to impact construction activity and project performance shall be documented within monthly inspection records and notification shall be provided to the Engineer. Skagit County shall be responsible for weed management outside of areas disturbed by construction activities.

- **Special Provisions pg. 86 and 87, Section 8-02.3(3)C Project Area Weed and Pest Control, is revised to read:**

8-02.3(3)C Project Area Weed and Pest Control

This section is replaced with the following:

(******)
All plant species listed as noxious weeds in Skagit County will be controlled within areas disturbed by construction activities.

Noxious weeds and pest vegetation on this project may include, but is not limited to, the following:

1. Himalayan blackberry (Rubus discolor, R. procerus or R. armeniacus),
2. Reed canarygrass (Phalaris arundinacea),
3. Tansy ragwort (Jacobaea vulgaris)

This list of pest vegetation is not a complete list of weeds to be controlled within the project limits. The site may also include other unwanted invasive or competitive vegetation, as determined by the Engineer, which shall be controlled as recommended by the Washington State Noxious Weed Program (http://www.nwcb.wa.gov/) or as ordered by the Engineer. The Contractor shall identify all target weeds, specific to the site, to be controlled in the Weed and Pest Control Plan in accordance with Section 8-02.3(2).

All weeds and invasive plants contained within the clearing limits as shown on the Contract Plans shall be removed per Section 2-01(Clearing, Grubbing, and Roadside Cleanup).

- **Special Provisions pg. 89, Section 8-02.5 Payment, Line 35 is revised to read:** ""Seeding, Fertilizing, and Mulching – Erosion Control Seeding" per acre."

- **Special Provisions pg. 89, Section 8-02.4 Measurement, the following is added to the end of this section:**

  "Topsoil Type B – Side Channel", per cubic yard.

  No specific unit of measurement will apply to the lump sum item for Weed and Pest Control Plan; however, measurement will be for the sum total of all costs to prepare, submit for review, and obtain approval for the Weed and Pest Control Plan consistent with the requirements in these Contract Specifications. All work to implement the approved Weed and Pest Control Plan shall be incidental to and included in the other bid items of work."

- **Special Provisions pg. 89, Section 8-02.5 Payment, the following is added to the end of this section:**

"The unit cost per cubic yard for "Topsoil Type B – Side Channel", shall be full compensation for furnishing all labor, materials, tools, equipment, and incidentals, and for completing all work involved in placing, staking, and compacting Topsoil Type B under the side channel banks as shown in the Contract Plans.

Weed and Pest Control Plan", lump sum."

- **Special Provisions pg. 96, Section 8-19.2(A) Rock Scramble Boulders, the following is added to the end of this section:**
  "G. Epoxy that is able to withstand local weather conditions shall be used to form a seal between boulders where shown in the Contract Plans to prevent entrapment between boulders."

The Bid Proposal is revised as follows:

- **Delete Schedule "H" and Schedule "R" (pages 3-6)** and replace with Revised Schedule "H" and Schedule "R", included herein.
- **Delete Bidder's Qualification Certificate (pages 14-17)** and replace with Revised Bidder's Qualification Certificate, included herein.

PRE-BID QUESTIONS and REQUEST FOR CLARIFICATION

Answers are informational only. Written questions submitted by Friday, January 29, 2021, at 4:30 p.m. were considered; any questions submitted after the deadline were not considered.

Informal Questions:

A. Notes from pre-bid meeting:

1. See Addendum #1, including the pre-bid meeting agenda, a list of contractors in attendance at the pre-bid meeting, posted to the project website on Thursday January 21, 2021.

2. "Excess Trees" removed during clearing activities but not salvaged for use in the project as described in the contract documents are to remain on-site to be chipped by the County in the future. See Section 8-05.2 of the Contract Specifications.

3. There are several existing structures on site within the future Day Use Area that are scheduled for removal prior to construction, as noted on Drawing C-1.1. The County will demo these structures in February.

4. The County's surveyor finished staking the clearing limits last Monday January 25th, 2021.

B. Responses to questions from bidders received by 4:30 p.m. on Friday January 29, 2021:

1. Q: I was wondering if Big R Bridge had any specific handling instructions for transporting and hoisting the 3 bridges. Are there specific nodes/points on the trusses to support during transport and specific nodes/points to hoist them? Q: Are there any lifting diagrams for the pre-fabricated bridges? – A: Big R has provided their installation guide that includes unloading notes, lifting instructions, splicing notes, bearing preparation, and setting instructions. This information will be added to "Appendix J Prefabricated Bridge Plans" of the Contract Provisions and Plans via an **addendum**.

2. Q: Will installation of already procured owner-supplied artisan boulders be included in this construction contract? A: No, work to transport and place previously procured artisan boulders is not currently included in this construction contract. There is no bid item for that work. At this time, that work is anticipated to be completed by the County outside of this construction contract. This construction contract does include work to place rock scramble boulders and trail and campground edge rocks (see Bid items R-027, R-028, R-029) as described in the Contract Plans and Specifications.

3. Q: What work is required for the Weed and Pest Control Plan and how is it quantified? A: The Work to prepare, submit, and obtain approval from the Engineer on the Weed and Pest Control Plan is covered by Bid Item R-021 Weed and Pest Control Plan, LS. The work to implement the Weed and Pest Control Plan as described in Section 8-02.3(2)B Weed and Pest Control Plan shall be incidental to and included in the other bid items of work. For example, the grading plans contained on Contract Drawings C-5.0 through C-5.5 indicate areas within the grading limits where there is potential for weed prone Topsoil Type B to be encountered; these drawings also include sections and details for placing and burying weed prone topsoil in fill placement areas. Please note that Pressentin Park is a pesticide free management area and work to be performed under this contract does *not* include the application of pesticides or herbicides, but rather the Contractor's familiarity with noxious weeds and pest vegetation and the incorporation of best management practices to manage potential noxious weeds and pest vegetation that could be encountered during construction activities. Clarification of the Measurement and Payment will be included in an **Addendum**.

   Also note that the Skagit Fisheries Enhancement Group has already provided some pre-project weed control and will be onsite to conduct one more round of weed control prior to project construction.

4. Q: Who is responsible to provide de-fishing for the channel tie-ins during the fish window? A: Section 8-01.3(1)F Work Area Isolation, Dewatering, and Fish Handling currently states that "The Contractor shall be responsible for all labor, materials, equipment, and maintenance for the work area isolation, construction of temporary push up dams, temporary flow by-pass channels, and fish exclusion and fish handling." However, aside from during flood events, the area where the future side channel will be constructed does not currently have a surface hydrologic connection to the Skagit River and thus there are currently no fish to be removed from this area. The contractor's sequence will need to consider when to make the connections to the Skagit River to optimize level of effort and still meet permit requirements and fish windows.

5. Q: Can Contractors obtain the CAD drawings for bidding? A: No. The CAD drawings will be provided to the Contractor after contract award.

6. Q: Is there epoxy required between the rocks somewhere? A: Yes, there is a note about epoxy being required for the Rock Scramble related to Section 2 on Dwg L-3.5. As a safety measure, epoxy that is able to withstand local weather conditions shall be used to form a seal between boulders where shown in the Contract Plans to prevent entrapment between boulders. This will be clarified in Section 8-19.2(A) of the Special Provisions with an **addendum**.

7. Q: How is the wood material acquired? A: See the specific sections of the Contract Specification (e.g., Sections 2-01.3(1), 8-05.2) for log salvage from clearing activities as well as Section 9-38 Wood Material for Engineered Log Structures that outlines the specific material requirements for that wood material. Additional material necessary to meet the project needs specified in the Contract Plans and Specifications but not available from clearing will be procured separately by others and delivered to the site in coordination with the Contractor, per the Contract Specifications. The Contractor shall not waste suitable material.

8. Q: How much cultural monitoring will be involved during excavation activities? A: Please see the Cultural Resources Monitoring Plan in Appendix G for specific details related to the cultural monitoring protocols. This plan outlines that the archaeologist will provide a required training, including an Unanticipated Discoveries Protocol training to all workers associated with the project prior to construction. This monitoring plan and Section 2-01 of the Contract Specifications describes a protocol for coordination with the Engineer and Tribes prior to Tree removal. Please also see the approximated limits of the "Terrace Sensitive Area" as shown on the Contract Plans. Page 8 of the Cultural Resources Monitoring Plan states that "The archaeological monitor will be onsite during all activities on the terrace or within 50 feet of the toe of the terrace." There is to be no ground-disturbing activity within the "Terrace Sensitive Area", and it is likely that the cultural monitor will be onsite to observe the installation of the water line near the transition between the "Terrace Sensitive Area" and the floodplain. Regarding earthwork in the floodplain, the monitor is likely to be present during other key milestones and at transitions to earthwork in new areas; however, the Cultural Resources Monitoring Plan in Appendix G outlines the potential role of the archaeological monitor to observe excavation activities and potentially examine excavated soils and areas.

9. Q: Who is installing the interpretive signage and when? A: Currently that work is not included in this construction contract and will be contracted separately.

10. Q: There are additional furnishings shown in the plans but listed as "not in contract". Will that work be contracted and constructed separately? A: Yes.

11. Q: Will the Owner adhere to the Bidder's Prior Work Experience requirements listed in 1-02.14 Sections 8 and 9 and only award the project to a qualified bidder who meets the minimum

qualifications on both the stream, river or floodplain and park project elements? A: Yes, the Bidder will be deemed not responsible if the Bidder does not meet the mandatory bidder responsibility criteria, including Supplemental Criteria 1-9 in Section 1-02.14 of the Contract Specifications. This will be clarified in an **addendum**.

12. Q: The proposal package seems to include space for the contractor to list up to five (5) projects to meet the documentation requirement of 1-02.14 Section 8 for stream, river or floodplain projects. A: The documentation requirements for items 8 and 9 under Section 1-02.14, specify listing at least 3 channel construction projects and at least 3 parks construction projects; this section also states that "the same projects may be used to meet Criteria 8 and 9 if the project had both channel construction and park construction of similar size and scope." The Bidder's Qualification Certificate included in the Bid Proposal package will be updated in an **addendum** to provide additional space for listing additional experience requirements for both stream, river, or floodplain projects as well as park projects.

13. Q: The proposal package does not include fields for the contractor to list projects to meet the documentation requirements listed in 1-02.14 Section 9 for the park projects. Presumably another five (5) spaces should be added which are tailored to the experience requirements identified for park projects in which the contractor could provide the requested information. Please advise A: The documentation requirements for items 8 and 9 under Section 1-02.14, specify listing at least 3 channel construction projects and at least 3 parks construction projects; this section also states that "the same projects may be used to meet Criteria 8 and 9 if the project had both channel construction and park construction of similar size and scope." The Bidder's Qualification Certificate included in the Bid Proposal package will be updated in an **addendum** to provide additional space for listing additional experience requirements for both stream, river, or floodplain projects as well as park projects.

14. Q: The specifications indicate that the contractor's design of the bridge foundations (to be engineered by a Professional Engineer) must meet all local, state and federal codes, laws including ADA requirements. Will it be sufficient to have these foundations designed to meet IBC and ACI 318 code? A: Per Section 6-20.1 of the Contract Specifications, "This work will include but is not limited to design by licensed professional engineers to meet all local, state and federal codes, laws and requirements (including ADA), and submittals supporting permitting for construction." Also Section 6-21.1 of the Contract Specifications states, "The Contractor is responsible to design and build the reinforced concrete bridge foundations to bear on the prepared GRS abutment surface. The Contractor is also responsible to furnish and install any additional block fascia and approach fill to backfill the bridge foundations and complete the trail approaches to suit final grades."

    The reinforced concrete bridge footings are to be designed by the contractor, meeting applicable IBC and ACI codes, given the recommendations in Sections 6-20 and 6-21 of the Special Provisions, the Building Permit requirements to be included in Appendix E of the Contract Provisions via **addendum**, the Geotechnical Report included in Appendix H of the Contract Provisions, the bearing and anchoring requirements outlined by the prefabricated bridge drawings included in Appendix J of the Contract Provisions, as well as any inspection requirements outlined in the County inspection form included in Appendix I of the Contract Provisions.

15. Q: We have an engineering company looking at designing and permitting the bridges. Please find their questions below: A. Please note that the prefabricated bridges themselves have already been designed and procured by the Contracting Agency. They are stockpiled in the locations shown on the Contract Drawings. Big R Bridge was the bridge designer for these prefabricated bridges. The Big R Bridge calculations for these bridges as well as the Big R Bridge Pedestrian Bridge Installation Guide will be inserted in to Appendix J in an **addendum**. If there are particular questions about the bridge design that are necessary to inform the winning Contractor's efforts to design and build the reinforced concrete bridge foundations to bear on the prepared GRS abutment surface as described in the Contract Documents, further follow-up and coordination between the winning Contractor and Big R Bridge can be pursued at that time.
    a. Q: Are the bridge reactions shown on Sheet 3 for each bridge in Appendix J Allowable (ASD) or Load and Resistance Factor Design (LRFD) loads? A: All bridges constructed for this project were designed according to LRFD Guide Specifications for Design of Pedestrian Bridges by AASHTO, December 2009 (AGS).
    b. Q: Please clarify the bridge reactions at each baseplate. The "P" reactions are noted as (4) per bridge so we're assuming the dead load at each base plate for Bridge #1 would be of 10,900lb/4 = 2725 lb/baseplate, please confirm. A: Yes, sheet 3 for each bridge in Appendix J outlines the bridge reactions, and yes, there are four "P" reactions for the dead load for each bridge. Please see the calculations to be included in an **addendum** to Appendix J.
    c. Q: The "H" reactions are noted as (2) per bridge but it appears that all (4) baseplates would be effective at resisting loads in this direction. For example H,seismic for Bridge #1 would be 20,500lb/4 = 5125 lb/baseplate, please confirm. A: Sheet 3 for each bridge in Appendix J outlines the bridge reactions. Each abutment includes one fixed bearing and one expansion bearing, thus according to Big R's drawings and specs there are only two "H" reactions per bridge and one per abutment. Please see the calculations to be included in an **addendum** to Appendix J.
    d. Q: The "L" reactions are noted as (4) per bridge but all (4) bridge bearing plates have slotted holes in the longitudinal direction. How are the bridge seismic forces imposed on the baseplates and foundations in this direction? A: Seismic loading designed to ABDS 3.10 per Big R's calculations. Please see the calculations to be included in an **addendum** to Appendix J.
    e. Q: What are the geotechnical values for soil coefficient of friction and/or passive pressure for resisting lateral forces on the footings? A: Geotechnical values can be found within the Geotechnical Report included in Appendix H.
    f. Q: Please confirm the GRS walls have been engineered to support vertical reactions from the bridge foundation. Please confirm the GRS walls have designed to also support lateral reactions (transverse and longitudinal) to the bridge. A: Yes, the GRS abutment walls have been engineered to support the vertical reactions from the reinforced concrete bridge footings/foundations and can support an allowable bearing capacity of 3,000 pounds per square foot for each bridge as noted in Section 6-21 of the Special Provisions. Lateral design considerations and limitations are discussed in the Geotechnical Report included in Appendix H.

g. Q: Is the dead load camber shown on Sheet 4 based on the truss weight only or does this include the weight of the concrete deck? If it's the truss only, what is the deflection under the concrete deck weight? A: The deck was included in the dead load calculations in Big R's design. Maximum calculated and allowable deflections are included in Big R's Calculations for each bridge. Please see the calculations to be included in an **addendum** to Appendix J.

h. Q: How will the slotted holes in the baseplates accommodate the camber deflection upon the placement of the concrete deck, live load, etc. as well as thermal expansion/contraction? In other words, are the baseplate slots long enough to prevent engaging the anchor bolts? Are there any requirements for the location of the anchor bolts in the slotted holes? A: Sheets 6 and 7 for each Bridge Design set include the anchoring, bearing plate, details for each bridge. The Big R Pedestrian Bridge Installation Guide, to be included in an **addendum** to the Contract Specifications, provides other general bearing preparation and setting instructions. Please see the calculations to be included in an **addendum** to Appendix J.

16. Q: Pg 31 line 38 & 39 discuss culvert removal and sheet pile work. I think that may be in the specs in error. Please advise. A: You are correct. These lines are revised per **Addendum** 2 to instead read "The same projects may be used to meet Criteria 8 and 9 if the project had both channel construction and park construction of similar size and scope."

17. Q: Division 4 of the specs states that "bases" will be paid by the CY however the bid form states that they'll be paid by the ton. Please advise. A: Per **Addendum** 2, the special provisions Sections 4-04.4 and 4-04.5 are revised to clarify that "Crushed Surfacing Top Course: 3/8" – 0" shall be measured by the ton.

18. Q: Detail 1/C-5.2,C-5.2 "typical side channel" shows 12 in. of topsoil b on the slopes and 12 in. of streambed sediment at the bottom of the channel. How do we get paid to place those materials? A: Detail 1/C-5.5 depicts the typical side channel detail. Section 2-03 Roadway Excavation and Embankment as amended in the Contract Provisions describe the construction requirements, and the measurement and payment are consistent with the Standard Specifications. As the test pits depicted on Drawing C-5.5 illustrate, native alluvium is anticipated to be present at the finished grade of the side channel. Adequate Topsoil Type B is also anticipated during excavation activities. Section 2-03.2 Materials of the Special Provisions discusses materials for salvage. Sections 2-03.4 and 2-03.5 of the Standard Specifications describe the Measurement and Payment, respectively, for Channel Excavation and Channel Excavation Incl. Haul. A new bid item for "Topsoil Type B – Side Channel" is added in Addendum 2 to provide a clear mechanism for payment for salvage and placement of Topsoil Type B in the banks as shown in Detail 1/C-5.5 if needed.

19. Q: What happens if the contractor ends up short on streambed sediment or topsoil type b, at no fault of their own. Will the contracting agency pay to import these materials? A: At this point, as the contract includes Bid Item H-011 Channel Excavation Incl. Haul for an approximated quantity of 12,100 CY, and because the contract includes salvage of several types of materials as

described in Section 2-03.2 Materials of the Special Provisions, a shortage of topsoil and native alluvium is not anticipated unless the contractor has wasted or otherwise disposed of salvageable material.

20. Q: Proposal forms for Schedule H and Schedule R instruct the Contractor to include tax in the various bid items per 1-07.2(1). The summary sheet which summarizes both bid schedules and lists the alternates includes Sales Tax at 8.5% on the project subtotals. Please clarify if the Contractor is to include use tax within the various bid items, or is the Owner going to pay Sales Tax on the project total. A: **Addendum** 2 includes corrected bid forms that remove the statement "THE CONTRACTOR SHALL INCLUDE FOR COMPENSATION THE AMOUNT OF ANY TAXES PAID IN THE VARIOUS UNIT BID PRICES IN ACCORDANCE WITH SECTION 1-07.2(1)". Tax is to be applied to the project subtotals.

21. Q: Is there supposed to be a Schedule R Alternate A1 and A2 bid schedule or do we just put the price on the cost element page of the proposal? A: Yes, **Addendum** 2 includes corrected bid forms that include the Schedule R additive alternate bid items, Alternate A1 Meadow Picnic Shelter, and Alternate A2 Orchard Picnic Shelter.

22. Q: Is there a Buy American clause for all the steel associated with this project, chain, cable, clamps, plates, etc.? A: No, there is no federal funding on this project and there is no Buy American clause for steel.

23. Q: Plan sheet 54 indicates gravel borrow backfill spec 9-03.14(1) for the vehicle access road, is this imported gravel? and how is this paid? A: The gravel borrow referenced in Section 6/L-3.1 is to be salvaged from onsite Channel Excavation work. See an update to this note via Addendum 2. The work to construct the gravel borrow as shown in Section 6/L-3.1 is paid for by bid item R-008 Embankment Compaction – Vehicle Access Road and Trails.

24. Q: Can you clarify what permits are the Contractors responsibility for the bridges? A: Although the building permit covering the bridges has already been acquired by the County and will be included in Appendix E via **Addendum** #2, it is the Contractor's responsibility to comply with the conditions of this permit, the conditions of all other permits included in Appendix E, the conditions of the Stormwater Permit, as well as any inspection requirements outlined in the County inspection form included in Appendix I of the Contract Provisions. Further, as described in the response to question #14, the reinforced concrete bridge footings are to be designed by the contractor, meeting applicable IBC and ACI codes, given the recommendations in Sections 6-20 and 6-21 of the Special Provisions, the Building Permit requirements to be included in Appendix E of the Contract Provisions via **addendum**, the Geotechnical Report included in Appendix H of the Contract Provisions, the bearing and anchoring requirements outlined by the prefabricated bridge drawings included in Appendix J of the Contract Provisions, as well as any inspection requirements outlined in the County inspection form included in Appendix I of the Contract Provisions.

25. Q: Is the intent of the contract for all woody debris including stumps to remain onsite? A: Yes, per Section 8-05.2 Materials, "Move onto the Temporary Construction Access Road for the Contracting Agency's future use all surplus key logs, racking logs or slash material left over after completing the Project." See Section 2-01.3(1)A for salvage of trees with rootwads attached for reuse in the project.

26. Q: What material will be placed on the high visibility fence in the Terrace Sensitive area? Appears to be import and how is it paid? A: See Dwgs C-5.0, C-5.3, C-5.4 for a grading plan and details for placing material salvaged from onsite excavation activities on the terrace cap near the day use area. The bid item H-012 Embankment Compaction – Terrace Cap Near Day Use Area covers this work as described by the associated measurement and payment sections of Section 2-03 of the Special Provisions. Also see the L sheets for details on the Day Use and Nature Play Area grading and surfacing. The bid item H-015 Embankment Compaction – Day Use Area covers the work to place material salvaged from onsite excavation activities on the day use area, as described by the associated measurement and payment sections of Section 2-03 of the Special Provisions.

27. Q: I had a question on the orchard picnic shelter. On page L3.10 section 18/S2 call for a furred out plinth dimension per arch. The elevation on this page calls for the stone plinth as not in contract, to be added at future time. Is it intended that we provide furring for stone veneer as part of this contract? If we are supposed to provide the furring as part of this contract, it's not clear if the plinth is going to be round or square and what the dimensions would be. A: On Drawing L-3.10, section 18/S2 calls for a 'furred out plinth dimension per arch...'. The furred out plinth is future work and not part of this contract.

28. Q: During the pre-bid meeting there were discussions of materials supplied by the owner. Please confirm owner supplied materials.
    a. Additional ELS Logs, Slash, and racking not salvaged from the site. A: See general answer below.
    b. Additional Boulders for rock scramble, trail and campground edge rocks not salvaged from the site. A. Boulders for the rock scramble and trail and campground edge rocks may be salvaged from suitable on site materials. However, given the uncertainty in the amount of material available on site for these items, the bid item quantities have not been adjusted to reflect any salvage.
    c. Ballast Rock for ELS Structures. A. Light Loose Riprap for the ELS structures and Scour Protection Rock for the bridges may be salvaged from suitable on site materials, including from the "Rock Pile" shown on the drawings and/or from onsite excavation activities. However, given the uncertainty in the amount of material available on site for these items, the bid item quantities have not been adjusted to reflect this potential salvage.

    A: Owner supplied materials include the 1) prefabricated bridges shown on Drawings 8-1.0 and 8-1.1, and described in Section 6-20 of the Special Provisions 2) the Wood Material for Engineered Log Structures required beyond that available from onsite material salvage to satisfy the requirements shown on the Contract Plans, described in Sections 8-05 and 9-38 of the Special Provisions.

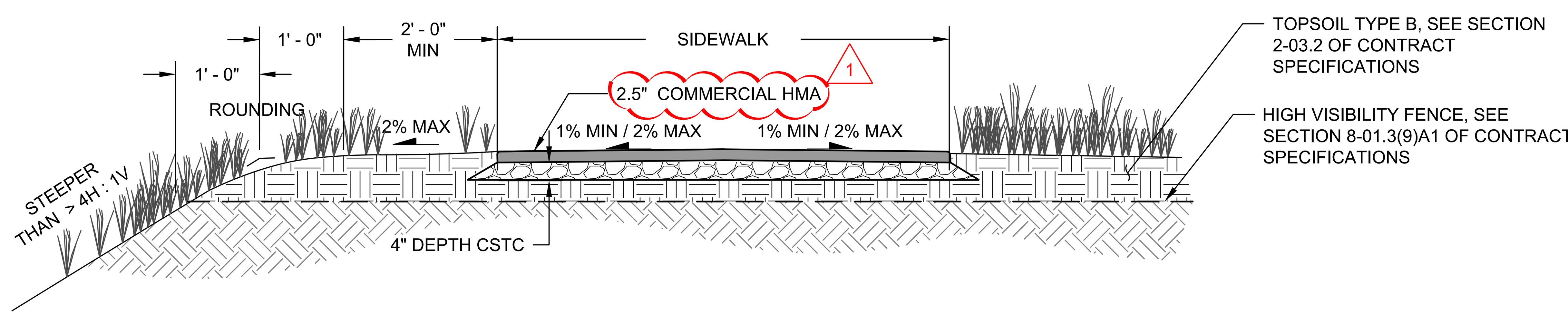
END OF ADDENDUM #2

NOTE: The bidder must provide acknowledgement of Addendum No. 2, on page 8 of the Bid Proposal.

DATE AND TIME OF BID OPENING: Monday, February 8, 2021, at the hour of 3:30 p.m.

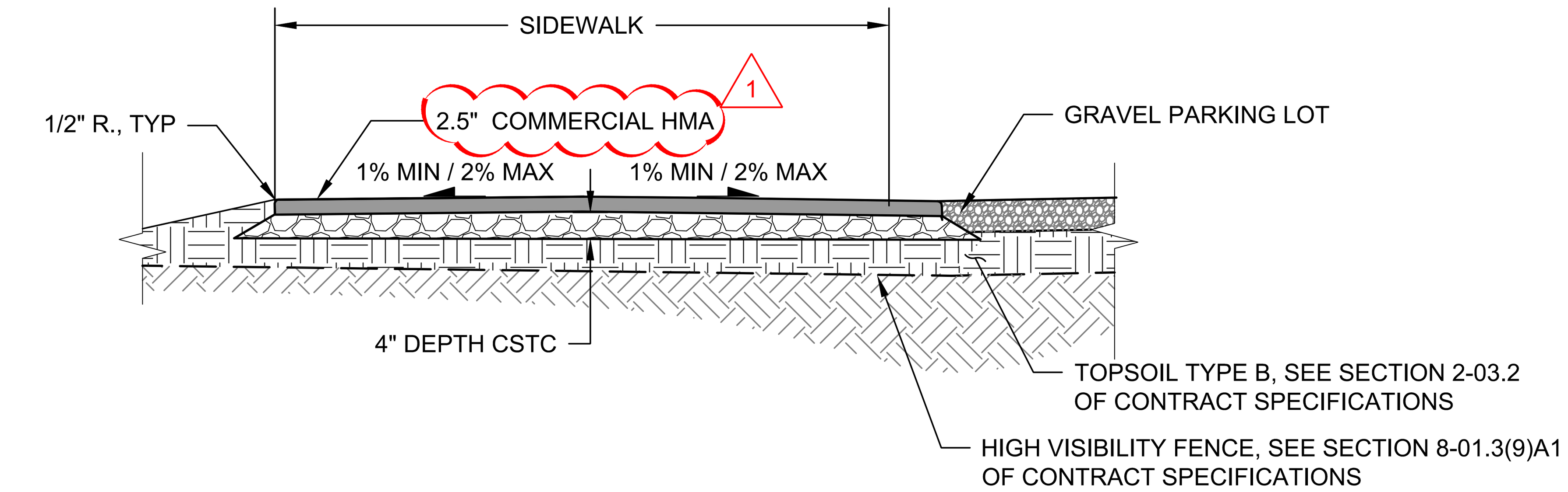
Brian Adams

Brian Adams, Director



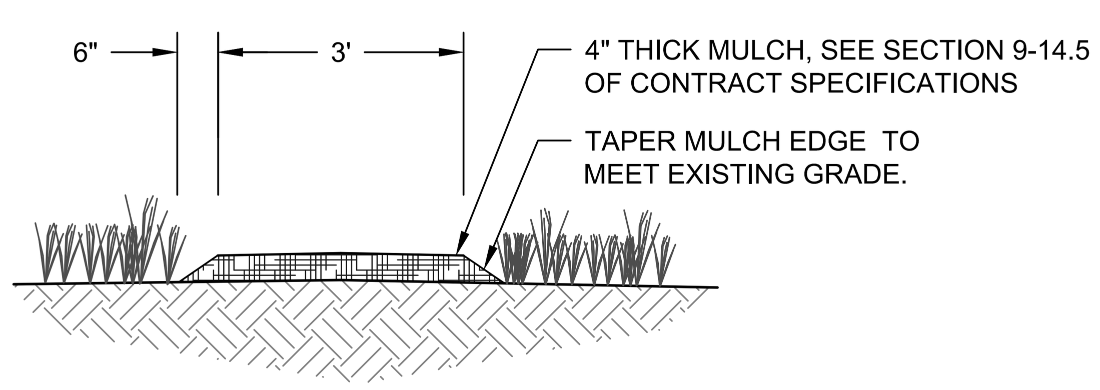
SECTION - DAY USE AREA TRAIL ADJACENT TO TERRACE SLOPE (1 / L-1.0)

SCALE: NTS



SECTION - DAY USE AREA TRAIL (2 / L-1.0)

SCALE: NTS

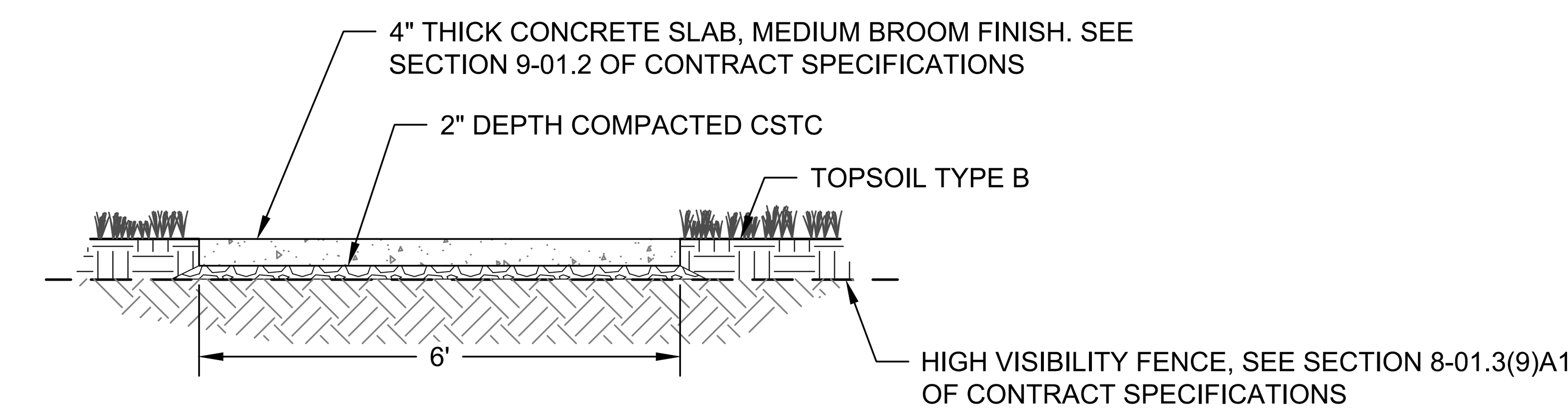


MULCH TRAIL NOTES:

1. MULCH TRAILS TO BE STAKED IN THE FIELD AND APPROVE.D BY PROJECT ENGINEER PRIOR TO BUILDING.
2. MULCH TO BE LAID DIRECTLY ON NATIVE SOIL WITHOUT PRIOR CLEARING AND GRUBBING.
3. FOR ADDITIONAL DETAIL ON PLACEMENT OF MULCH TRAILS, SEE SECTION 2-03.2 OF CONTRACT SPECIFICATIONS.

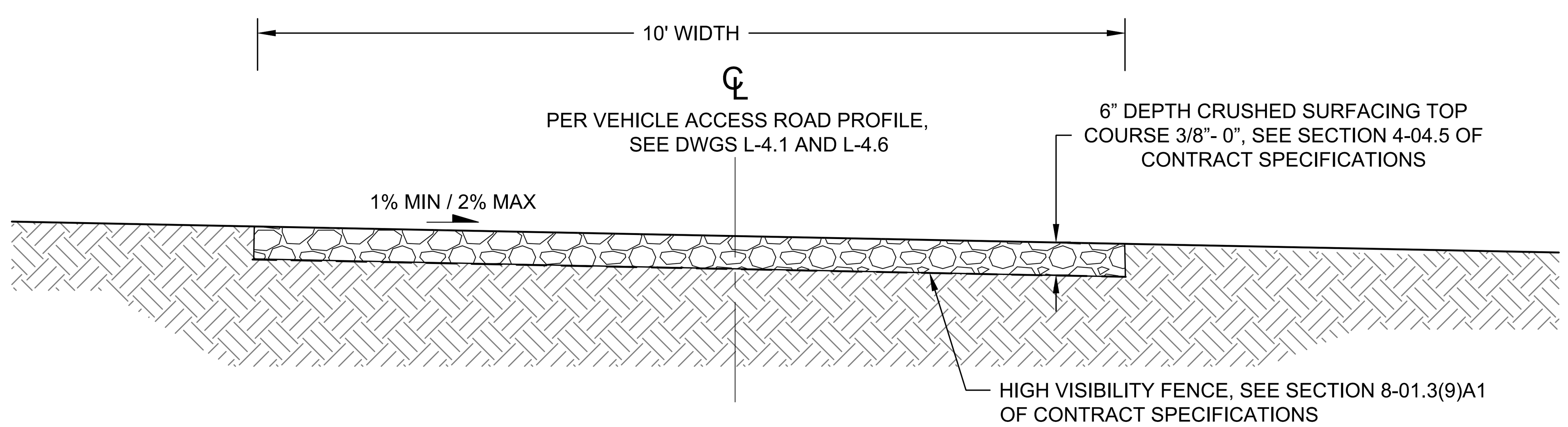
SECTION - MULCH TRAIL (3 / VAR)

SCALE: NTS



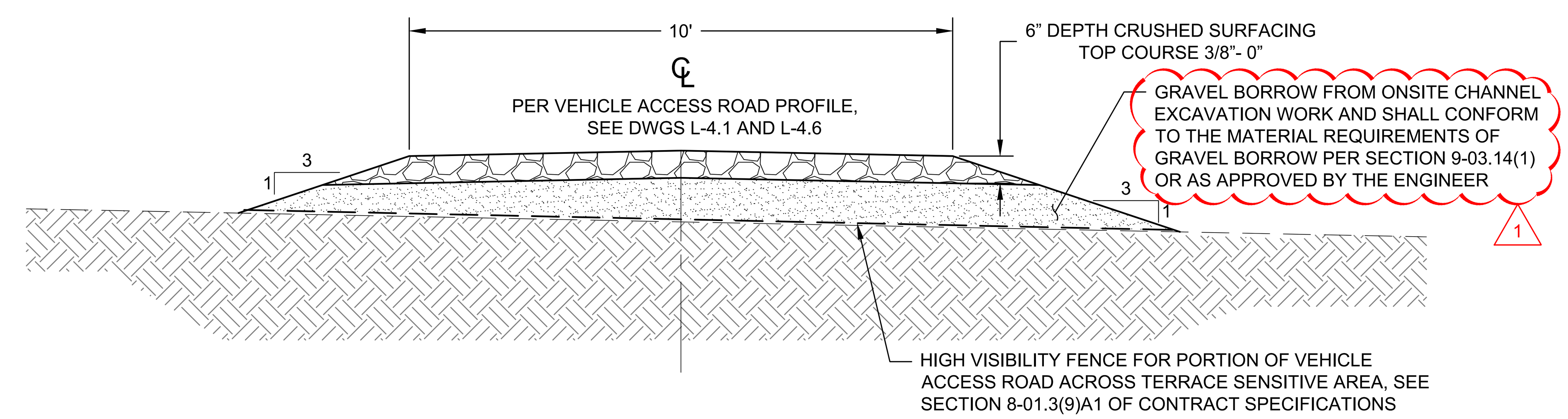
SECTION - KIOSK CONCRETE PAD (4 / L-1.0)

SCALE: NTS



SECTION - VEHICLE ACCESS ROAD - EXCAVATED CONDITIONS (5 / VAR)

SCALE: NTS



SECTION - VEHICLE ACCESS ROAD - FILL CONDITIONS (6 / VAR)

SCALE: NTS

NOTES:

1. SEE DRAWINGS L-4.2-L-4.5 AND L-4.7 FOR TRAIL LAYOUTS AND PROFILES.

100% DESIGN - BID SET

No.	REVISION	BY	APP'D	DATE
1	REVISION 1	EM	KF	2/1/21

ONE INCH AT FULL SIZE, IF NOT ONE INCH SCALE ACCORDINGLY

811 Know what's below. Call before you dig.

HERRERA

SKAGIT COUNTY Parks and Recreation

SKAGIT FISHERIES ENHANCEMENT GROUP

STATE OF WASHINGTON KATHRYN SUZANNE FORESTER REGISTERED LANDSCAPE ARCHITECT NO. 1448 EXP. 12/02/21

DESIGNED: K. FORESTER	DRAWN: E. MARSHALL
DESIGNED: S. VAYANOS	DRAWN: -
DESIGNED: -	CHECKED: C. AVOLIO
SCALE: AS NOTED	APPROVED: M. EWBANK

PRESSENTIN PARK

SIDE CHANNEL RESTORATION AND RECREATIONAL IMPROVEMENTS

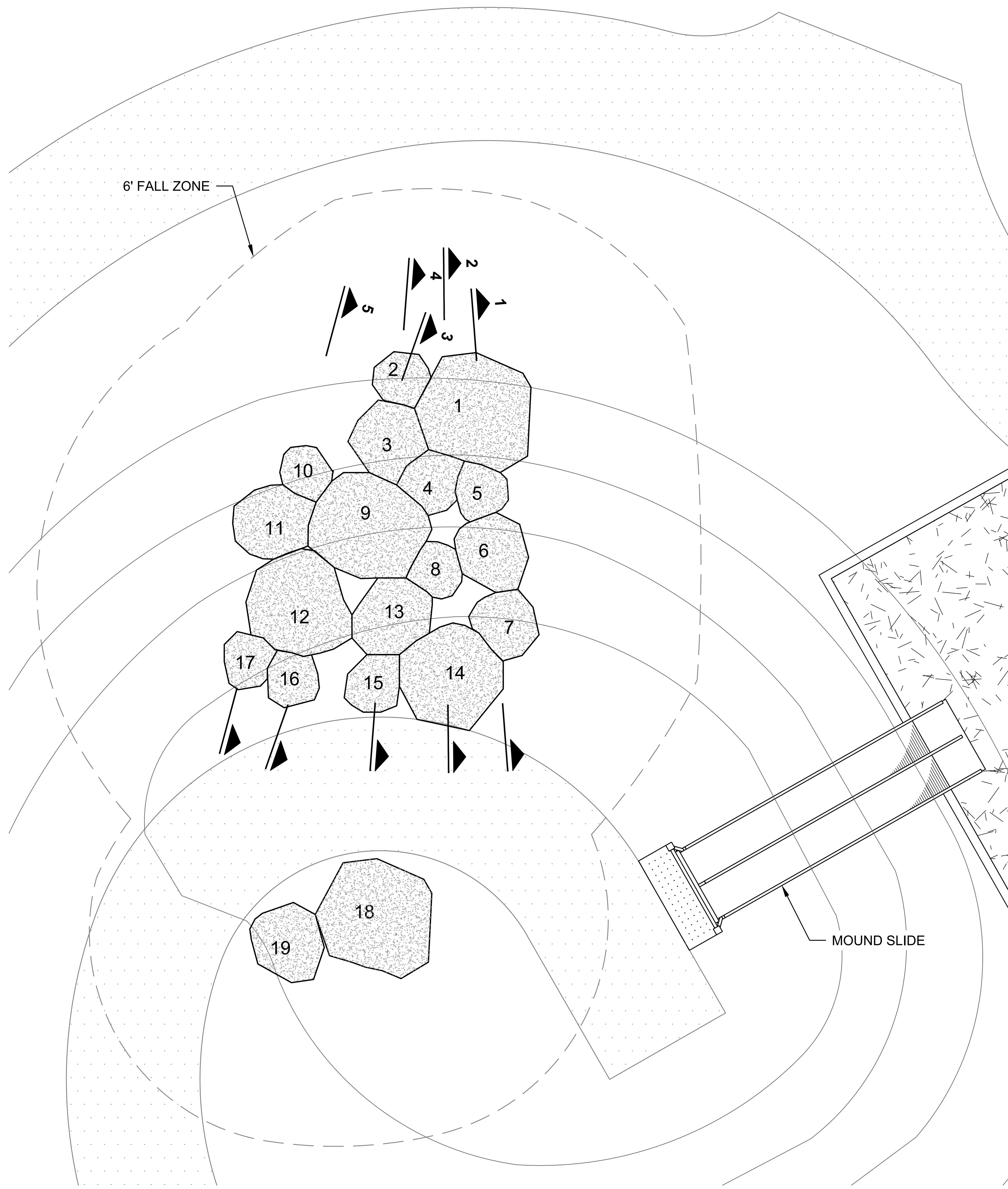
TRAIL AND ACCESS ROAD DETAILS 2

DATE: DECEMBER 2020

PROJECT NO: 18-06777-000

DRAWING NO: L-3.1

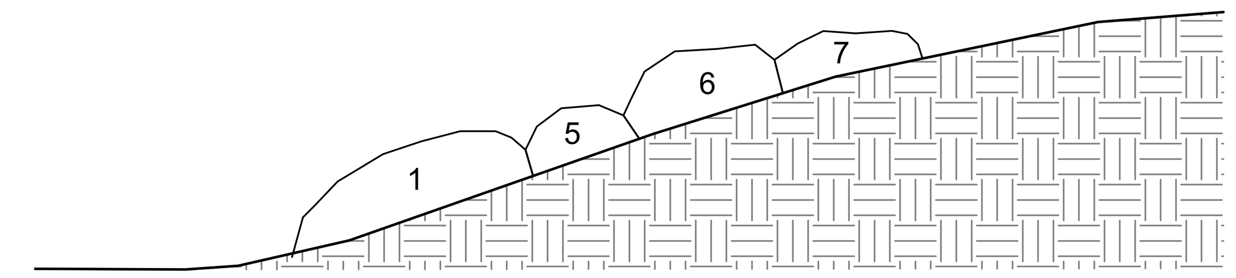
SHEET NO: 54 OF 71



DETAIL - ROCK SCRAMBLE

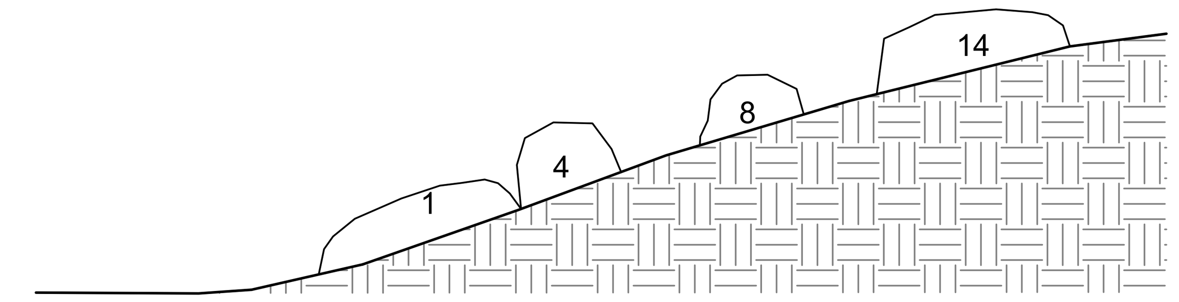
SCALE: NTS

1
L-1.0



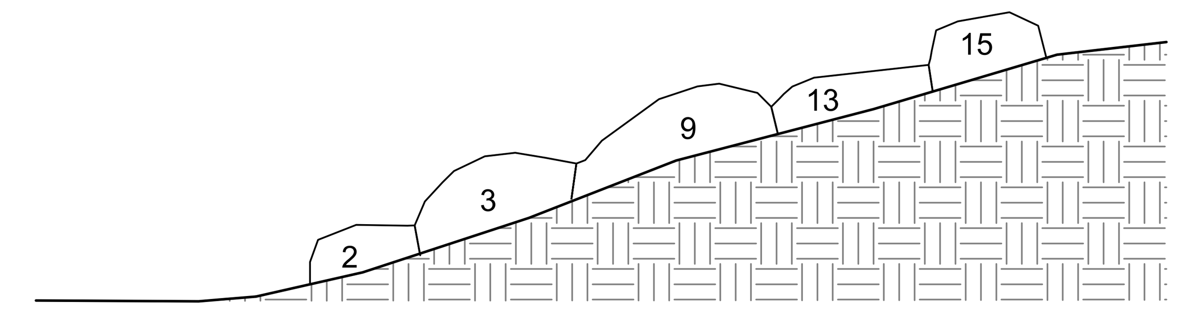
SECTION 1

SCALE: NTS



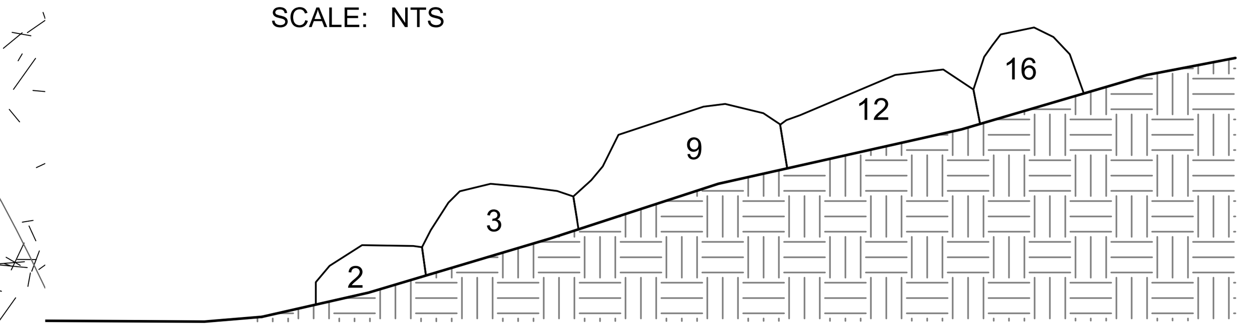
SECTION 2

SCALE: NTS



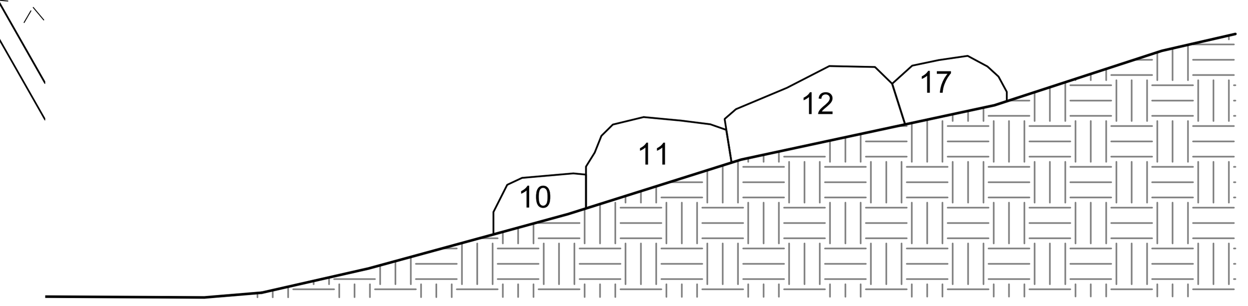
SECTION 3

SCALE: NTS



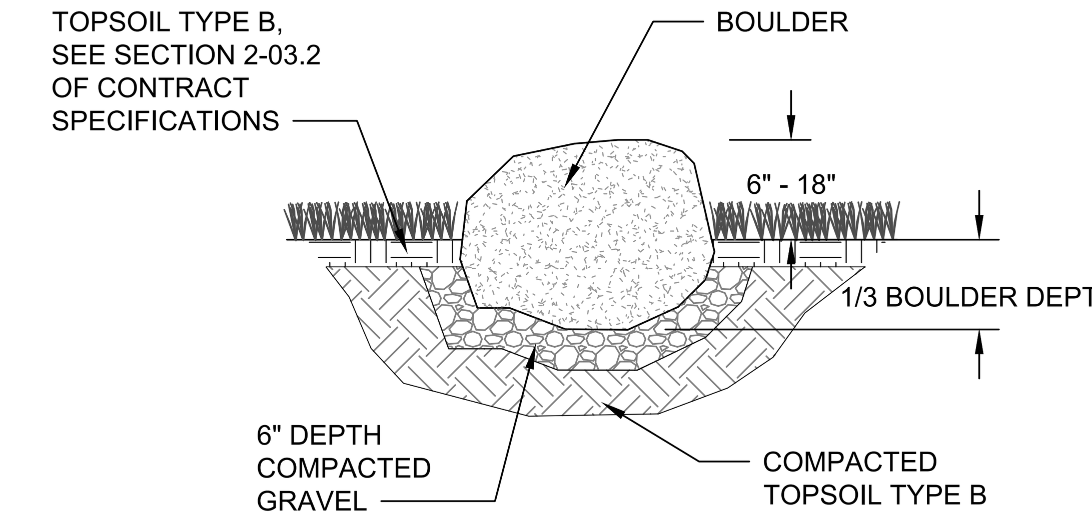
SECTION 4

SCALE: NTS



SECTION 5

SCALE: NTS



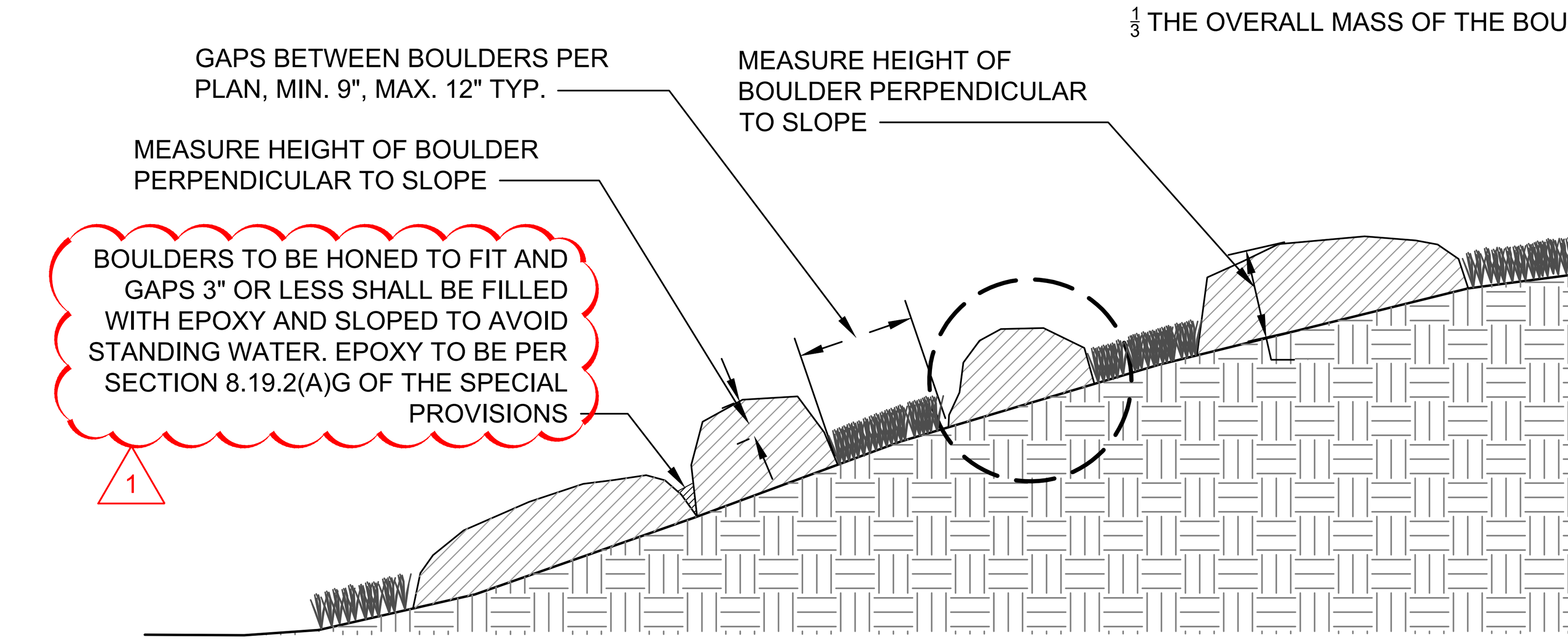
BOULDER SCRAMBLE DETAIL

SCALE: NTS

A
-

NOTES:

1. FINAL BOULDER SELECTIONS, LOCATIONS AND ORIENTATION TO BE APPROVED BY OWNERS REPRESENTATIVE PRIOR TO SEEDING OF ADJACENT SURFACES.
2. SEE PLANS FOR APPROXIMATE SIZES AND LOCATIONS
3. BOULDERS SHALL REST IN A STABLE POSITION FULLY SUPPORTING THEIR OWN WEIGHT.
4. SUBGRADE AND SOIL SHALL BE COMPACTED TO A LEVEL CAPABLE OF SUPPORTING BOULDERS WITHOUT SETTLING.
5. BOULDERS SHALL FIT TIGHTLY TO AVOID GAPS WHEN ABUTTING ANOTHER BOULDER.
6. BOULDERS SHALL BE EMBEDDED TO A DEPTH $\frac{1}{3}$ THE OVERALL MASS OF THE BOULDER.



SECTION 2

SCALE: NTS

BOULDER SCHEDULE FOR BOULDER SCRAMBLE

BOULDER	MIN/MAX HEIGHT	MIN WIDTH/LENGTH	SIZE*
1	12"-18"	48"-56"	A
2	8"-12"	22"-30"	B
3	12"-18"	34"-42"	B
4	12"-18"	22"-20"	B
5	8"-12"	22"-30"	B
6	12"-18"	34"-42"	B
7	8"-12"	22"-30"	B
8	12"-18"	22"-30"	B
9	16"-24"	48"-56"	A
10	8"-12"	22"-30"	B
11	12"-18"	34"-42"	B
12	12"-18"	48"-56"	A
13	12"-18"	34"-42"	B
14	16"-24"	48"-56"	A
15	12"-18"	22"-30"	B
16	16"-24"	22"-30"	B
17	12"-18"	22"-30"	B
18	16"-24"	48"-56"	A
19	12"-18"	34"-42"	B

*SIZE A: 4-5 MAN BOULDER
SIZE B: 2-3 MAN BOULDER

NOTES:

1. FINAL LAYOUT WILL BE FIELD APPROVED BY OWNER'S REPRESENTATIVE.
2. BOULDER LAYOUT IS DIAGRAMMATIC; DIMENSIONS ARE APPROXIMATE AND INTENDED TO SHOW DESIGN INTENT.
3. ROCK SCRAMBLE BOULDERS TO BE PER SECTIONS 8-19.2 AND 8-19.3 OF THE STANDARD SPECIFICATIONS.

O:\proj\Y2018\18-06777-000\CAD\Dwg\LA-DETAILS.dwg | 2/1/2021 3:29 PM | Eric Marshall

100% DESIGN - BID SET

No.	REVISION	BY	APP'D	DATE
1	REVISION 1	EM	KF	2/1/21

ONE INCH
AT FULL SIZE, IF NOT ONE INCH SCALE ACCORDINGLY

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HERRERA

SKAGIT COUNTY Parks and Recreation

SKAGIT FISHERIES ENHANCEMENT GROUP

STATE OF WASHINGTON, SUZANNE FORESTER, LICENSED LANDSCAPE ARCHITECT, 1448, EXP. 12/02/21

DESIGNED: K. FORESTER
DESIGNED: S. VAYANOS
DESIGNED: -
SCALE: AS NOTED
DRAWN: E. MARSHALL
DRAWN: X. WU
CHECKED: C. AVOLIO
APPROVED: M. EWBANK

PRESSENTIN PARK

SIDE CHANNEL RESTORATION AND RECREATIONAL IMPROVEMENTS

SITE DETAILS 4

DATE: DECEMBER 2020
PROJECT NO: 18-06777-000
DRAWING NO: L-3.5
SHEET NO: 58 OF 71

Skagit County
Planning & Development Services

1800 Continental Place ◆ Mount Vernon, WA 98273

360- 416-1320 ◆ pds@co.skagit.wa.us ◆ www.skagitcounty.net/planning

Skagit County Flood Area Development

Permit: FP19-0002

Issued for permit #: N/A

Issue date: 08/17/2020

FIRM designation: A9

Floodway Panel 20

Water velocity, if any: 0

Elevation certificate or exempt? EXMT

Base flood elevation: **316' above mean sea level**

Minimum floor elevation: **317' above mean sea level; or,**
height above adjacent grade in Zones A or AO, or height to bottom of lowest horizontal member in Zone V4

Description: Off-channel habitat restoration & park

Parcel No: P46150

P124415

P130473

[illegible]15194

[illegible]46151

P46152

P46175

Job address: 60060 STATE ROUTE 20 MARB

60060 State Route 20

Applicant: Skagit County Parks
1730 Continental Place
Mount Vernon, WA
98273

Owner: SKAGIT COUNTY
1800 CONTINENTAL PL
MOUNT VERNON WA
98273

I hereby certify that I am the owner of the property for which this permit is issued or I am an authorized representative of the owner. The attached conditions are noted and accepted.

Owner/agent: ______________________ Date: 9-11-20

Department agent: ______________________ Date: 9-11-20

Skagit County
Planning & Development Services

1800 Continental Place • Mount Vernon, WA 98273

360- 416-1320 • pds@co.skagit.wa.us • www.skagitcounty.net/planning

---

Building Permit #: BP19-0960

Status: Issued
Issue date: August 17, 2020
Expire date: August 17, 2023
Renewal Expire date:

Project Description: 2 picnic shelters, 2 pedestrian foot bridges, & 1 maintance vehicle bridge

Parcel No: P46152
P124415
P130473
P45191
P45194
P46150
P46151
P46175

Job address: 60108 STATE ROUTE 20 MARB
59992 STATE ROUTE 20 MARB
59924 STATE ROUTE 20 MARB

Applicant: Skagit County
1800 Continental Place
Mount Vernon, WA 98273

Owner: Skagit County
1800 Continental Place
Mount Vernon, WA 98273

Contractor: APPLICANT
0

Zoning: Public Open Space
Setbacks: Front: 35 Side(s): 0 Rear: 0
Setback Comments:

Valuation:

Occupancy	Type	Factor	Sq Feet	Valuation
	Additional Amount...			500,000.00
	Totals...			$500,000.00*

"Construction or work for which a permit is required shall be subject to inspection by the building official and such construction or work shall remain accessible and exposed for inspection purposes until approved." IBC 109.1 "The final inspection shall be made after all work required by the building permit is completed." IBC 109.5. I hereby certify that I am the owner or I am an authorized representative of the owner of the property for which this permit is issued. This permit does not grant any right to trespass on another's property. This permit will expire three years from the date of issuance.

Owner/agent: [signature] Date: 9-11-20

Department agent: [signature] Date: 9/11/2020

BP19-0960

Additional requirements: 1 No item or element of construction shall be covered or concealed where inspections are required, before requesting such inspection and receiving approval from the building inspector. Inspections will be performed according to the current inspection schedule, except holidays and other days of office closure. Due to limited resources, requests for inspections at specific days, times or periods of time (such as a.m. or p.m.) will be reviewed daily but cannot be guaranteed and shall not reduce the requirement for inspection. If the construction is not ready for inspection at the time of building inspector arrival, re-inspection must be requested for the next, or other, day.

2 The bridge is required to meet HS20 rating and post weight limits Contact Fire Marshal Office 360-416-1842

3 Special Inspections

Special Inspections are required on the types of work listed under 2015 IBC Chapter 17.
1. Prior to start of construction of any type, the registered design professional in charge shall provide a list of Special Inspections as per IBC Sections 1704 and 1705 and submit it to the building official along with the agency that will perform the special inspections including credentials.
2. Perform all required special inspections listed in 2015 IBC -1704 & 1705 on and off site.
3. Special Inspectors shall furnish an inspection reports to the building official and registered design professional in charge within 7 calendar days indicating that work inspected was done in conformance to the approved documents submitted.
4. Any discrepancies shall be reported to the building official and registered design professional in charge for correction.
5. Submit a final report and Certificate of Compliance within 7 calendar days to the building official and the professional designer of record in charge documenting corrections of any discrepancies.

4 Before 2021 the wells located on the two northern parcels of the development parcels that do not meet setacks from septics per WAC 173-160/SCC 12.48/SCC 12.05 are required to be decommissioned per WAC 173-160 and all properties with development on them connected to The public water line that fronts the lots.

5 Any fill that will support a building requires proof of 90% compaction by an approved testing agency.

Any associated grading permit must be finaled prior to final inspection of this building permit.

The accompanying engineering is an intregal part of the approved plans. It is the responsibility of the builder and/or owner to read and understand the engineering and to comply with all requirements or conditions of the engineering.

8 Any changes to the accompanying engineering, including substitution of materials such as holddown types, must have the written approval of the engineer of record as well as the approval of the plans examiner before the work changes are made. Changes or revisions to the engineering will not be approved in the field at the time of an inspection. It is the responsiblity of the builder and/or owner to provide the plans examiner with 2 copies of the intended revisions for review.

9 DISTURBED AREAS SHALL BE KEPT TO A MINIMUM DURING THE CONSTRUCTION PROCESS. DISTURBED AREAS MUST BE COVERED WITH STRAW DURING CONSTRUCTION AND SEEDED UPON PROJECT COMPLETION.

10 All temporary erosion control devices must remain in place until permanent vegetation is re-established.

11 This project shall comply with all requirements of Skagit County Code 14.32.060 Erosion and Sediment Control.

12 All runoff from impervious surfaces and roof & footing drains shall be directed so as not to adversely affect adjacent properties.

Adjacent properties, roads, conveyances and water bodies shall be protected from sediment deposition by use of appropriate measures.

14 All soils exposed during construction must be seeded, planted, landscaped or provided with approved erosion and sedimentation control measures AT, OR PRIOR TO, the final inspection or approval for occupancy. Requests concerning alternatives or exemptions should be directed to a stormwater review technician at Skagit County Planning & Development Services. 360.416.1320

I have read and understand the conditions for this project. ______________________

Signature

Permit #: BP19-0960

Applicant: Skagit County
1800 Continental Place
Mount Vernon, WA

Assessor ID number and legal description:

351118-0-010-0004

(4.8500 ac) LT 6

Fee Summary:

Description	Tot Fee	Paid
BCAC	25.00	.00
Building Permits	3,820.00	.00
Stormwater Review	3,975.20	.00
Plan Check Fee/Deposit	2,483.00	.00

Total fees: $10,303.20
Total payments: $0.00
Balance due: $10,303.20

Skagit County
Planning & Development Services

1800 Continental Place • Mount Vernon, WA 98273

360- 416-1320 • pds@co.skagit.wa.us • www.skagitcounty.net/planning

Grading Permit #: BP19-0961

Status: Issued
Issue date: 08/17/2020
Expire date: 08/17/2023
Renewal Expire date:

Description of work:
Channel restoration & trail network improvements

Job address: 60108 STATE ROUTE 20 MARB
59992 STATE ROUTE 20 MARB
59924 STATE ROUTE 20 MARB

Location: Pressentin Park: 59992 State Route 20, M

Parcel No: P46152
P124415
P130473
[illegible]1
[illegible]
[illegible]
P4[illegible]51
P46175

Applicant: Skagit County
1800 Continental Place
Mount Vernon, WA 98273

Owner: Skagit County
1800 Continental Place
Mount Vernon, WA 98273

Contractor: APPLICANT
0

Greater quantity of cut or fill: , cubic yards

Fee Summary:

Description	Tot Fee	Paid
[illegible]l & Grade Permits	523.00	.00
[illegible]ll & Grade Plan Check	339.95	.00

Total fees: **$862.95**
Total payments: **$0.00**
Balance due: $862.95

The permittee shall notify the building official when the grading operation is ready for final inspection. Final approval shall not be given until all work, including installation of all drainage facilities and their protective devices, and all erosion-control measures have been completed in accordance with the final approved grading plan, and the required reports have been submitted." *UBC 3318.2.*

I hereby certify that I am the owner, or I am an authorized representative of the owner, of the property for which this permit is issued.
This permit will expire three years from the date of issuance.

Owner/agent: [signature] Date: 9-11-20

Department agent: [signature] Date: 9-11-20

1 No item or element of construction shall be covered or concealed where inspections are required, before requesting such inspection and receiving approval from the building inspector. Inspections will be performed according to the current inspection schedule, except holidays and other days of office closure. Due to limited resources, requests for inspections at specific days, times or periods of time (such as a.m. or p.m.) will be reviewed daily but cannot be guaranteed and shall not reduce the requirement for inspection. If the construction is not ready for inspection at the time of building inspector arrival, re-inspection must be requested for the next, or other, day.

2 Any fill that will support a building requires proof of 90% compaction by an approved testing agency.

3 The accompanying engineering is an intregal part of the approved plans. It is the responsibility of the builder and/or owner to read and understand the engineering and to comply with all requirements or conditions of the engineering.

4 Any changes to the accompanying engineering, including substitution of materials such as holddown types, must have the written approval of the engineer of record as well as the approval of the plans examiner before the work changes are made. Changes or revisions to the engineering will not be approved in the field at the time of an inspection. It is the responsiblity of the builder and/or owner to provide the plans examiner with 2 copies of the intended revisions for review.

5 DISTURBED AREAS SHALL BE KEPT TO A MINIMUM DURING THE CONSTRUCTION PROCESS. DISTURBED AREAS MUST BE COVERED WITH STRAW DURING CONSTRUCTION AND SEEDED UPON PROJECT COMPLETION.

6 All temporary erosion control devices must remain in place until permanent vegetation is re-established.

7 This project shall comply with all requirements of Skagit County Code 14.32.060 Erosion and Sediment Control.

8 All runoff from impervious surfaces and roof & footing drains shall be directed so as not to adversely affect adjacent properties.

9 Adjacent properties, roads, conveyances and water bodies shall be protected from sediment deposition by use of appropriate measures.

10 All soils exposed during construction must be seeded, planted, landscaped or provided with approved erosion and sedimentation control measures AT, OR PRIOR TO, the final inspection or approval for occupancy. Requests concerning alternatives or exemptions should be directed to a stormwater review technician at Skagit County Planning & Development Services. 360.416.1320

11 Sheet(s) titled "Stormwater Approval and Inspections Conditions", include additional permit conditions.

12 Once all grading has been completed, all exposed soils must be revegetated within 30 days. Call 360-416-1330 for final

inspection.

Permit #: BP19-0961

Applicant: Skagit County 1800
Continental Place
Mount Vernon, WA

Additional requirements:

I have read and understand the conditions for this project. ____________________
Signature

Instructions for Transfer of Coverage

Construction Stormwater General Permit

DEPARTMENT OF ECOLOGY
State of Washington

Instructions

This form is used to process two types of permit transfers: 1) Complete Transfer, or 2) Partial Transfer. Determine which type of transfer applies to your situation before filling out this form.

1. Complete Transfer: The original permittee has sold, or otherwise released control of the entire site to another party.

Required Paperwork for Complete Transfer:

- Either the current permittee, or the new permittee(s), must submit a complete and accurate Transfer of Coverage form to Ecology for each new party. The form must be signed by the current permittee ***and*** the new permittee.

2. Partial Transfer: The original permittee retains control over some portion of the site after selling or releasing control over a portion of the site.

Required Paperwork for Partial Transfer

- Either the current permittee or the new permittee(s) must submit a complete and accurate Transfer of Coverage Form for each new operator to Ecology. The form must be signed by the current permittee and the new permittee.
- For partial transfers, once all transfers are submitted, the original permittee should submit the Notice of Termination only if the portion(s) they still own or control have undergone final stabilization and meet the criteria for termination.

For Your Information

- When this form is 1) completed, 2) signed by the current and new permittee, and 3) submitted to Ecology, permit transfers are effective on the date specified at the top of page 1 (unless Ecology notifies the current permittee and new permittee of its intention to revoke coverage under the General Permit or if Ecology sends notice that the application is incomplete). If no date for the transfer of coverage is specified, Ecology will use the date of the last signature.
- The new permittee should keep a copy of the signed Transfer of Coverage form (which serves as proof of permit coverage) until Ecology sends documentation in the mail.
- Following the transfer, the new permittee must either: (1) use the Stormwater Pollution Prevention Plan (SWPPP) developed by the original operator, and modified as necessary, or (2) develop and use a new SWPPP that meets the requirements of the Construction Stormwater General Permit.
- For projects for which the original permittee has completed a Proposed New Discharge to an Impaired Waterbody Form (ECY 070-399), or for projects that are operating on sites with soil or groundwater contamination: Upon completion of the Transfer of Coverage form, the new permittee will adopt any special provisions made to protect water quality for sites that have existing contamination or that discharge to an impaired waterbody.

To request ADA accommodation including materials in a format for the visually impaired, call the Water Quality Program at 360-407-6600 or visit https://ecology.wa.gov/accessibility. *People with impaired hearing may call Washington Relay Service at 711. People with speech disability may call 877-833-6341.*

Transfer of Coverage

Permit # WAR____

Construction Stormwater General Permit

This form transfers permit coverage for all, or a portion of a site to one or more new operators.

Type of permit transfer (check one): ☐ Partial transfer (complete the Partial Transfer acreage below) ☐ Complete transfer

Specific date that permit responsibility, coverage, and liability is transferred to new operator: ________

**If no date is indicated Ecology will determine the date of transfer.*

Please see instructions for details on type of transfer.

For PARTIAL TRANSFERS indicate the acreage remaining under your operational control:

- List *total size of project/site* remaining under your operational control following the **partial transfer**: ______ acres.
- List *total area of soil disturbance* remaining under your operational control following the **partial transfer**: ______ acres.
- Submitting this form meets the requirement to submit an updated NOI (General Permit Condition G9)

Current Operator/Permittee Information

Current Operator/Permittee Name:		Company:		
Business Phone:	Ext:	Mailing Address:		
Cell Phone:	Fax (optional):			
Email:		City:	State:	Zip+4:
Signature* (see signatory requirements in Section VIII):		Title:		Date:

New Operator/Permittee Information

(the remainder of this form applies to the **new** Operator/Permittee)

I. New Operator/Permittee (Party with operational control over plans and specifications or day-to-day operational control of activities which ensure compliance with Stormwater Pollution Prevention Plan (SWPPP) and permit conditions. Ecology will send correspondence and permit fee invoices to the permittee on record.)

Name:		Company:		
Business Phone:	Ext:	Unified Business Identifier (UBI): *(UBI is a nine-digit number used to identify a business entity. Write "none" if you do not have a UBI number.)*		
Cell Phone (Optional):	Fax (Optional):	E-mail:		
Mailing Address:		City:	State:	Zip + 4:

II. Property Owner (The party listed on the County Assessor's records as owner and taxpayer of the parcel[s] for which permit coverage is requested. Ecology will *not* send correspondence and permit fee invoices to the Property Owner. The Property Owner information will be used for emergency contact purposes.)

Name:		Company:		
Business Phone:	Ext:	Unified Business Identifier (UBI): *(UBI is a nine-digit number used to identify a business entity. Write "none" if you do not have a UBI number.)*		
Cell Phone (Optional):	Fax (Optional):	E-mail:		
Mailing Address:		City:	State:	Zip + 4:

III. On-Site Contact Person(s) (Typically the Certified Erosion and Sediment Control Lead or Operator/Permittee)

Name:		**Company:**		
Business Phone:	**Ext:**	**Mailing Address:**		
Cell Phone:	**Fax(Optional):**	**City:**	**State:**	**Zip+4:**
Email:				

IV. Site/Project Information

Site or Project Name

Street Address or Location Description (*If the site lacks a street address, list its specific location. For example, Intersection of Highway 61 and 34.)*

____

Parcel ID#: ______________________ *(Optional)*

Type of Construction Activity (*check all that apply*):

- ☐ Residential
- ☐ Commercial
- ☐ Industrial
- ☐ Highway or Road (city ,county, state)
- ☐ Utilities (specify): ______________________.
- ☐ Other (specify):_______________________.

Site Acreage

Total size of your site/project (that **you** own/control): ______acres. *(Note: 1 acre = 43,560 sq. ft.)*

Total area of soil disturbance for your site/project over the life of the project: ______acres. Include grading, equipment staging, excavation, borrow pit, material storage areas, dump areas, haul roads, side-cast areas, off-site construction support areas, and all other soil disturbance acreage associated with the project. (Note: 1 acre = 43,560 sq. ft.)

City (or nearest city):	Zip Code:	Estimated project start-up date (mm/dd/yy):
County:		Estimated project completion date (mm/dd/yy):

Record the latitude and longitude of the *main entrance* to the site or the approximate center of site.

Latitude: ______________________°N Longitude: ______________________°W

V. Existing Site Conditions

1. Are you aware of contaminated soils present on the site? ☐ Yes ☐ No
2. Are you aware of groundwater contamination located within the site boundary? ☐ Yes ☐ No
3. If you answered yes to questions 1 or 2, will any contaminated soils be disturbed or will any contaminated groundwater be discharged due to the proposed construction activity? ☐ Yes ☐ No

("Contaminated" and "contamination" here mean containing any hazardous substance (as defined in WAC 173-340-200) that does not occur naturally or occurs at greater than natural background levels.)

If you answered yes to Question 3, please provide detailed information with the NOI (as known and readily available) on the natures and extent of the contamination (concentrations, locations, and depth), as well as pollution prevention and/or treatment Best Management Practices (BMPs) proposed to control the discharge of soil and/or groundwater contaminants in stormwater. This should include information that would be included in related portions of the Stormwater Pollution Prevention Plan (SWPPP) that describe how contaminated and potentially contaminated construction stormwater and dewatering water will be managed.

VI. WQWebDMR (Electronic Discharge Monitoring Reporting)

You must submit monthly discharge monitoring reports using Ecology's WQWebDMR system. To sign up for WQWebDMR, or to register a new site, go to https://www.ecology.wa.gov/Regulations-Permits/Guidance-technical-assistance/Water-quality-permits-guidance/WQWebPortal-guidance. If you are unable to submit your DMRs electronically, you may contact Ecology to request a waiver. Ecology will generally only grant waiver requests to those permittees without internet access. Only a permittee or representative, designated in writing, may request access to or a waiver from WQWebDMR. To have the ability to use the system immediately, **you must submit the Electronic Signature Agreement with your transfer of coverage form**. If you have questions on this process, contact Ecology's WQWebDMR staff at WebDMRPortal@ecy.wa.gov or 800/633-6193 or 360-407-7097 (local). Note: DMRs are optional for permitted sites under 1 acre that do not discharge to impaired waterbodies.

VII. Discharge/Receiving Water Information

Indicate whether your site's stormwater and/or dewatering water could enter surface waters, *directly and/or indirectly*:

☐ Water will discharge directly or indirectly (through a storm drain system or roadside ditch) into one or more surface waterbodies (wetlands, creeks, lakes, and all other surface waters and water courses).

If your discharge is to a storm sewer system, provide the name of the operator of the storm sewer system:
(e.g., City of Tacoma): ______________________________

☐ Water will discharge to ground with 100% infiltration, with no potential to reach surface waters under any conditions.

If your project includes dewatering, you **must** include dewatering plans and discharge locations in your site Stormwater Pollution Prevention Plan.

Location of Outfall into Surface Waterbody

Enter the outfall identifier code, waterbody name, and latitude/longitude of the point(s) where the site has the potential to discharge into a waterbody (the outfall). Enter all locations. **See illustration of Surface Waterbody Outfall locations at the end of this form.**

- Include the names and locations of both direct and indirect discharges to surface waterbodies, even if the risk of discharge is low or limited to periods of extreme weather. **Attach a separate list if necessary.**
- Give each point a unique 1-4 digit alpha numeric code. This code will be used for identifying these points in WQWebDMR.
- Some large construction projects (for example, subdivisions, roads, or pipelines) may discharge into several waterbodies.
- If the creek or tributary is unnamed, use a format such as "unnamed tributary to Deschutes River."
- If the site discharges to a stormwater conveyance system that in turn flows to a surface waterbody, include the surface waterbody name and location.

Outfall Identifier Code. These cannot be symbols. (Maximum of 4 characters).				Surface Waterbody Name at the Outfall	Latitude Decimal Degrees	Longitude Decimal Degrees
Example: 001A				**Example:** Puget Sound	47.5289247° N	-122.3123550° W
					° N	° W
					° N	° W
					° N	° W

If your site discharges to a waterbody that is on the impaired waterbodies list (e.g., 303[d] list) for turbidity, fine sediment, high pH, or phosphorus, Ecology will require additional documentation before issuing permit coverage and these sites will be subject to additional sampling and numeric effluent limits (per Permit Condition S8). Ecology will notify you if any additional sampling requirements apply. Information on impaired waterbodies is available online at: https://www.ecology.wa.gov/Water-Shorelines/Water-quality/Water-improvement/Assessment-of-state-waters-303d.

Before signing, please use the following checklist to ensure this form is complete:

☐ All spaces on this form have been completed. (Attach additional sheets if necessary)

☐ The transfer form has been signed by both the current permittee (see Page 1) *and* the new permittee (see Section VIII below).

☐ The date permit responsibility was transferred is specified. (See Page 1)

☐ New Operator/Permittee: Before you submit this form to Ecology, please retain a copy for your records – this will serve as proof of permit coverage until documentation arrives from Ecology.

☐ For partial transfers: If the original permittee no longer owns or controls any portions of the site that meet the criteria for termination, the original permittee must submit a Notice of Termination (NOT) to terminate permit coverage. See the CSWGP website for a link to the NOT form: www.ecology.wa.gov/constructionstormwaterpermit.

☐ For sites with contaminated soils/groundwater or a new discharger to an impaired waterbody: Any special provisions to protect water quality put in place at the time of initial coverage have been reviewed and adopted by the new permittee.

Administrative Order Docket No. ______________________

VIII. Certification of New Permittee

"I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system or those directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations."

Printed/Typed Name	Company (operator/permittee only)	Title
Signature of New Operator/Permittee		*Date*

Signature of Operator/Permittee requirements:

A. For a corporation: By a responsible corporate officer.
B. For a partnership or sole proprietorship: By a general partner or the proprietor, respectively.
C. For a municipality, state, federal, or other public facility: By either a principal executive officer or ranking elected official.

Please sign and return this **ORIGINAL** document to the following address:

Department of Ecology – Construction Stormwater
PO Box 47696
Olympia, WA 98504-7696

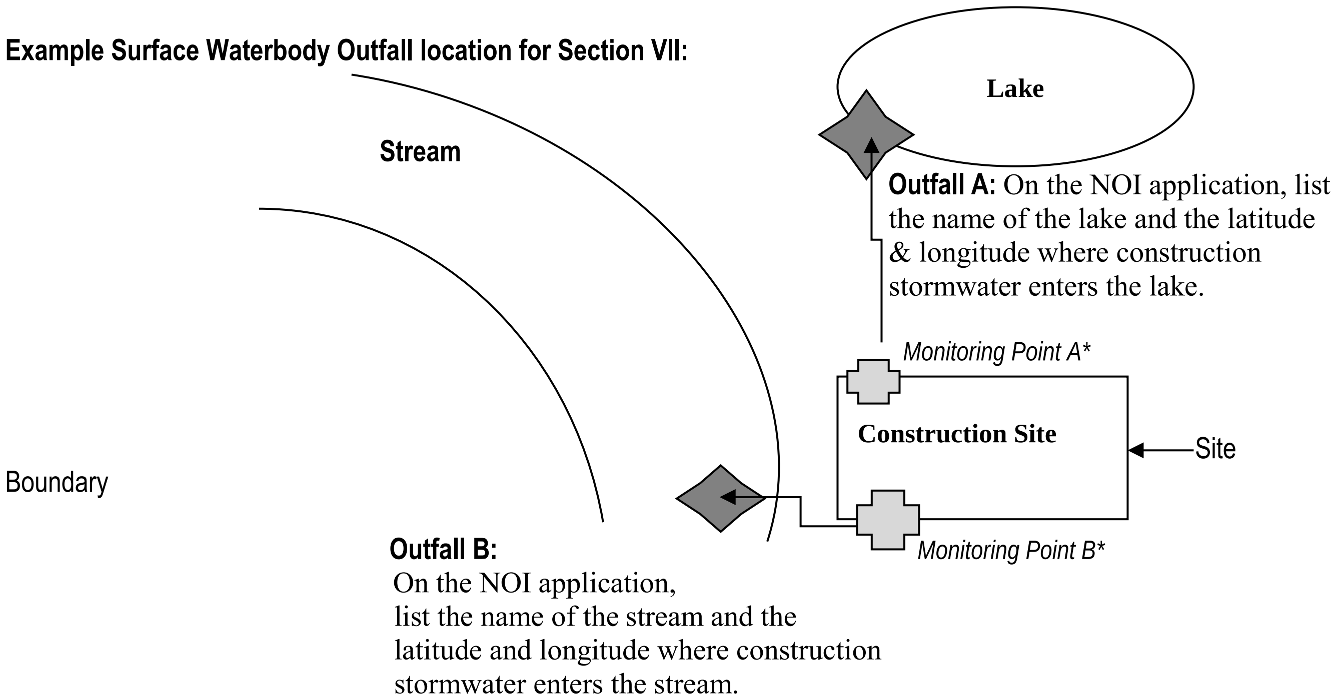
If you have questions about this form, contact the following Ecology staff:

Location	**Contact Name**	**Phone**	**E-mail**
City of Seattle, and Kitsap, Pierce, and Thurston counties	Josh Klimek	360-407-7451	josh.klimek@ecy.wa.gov
Island, King, and San Juan counties	RaChelle Stane	360-407-6556	rachelle.stane@ecy.wa.gov
Adams, Asotin, Columbia, Ferry, Franklin, Garfield, Grant, Lincoln, Pend Oreille, Skagit, Snohomish, Spokane, Stevens, Walla, Whatcom, and Whitman counties.	Shawn Hopkins	360-407-6442	shawn.hopkins@ecy.wa.gov
Benton, Chelan, Clallam, Clark, Cowlitz, Douglas, Grays Harbor, Jefferson, Kittitas, Klickitat, Lewis, Mason, Okanogan, Pacific, Skamania, Wahkiakum, and Yakima counties.	Joyce Smith	360-407-6858	joyce.smith@ecy.wa.gov

You must submit monthly discharge monitoring reports using Ecology's WQWebDMR system. To sign up for WQWebDMR, or to register a new site, go to www.ecology.wa.gov/Regulations-Permits/Guidance-technical-assistance/Water-quality-permits-guidance/WQWebPortal-guidance. If you are unable to submit your DMRs electronically, you may contact Ecology to request a waiver. Ecology will generally only grant waiver requests to those permittees without internet access. Only a permittee or representative, designated in writing, may request access to or a waiver from WQWebDMR. To have the ability to use the system immediately, **you must submit the Electronic Signature Agreement with your application**.

If you have questions on this process, contact Ecology's WQWebDMR staff at WQWebPortal@ecy.wa.gov or 800-633-6193 or 360-407-7097 (local).

Example Surface Waterbody Outfall location for Section VII:



*Note: The monitoring points are for illustration only and are not required on this Notice of Intent application form. Monitoring point information will be entered on the monthly discharge monitoring report as required for active permits.

To request ADA accommodation including materials in a format for the visually impaired, call the Water Quality Program at 360-407-6600 or visit https://ecology.wa.gov/accessibility. People with impaired hearing may call Washington Relay Service at 711. People with speech disability may call TYY at 877-833-6341.

STATE OF WASHINGTON
DEPARTMENT OF ECOLOGY
PO Box 47600 • Olympia, WA 98504-7600 • 360-407-6000
711 for Washington Relay Service • Persons with a speech disability can call 877-833-6341

January 11, 2021

Brian Adams
Skagit County Parks
1730 Continental Pl
Mount Vernon, WA 98273

RE: Coverage under the Construction Stormwater General Permit

Permit number:	**WAR309726**	
Site Name:	**Pressentin Park**	
Location:	**59992 State Route 20**	
	Marblemount, WA	**County: Skagit**
Disturbed Acres:	**11.2**	

Dear Brian Adams:

The Washington State Department of Ecology (Ecology) received your Notice of Intent for coverage under Ecology's Construction Stormwater General Permit (CSWGP). This is your permit coverage letter. Your permit coverage is effective January 11, 2021.

Retain this letter as an official record of permit coverage for your site. You may keep your records in electronic format if you can easily access them from your construction site. You can get the CSWGP, permit forms, and other information at www.ecology.wa.gov/eCoverage-packet. Contact your Permit Administrator, listed below, if you want a copy of the CSWGP mailed to you. Please read the permit and contact Ecology if you have any questions.

Electronic Discharge Monitoring Reports (WQWebDMR)
This permit requires you to submit monthly discharge monitoring reports (DMRs) for the full duration of permit coverage (from the first full month of coverage to termination). DMRs must be submitted electronically using Ecology's secure online system, WQWebDMR. To sign up for WQWebDMR go to www.ecology.wa.gov/programs/wq/permits/paris/webdmr.html. If you have questions, contact the portal staff at (360) 407-7097 (Olympia area), or (800) 633-6193/option 3, or email WQWebPortal@ecy.wa.gov.

Appeal Process
You have a right to appeal coverage under the general permit to the Pollution Control Hearing Board (PCHB). Appeals must be filed within 30 days of the date of receipt of this letter. Any appeal is limited to the general permit's applicability or non-applicability to a specific discharger. The appeal process is governed by chapter 43.21B RCW and chapter 371-08 WAC. "Date of receipt" is defined in RCW 43.21B.001(2). For more information regarding your right to appeal, go to https://apps.ecology.wa.gov/publications/summarypages/1710007.html to view Ecology's Focus Sheet: *Appeal of General Permit Coverage*.

Ecology Field Inspector Assistance
If you have questions regarding stormwater management at your construction site, please contact your Regional Inspector, Stephanie Barney of Ecology's Bellingham Field Office at stephanie.barney@ecy.wa.gov or (360) 255-4390.

Questions or Additional Information
Ecology is here to help. Please review our web page at www.ecology.wa.gov/constructionstormwaterpermit. If you have questions about the Construction Stormwater General Permit, please contact your Permit Administrator, Melinda Wilson at melinda.wilson@ecy.wa.gov, or (360) 407-7229.

Sincerely,

Jeff Killelea, Acting Manager
Program Development Services Section
Water Quality Program

K:\Draft-dept\Standard dwgs\Installation Guides\PEDESTRIAN-INSTALL.dwg 12/6/2011 1:54 PM

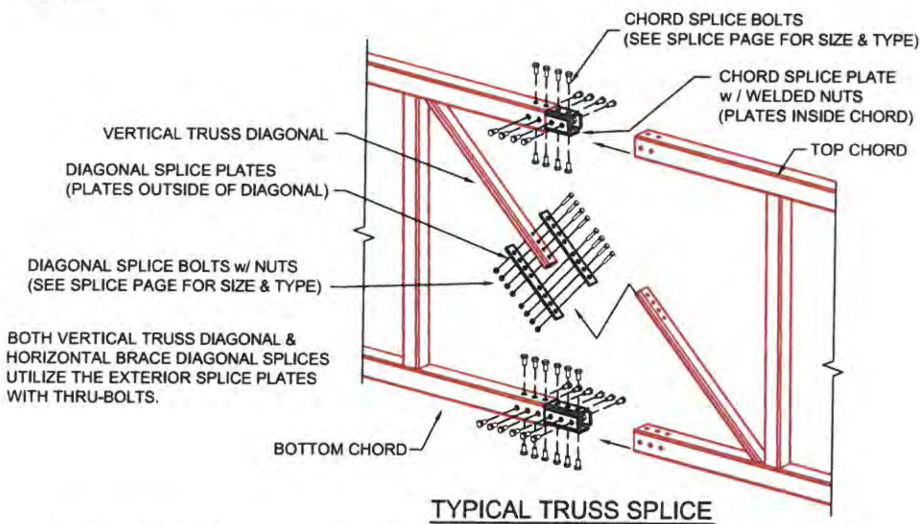
UNLOADING

- BRIDGE SECTIONS WILL ARRIVE ON OVER THE ROAD TRUCKING AND BE DELIVERED AS CLOSE TO THE BRIDGE LOCATION AS POSSIBLE. THE CONTRACTOR WILL BE RESPONSIBLE FOR UNLOADING THE BRIDGE AT THE SITE. OCCASIONALLY, IT MAY BE NECESSARY TO UNLOAD OTHER BIG R MATERIAL TO REACH THE BRIDGE. THE CONTRACTOR WILL NEED TO RELOAD SAID MATERIAL IN THIS EVENT.
- LOOSE ITEMS SUCH AS SETTING PLATES AND BOLTS WILL ARRIVE WITH THE BRIDGE. THE CONTRACTOR SHOULD MAKE SURE ALL LOOSE ITEMS ARE UNLOADED WITH THE BRIDGE. REFER TO THE BILL OF LADING.

SPLICING NOTES (WHEN REQUIRED)

TWO TYPES OF BOLTED SPLICE CONNECTIONS ARE TYPICALLY USED UNLESS OTHERWISE NOTED ON THE SHOP DRAWINGS. VERTICAL TRUSS DIAGONALS AND HORIZONTAL BRACE DIAGONALS WILL BE JOINED WITH SPLICE PLATES ON THE *OUTSIDE* OF THE TRUSS MEMBERS WITH PASS THROUGH BOLTS. EACH HOLE LOCATION WILL RECEIVE ONE LOOSE BOLT AND ONE LOOSE NUT. THE CHORD SPLICE WILL HAVE LOOSE SPLICE PLATES WITH ALL NUTS WELDED INTO PLACE LOCATED ON THE INSIDE OF THE CHORD MEMBER. EACH HOLE LOCATION WILL RECEIVE ONE LOOSE BOLT. FOR THE BOLTED SPLICE DETAILS REFER TO THE SHOP DRAWINGS.

- VERTICAL TRUSS DIAGONAL AND HORIZONTAL BRACE DIAGONAL PLATES WILL ARRIVE LOOSE OR WIRED AND BOLTED TO THE BRIDGE. LIKE PLATES ARE INTERCHANGEABLE. FOR PLATE LOCATIONS AND BOLT SIZE REFER TO THE SHOP DRAWINGS.
- CHORD SPLICE PLATES WILL ARRIVE LOOSE OR ATTACHED BY WIRE AND SHIPPING BOLTS. LIKE PLATES ARE INTERCHANGEABLE BUT IF THEY ARRIVE ATTACHED, WE RECOMMEND USING THEM IN THE LOCATION WHERE THEY ARE ATTACHED. THE BRIDGE WAS FABRICATED WITH THE PLATES IN THESE LOCATIONS AND USING THEM IN THESE LOCATIONS WILL INSURE THE BEST FIT. SHIPPING BOLTS ARE TO BE REMOVED AND DISCARDED. PLATES ARE THEN TO BE SET IN THE PROPER LOCATION ON THE SPLICE AND BOLTS INSTALLED LOOSE. FOR PLATE LOCATIONS AND BOLT SIZE REFER TO THE SHOP DRAWINGS
- THERE ARE THREE COMMON PROCEDURES FOR SPLICING BRIDGE SECTIONS TOGETHER:
  - MOST SPLICED BRIDGES ARRIVE IN TWO SECTIONS. PLACE ONE SECTION ON A RELATIVELY FLAT SURFACE WITH THE SPLICED END CRIBBED UP IN THE AIR APPROXIMATELY 2'. THIS WILL ALLOW FOR EASIER FIT UP AND ALLOWS ROOM TO WORK UNDER THE BRIDGE. THE OTHER SECTION IS LIFTED WITH A CRANE. WHEN THE CHORD SPLICES ARE LINED UP, THE SECTION WILL BE SLID INTO PLACE. IT MAY BE NECESSARY TO USE COME-A-LONGS TO PULL THE SECTIONS TOGETHER. WHEN BOLT UP IS COMPLETE, THE ENTIRE BRIDGE MAY BE LIFTED AS ONE PIECE WITH THE CRANE AND SET ON THE FOUNDATIONS.
  - MID-AIR SPLICING CAN BE USED WHEN THERE ARE SEPARATE CRANES TO LIFT EACH SECTION.
  - ONE SECTION MAY BE PLACED ON THE APPROPRIATE FOUNDATION WHILE THE SPLICE RESTS ON TEMPORARY SHORING.



NOTE: BOTH VERTICAL TRUSS DIAGONAL & HORIZONTAL BRACE DIAGONAL SPLICES UTILIZE THE EXTERIOR SPLICE PLATES WITH THRU-BOLTS.

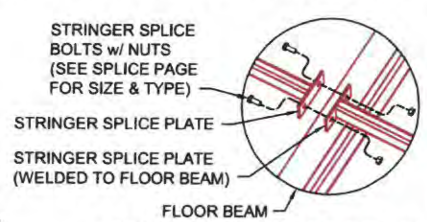
TYPICAL TRUSS SPLICE

NOTE: THESE PROCEDURES ARE RECOMMENDATIONS ONLY. THE JOB SITE WILL DETERMINE WHICH IS PREFERABLE. THESE PROCEDURES CAN BE USED FOR SIMPLE SPANS AS WELL AS MULTIPLE SPAN STRUCTURES. LIFTING WEIGHTS ARE LOCATED ON THE SHOP DRAWINGS.

DECKING CONSIDERATIONS:

1) IF THE BRIDGE HAS WOOD DECKING, IT IS ALLOWABLE BUT NOT REQUIRED FOR THE CONTRACTOR TO REMOVE 2-3 DECK PLANKS FROM EACH SIDE OF THE SPLICE TO MAKE ROOM FOR BOLTING THE BRACE DIAGONAL AND STRINGERS BELOW THE DECK.

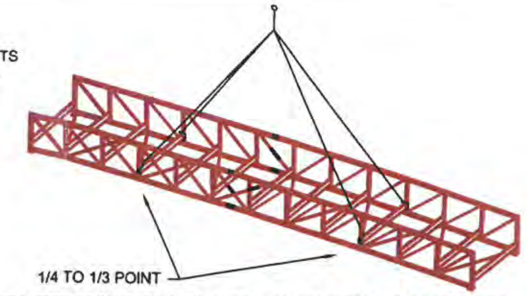
2) IF THE BRIDGE HAS A CONCRETE DECK, MOST OF THE GALVANIZED FORM DECKING WILL BE SHIPPED FACTORY INSTALLED EXCEPT FOR THE PIECES REQUIRED TO COVER THE SPLICE. THE CONTRACTOR WILL BE REQUIRED TO INSTALL THE SPLICE PIECES. THESE PIECES WILL BE CONNECTED TO THE FLOOR BEAMS UTILIZING SELF-TAPPING SCREWS. IT IS RECOMMENDED THAT THE CONTRACTOR PRE-DRILL ALL HOLES PRIOR TO INSTALLING THE SCREWS. THE SCREWS WILL BE PROVIDED AS LOOSE ITEMS WITH THE BRIDGE.



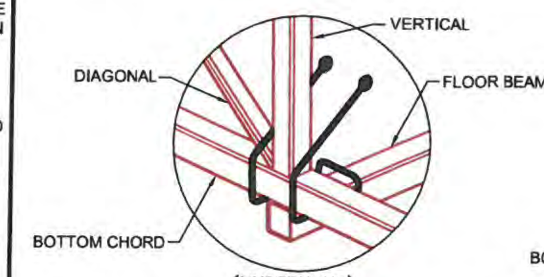
TYPICAL STRINGER SPLICE

LIFTING INSTRUCTIONS

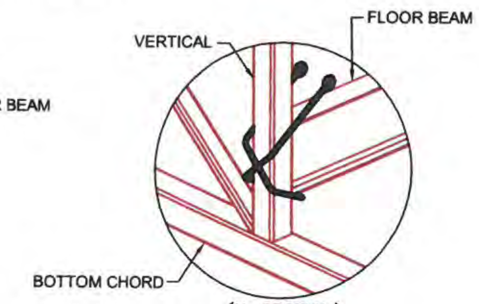
USE A MINIMUM OF (4) LIFTING POINTS WHEN LIFTING ANY BRIDGE. IT IS RECOMMENDED THAT LIFTING POINTS BE 1/4 TO 1/3 OF THE BRIDGE SPAN IN FROM THE ENDS OF THE BRIDGE. LIFTING MAY ALSO BE DONE AT THE ENDS OF THE BRIDGE AT THE END FLOOR BEAM AND VERTICAL AS DESCRIBED IN THE FOLLOWING:



- UNDERHUNG AND H-SECTION BRIDGES ARE TO BE LIFTED FROM THE BOTTOM CHORD OR FLOOR BEAMS ONLY. FOR UNDERHUNG BRIDGES WITH GAP BETWEEN DECK AND CHORD FACE, WRAP CHAIN, CABLE OR SLING OVER TOP OF FLOOR BEAM, UNDER BOTTOM CHORD, UP AND INSIDE OF TRUSS OVER THE DECK. FOR H-SECTION BRIDGES, WRAP CHAIN, CABLE OR SLING INSIDE THE VERTICAL BELOW THE FLOOR BEAM, AROUND THE VERTICAL CROSSING OVER ON THE OUTSIDE OF THE VERTICAL, UP AND INSIDE THE TRUSS OVER THE DECK.

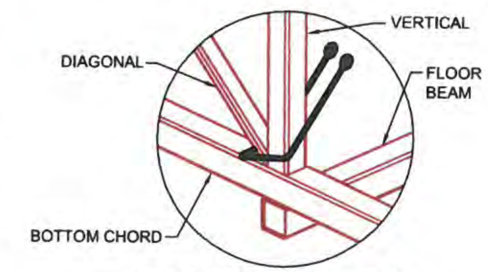


(UNDERHUNG)

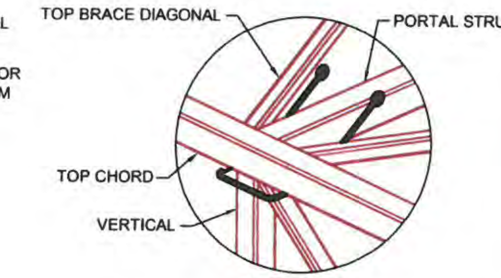


(H-SECTION)

- ALTERNATIVELY, BRIDGES MAY BE LIFTED FROM THE TOP CHORD IF A SPREADER BAR IS USED TO KEEP ANY TANGENTIAL FORCES FROM BEING APPLIED TO THE BRIDGE. THE TOP CHORDS SHOULD NEVER BE PULLED TOWARDS EACH OTHER DURING THE LIFTING PROCESS.
- WHEN AN UNDERHUNG BRIDGE HAS A CONCRETE DECK THAT EXTENDS ALL THE WAY TO THE CHORD FACE, LIFTING MAY BE DONE BY WRAPPING CABLE, CHOKER OR SLING AROUND A DIAGONAL AND VERTICAL MEMBER WHERE THEY MEET ON THE TOP OF THE BOTTOM CHORD AT DECK LEVEL.
- BOX TRUSS BRIDGES MAY BE LIFTED BY WRAPPING CHAIN, CHOKER OR SLING AROUND THE TOP CHORD AT THE JOINT OF A VERTICAL, DIAGONALS AND TOP STRUT.



(UNDERHUNG-CONCRETE DECK AGAINST CHORD FACE)



(BOX TRUSS)

- WHEN LIFTING PAINTED BRIDGES IT IS RECOMMENDED THAT STRAPS BE USED WITH PADDING PLACED BETWEEN THE STRAP AND BRIDGE ELEMENTS TO KEEP THE STRAP FROM POTENTIALLY DAMAGING THE PAINTED FINISH.

- ALL BOLTS ARE HIGH STRENGTH STRUCTURAL BOLTS. THE COMMON BOLT SIZES ARE ¾" AND 1" DIAMETER. THE PROPER SOCKET SIZES ARE 1 ¼" AND 1 5/8" RESPECTIVELY. WASHERS ARE TYPICALLY NOT REQUIRED AND NOT INCLUDED. ALL BOLTS SHOULD BE INSTALLED LOOSE AND THEN TIGHTENED FROM THE CENTER OF THE SPLICE FIRST AND THEN WORK OUTWARD.
- TIGHTENING OF THE BOLTS SHALL BE IN ACCORDANCE WITH THE "SPECIFICATION FOR STRUCTURAL JOINTS USING ASTM A325 OR A490 BOLTS" BY RCSC USING THE TURN-OF-NUT PROCEDURE DESCRIBED BELOW:

BRING ALL BOLTS TO A 'SNUG TIGHT' CONDITION TO INSURE THAT THE PARTS OF THE JOINT ARE BROUGHT INTO GOOD CONTACT WITH EACH OTHER. SNUG TIGHT IS DEFINED AS THE TIGHTNESS ATTAINED BY A FEW IMPACTS OF AN IMPACT WRENCH OR THE FULL EFFORT OF A MAN USING AN ORDINARY SPUD WRENCH. FOLLOWING THIS INITIAL OPERATION, ALL BOLTS SHALL THEN BE TIGHTENED ADDITIONALLY BY THE APPLICABLE AMOUNT OF NUT ROTATION AS SPECIFIED IN THE TABLE BELOW, WITH THE TIGHTENING PROGRESSING SYSTEMATICALLY FROM THE MOST RIGID PART OF THE JOINT TO ITS FREE EDGES. DURING THIS OPERATION, THERE SHALL BE NO ROTATION OF THE PART NOT TURNED BY THE WRENCH.

NUT ROTATION FROM SNUG TIGHT CONDITION

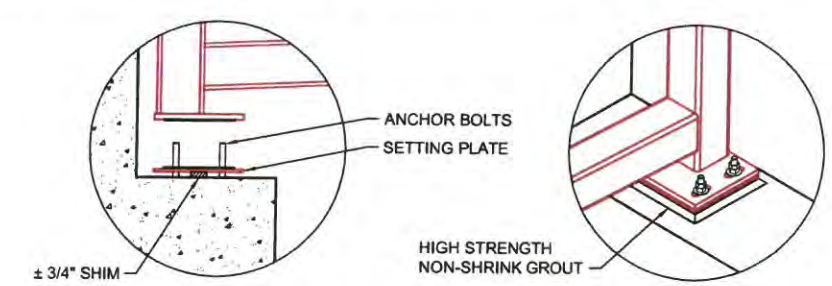
BOLT LENGTH (AS MEASURED FROM UNDERSIDE OF HEAD TO EXTREME END OF POINT)	DISPOSITION OF OUTER FACES OF BOLTED PARTS
	BOTH FACES NORMAL TO BOLT AXIS
NOT MORE THAN 4 DIAMETERS	1/3 TURN
MORE THAN 4 DIAMETERS BUT NOT MORE THAN 8 DIAMETERS	1/2 TURN
MORE THAN 8 DIAMETERS BUT NOT MORE THAN 12 DIAMETERS	2/3 TURN

NUT ROTATION IS RELATIVE TO BOLT, REGARDLESS OF THE ELEMENT (NUT OR BOLT) BEING TURNED. FOR BOLTS INSTALLED BY ½ TURN AND LESS, THE TOLERANCE SHOULD BE PLUS OR MINUS 30°; FOR BOLTS INSTALLED BY 2/3 TURN AND MORE, THE TOLERANCE SHOULD BE PLUS OR MINUS 45°.

- IF BOLTS DO NOT SMOOTHLY ENGAGE UP TO SNUG-TIGHT THERE MAY BE AN OBSTRUCTION WITHIN THE TREADS. THE BOLT SHOULD BE REMOVED, THE THREADS ON THE BOLT AND NUT CLEANED AND RETAPPED IF NECESSARY TO ALLOW SMOOTH INSTALLATION OF THE BOLTS.

BEARING PREPARATION

- ALL LOOSE SETTING PLATES ARE TO BE SET ON THE FOUNDATIONS ON APPROXIMATELY ¾" OF SHIMS BEFORE SETTING THE BRIDGE. LIGHTLY APPLY GREASE TO TOPS OF ALL BASE PLATES EXCEPT TEFLON/STAINLESS STEEL BEARINGS.
- ALL TEFLON/STAINLESS BEARING ASSEMBLIES WILL BE FACTORY SUPPLIED AND TACK WELDED TO BEARING PLATES. MAKE CERTAIN THAT THE SETTING PLATE (LOWER BEARING THAT SITS ON THE FOUNDATION) HAS THE TEFLON FACING UP AND THE TOP BEARING (PHYSICALLY WELDED TO THE BRIDGE) HAS THE STAINLESS FACING DOWN. REMOVE ANY PROTECTIVE COATINGS FROM THE TEFLON AND STAINLESS SURFACES.
- AFTER THE BRIDGE IS SET, SHIMS CAN BE ADJUSTED TO MAKE THE DECK FLUSH WITH THE BACKWALL AND TO OBTAIN FULL CONTACT BETWEEN THE SETTING PLATE AND THE BEARING PLATE.
- AFTER ALL ADJUSTMENTS ARE MADE, PLACE HIGH STRENGTH NON-SHRINK GROUT UNDER SETTING PLATE TO CREATE FULL CONTACT BETWEEN THE SETTING PLATE AND THE FOUNDATION SEAT.
- REFER TO THE SHOP DRAWINGS FOR ANY SPECIAL INSTRUCTIONS RELATED TO BEARINGS.



SETTING INSTRUCTIONS

- BRIDGE SHALL BE SET ON FOUNDATIONS AND ADJUSTED SO THAT SPACING IS EQUAL AT BOTH ENDS OR AS DIRECTED IN NOTES ON THE SHOP DRAWINGS. **NOTE: IF THE BRIDGE HAS AN ELEVATION DIFFERENCE, BE SURE TO SET THE HIGH END OF THE BRIDGE ON THE HIGHER FOUNDATION PER THE SHOP DRAWINGS. REFER TO THE SHOP DRAWINGS FOR CORRECT ALIGNMENT. BRIDGES WITH AN ELEVATION DIFFERENCE WILL HAVE A WELDED MARK - (H) FOR HIGH, (L) FOR LOW - LOCATED ON THE OUTSIDE FACE OF THE CORRESPONDING END FLOOR BEAM.**
- EACH ANCHOR BOLT WILL RECEIVE (1) WASHER AND (2) NUTS. ONE END OF THE BRIDGE IS DESIGNED TO BE *FIXED* AND THE NUTS ARE TO BE INSTALLED TIGHT. THE *EXPANSION END* WILL HAVE THE FIRST NUT TIGHTENED FINGER TIGHT TO THE WASHER PLACED ON THE BEARING PLATE. THE SECOND NUT WILL BE INSTALLED TIGHT TO THE FIRST. REFER TO THE SHOP DRAWINGS TO DETERMINE WHICH END OF THE BRIDGE IS TO BE THE FIXED OR EXPANSION END.
- WHEN INSTALLING PAINTED BRIDGES CARE MUST BE TAKEN TO MINIMIZE DAMAGE TO THE FINISH DURING INSTALLATION. PADDING SHOULD BE USED TO PROTECT THE PAINT FROM CHAIN, CHOKER OR SLING. IT WILL BE THE RESPONSIBILITY OF THE ONSITE CONTRACTOR TO PERFORM ALL TOUCH UP PAINTING AS NECESSARY. A NOMINAL AMOUNT OF TOUCH UP PAINT WILL BE SUPPLIED. THIS IS OFTEN AN EPOXY SYSTEM AND ATTENTION WILL NEED TO BE GIVEN TO MIXING THE PAINT. TOUCH UP MUST BE APPLIED TO BLEND WITH FACTORY APPLICATION AS MUCH AS POSSIBLE.

0	RELEASED	12/6/2011

BIG R BRIDGE

P.O. BOX 1290 • GREELEY, COLORADO 80632-1290

PHONE: (970) 356-9600 • FAX (970) 356-9621

TOLL FREE: (800) 234 0734 • www.bigrbridge.com

PEDESTRIAN BRIDGE INSTALLATION GUIDE

BIG R BRIDGE

GREELEY, CO

SHEET NO. 1 OF 1

BRIDGE DESIGN CALCULATIONS

FOR

PRESSENTIN PARK BRIDGE 1

SKAGIT COUNTY PUBLIC WORKS

83.292' X 6' HALF-THROUGH H-SECTION

WEATHERING STEEL BRIDGE

MARBLEMOUNT, WA

BIG R BRIDGE JOB NO. BR19-00321/1

Design Specifications: LRFD GUIDE SPECIFICATIONS FOR DESIGN OF PEDESTRIAN BRIDGES BY AASHTO, DECEMBER 2009 (AGS)

Other Specifications: AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS, 7TH EDITION, 2014 (ABDS)

AASHTO STANDARD SPECIFICATIONS FOR STRUCTURAL SUPPORTS FOR HIGHWAY SIGNS, LUMINAIRES, AND TRAFFIC SIGNALS, 6TH EDITION, 2013 (ASHS)

STEEL CONSTRUCTION MANUAL BY AISC, 14TH EDITION (AISC)

SPECIFICATION FOR STRUCTURAL STEEL BUILDINGS, 2010 (SSSB)

Structural Steel Material:

TUBING: A847
SHAPES: A588
PLATES: A588

December 24, 2019

Truss Layout

CL Bridge Length =	83.29167	ft
Low End Deck Cantilever =	0	ft
High End Deck Cantilever =	0	ft
Bridge Width = W =	6	ft
Bridge Height = H =	54	in
Roof Height =	0	in
Rail Height =	54	in
Total Bridge Width =	6.833333	ft
Total Truss Height =	6.166667	ft
Number of Bays =	10	ea

	Length	End Bay 1	End Bay 2
Front Truss (ft) :	83.29167	8.104167	8.104167
Rear Truss (ft) :	83.29167	8.104167	8.104167

Mid Bay Spacing =	8.333333	ft
CL to CL Chord Width = b =	77	in
CL TC to CL FB Max = h =	60.57	in
CL TC to CL FB Ave = h =	60.57	in
x =	1.86	in
Rise in Bearing Elevations =	0	in
Total Camber =	11 3/4	in
DL Camber =	1 1/8	in

Bridge Skew 1 =	0 °		End FB 1 Skew =	0 °
Bridge Skew 2 =	0 °		End FB 2 Skew =	0 °
			Int FB Skew =	0 °

Members		In-Plane Orientation	Number of Bays	Plated
End Top Chord =	HSS5x5x1/4	X	0	N
Top Chord =	HSS5x5x1/4	X		N
End Bottom Chord =	HSS5x5x1/4	X	0	N
Bottom Chord =	HSS5x5x1/4	X		N
End Verticals =	HSS5x5x1/4	X		
1st Verticals =	HSS4x4x1/4	X	0	
Verticals =	HSS4x4x1/4	X		
End Diagonals =	HSS4x3x1/4	Y	1	
Overlapped Diagonals =	HSS3x2x1/4	Y	0	
Gapped Diagonals =	HSS3x2x1/4	Y		
End Brace Diags. =	HSS3x3x1/4	X	1	
Brace Diagonals =	HSS3x3x1/4	X	3	
Stacked End Floor Beam =	N/A	N/A		
End Floor Beams =	W8x18	X		
1st Floor Beams =	W8x18	X	0	
Floor Beams =	W8x18	X		
End Top Brace Diagonals =	N/A			
Top Brace Diagonals =	N/A			
End Portal Struts =	N/A			
Portal Struts =	N/A			
Stringers =	N/A			
Shipping Struts =	N/A			
TC Plating =	N/A			
BC Plating =	N/A			

Interior Bay Gap = 1.25 in Starting at bay 2

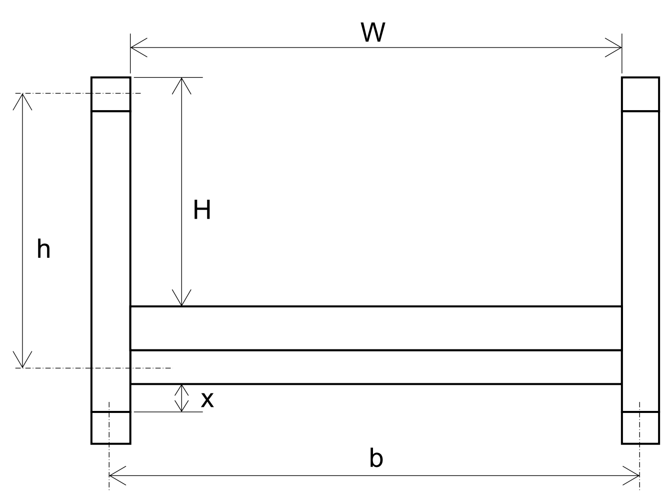
	Front Truss	Rear Truss
End Diagonal Angle =	34.60672 °	34.60672 °
End Diagonal Angle =	34.60672 °	34.60672 °
Overlapped Diagonal Angle =	33.83359 °	33.83359 °
Gapped Diagonal Angle =	35.40273 °	35.40273 °

End Brace Diagonal Gap From End FB = 0.75 in

Brace Diagonal Gap From CL = 0.75 in

Deck Layout:

Type =	Concrete			
Decking =	VULCRAFT 1.5C18			
Thickness of Deck at Edge =	5 in,	at CL =	5	in
Concrete Top Cover at Edge =	1.5 in,	at CL =	1.5	in
Top of Decking to Rebar =	0.875 in			
Rebar Size =	5			
Rebar Spacing =	12			
Stringer Spacing =	N/A in			



Bridge Length =	83.292	ft	Bridge Inside Width =	6	ft	Total Deck Area =	499.75	sf
Bay Length =	8.3333	ft	Clear Deck Width =	6	ft	Usable Deck Area =	499.75	sf
			Bridge Roof Width =	6.8333	ft	Total Roof Area =	569.16	sf

Dead Loads (DC)

Rail + Curb Weight =	14.199	lb/ft
Roof Weight =	0	psf
Deck Weight =	61.285	psf
Truss Weight =	10368	lb
Deck Load to End Floor Beam 1 =	261.1	lb/ft
Deck Load to End Floor Beam 2 =	261.1	lb/ft
Deck Load to Floor Beam =	510.71	lb/ft
Rail Load to End Vertical =	60.496	lb
Rail Load to Vertical =	118.33	lb
Roof Load to End Portal Strut 1 =	0	lb/ft
Roof Load to End Portal Strut 2 =	0	lb/ft
Roof Load to Portal Strut =	0	lb/ft
Total DC =	43361	lb

Wind Loads (WSH) (ASHS 3.8 & 3.9)

$P_z = 0.00256K_zGV^2I_rC_d$ =	46.214	psf
Basic Wind Speed = V =	90	mph
Design Life =	50	yr
$I_r = I_F$ =	1.15	
K_z =	1	
Max Height above grade =	32.8	ft
G =	***1.14***	
C_d =	***1.7***	
Projected Area of Truss =	215.37	sf
Projected Area of Deck & Rail =	284.82	sf
Projected Area of Roof =	0	sf
Total Projected Area = A_P =	500.2	sf
Wind Load to Top Chord =	69.383	lb/ft
Wind Load to Bottom Chord =	69.383	lb/ft
Total WS = P_zA_P =	23116	lb

Wind Loads (WSV) (ABDS 3.8.2)

P_V = ***20*** psf uplift over deck area

Uplift on Leeward Truss =	88.052	plf
Uplift on windward Truss =	31.948	plf

Wearing Surface & Utilities (DW)

DW Load to Verticals =	0	lb/ft
DW Load to Deck =	0	psf
DW to End Floor Beam 1 =	0	lb/ft
DW to End Floor Beam 2 =	0	lb/ft
DW to Floor Beam =	0	lb/ft
DW Load to End Vertical =	0	lb
DW Load toVertical =	0	lb
Total DW =	0	lb

Pedestrian Live Load (PL) (AGS 3.1)

Pedestrian Live Load =	90	psf
PL Reduction = $(0.25+15/A_T^{1/2})$ =	N/A	
Reduced Pedestrian Live Load (PL) =	90	psf
PL to End Floor Beam 1 =	383.44	lb/ft
PL to End Floor Beam 2 =	383.44	lb/ft
PL to Floor Beam =	750	lb/ft
Total PL =	44978	lb

Vehicle Live Load (LL) (AGS 3.2)

Vehicle =	4000	
IM =	1	
Weight =	4000	lb
Front Axle Spacing = WB =	4	ft
Rear Axle Spacing = WB_R =	0	ft
Wheel Spacing = T =	2.6667	ft
Edge = C =	0.75	ft
P_F =	1000	lb
P_R =	1000	lb
P_{RR} =	0	lb

Snow Load (SL)

Snow Load (SL) =	50	psf
SL to End Floor Beam 1 =	213.02	lb/ft
SL to End Floor Beam 2 =	213.02	lb/ft
SL to Floor Beam =	416.67	lb/ft
Total SL =	24988	lb

Fatigue Live Load (FLL) (ASHS 11)

$P_{NW} = 5.2C_dI_F =$ 10.166 psf

Horiz Fatigue Load to Top Chord = 15.263 lb/ft
Horiz Fatigue Load to Btm Chord = 15.263 lb/ft
Total Horizontal Fatigue Load = 5085 lb

V_T (Truck Speed if Over Road) = 0 mph
$P_{TG} = 18.8C_d(V_T/65)^2I_F =$ 0 psf
Vertical Fatigue Load to Btm Chord = 0 lb/ft

Stream Load (WA) (ABDS 3.7.3)

Stream Velocity = V = 0 fps
at 0 ft above deck
$P_{max} = C_DV^2 =$ 0 psf
$C_D =$ 1.4

Stream Force to Bottom Chord = 0 lb/ft
Stream Force to Top Chord = 0 lb/ft
Total Stream Load = 0 lb

Seismic Loads (EQ)

Design to ABDS 3.10
* See Seismic Loading Page for Details

For Load Factors and Combinations, use ABDS Table 3.4.1-1

Basic Load Combination = $\gamma_{DC}DC+\gamma_{DW}DW+\gamma_{PL}PL+\gamma_{LL}LL+\gamma_{SL}SL+\gamma_{WS}WS+\gamma_{EQ}EQ+\gamma_{WA}WA$

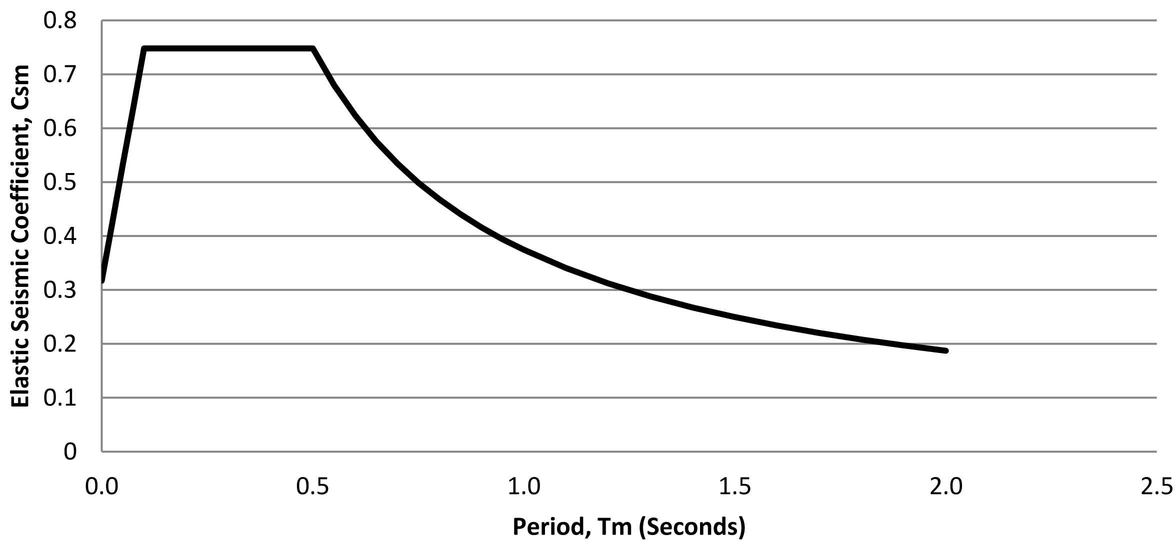
Load Combination Number	Load Combination Name	Load Factors γ_{DC}	γ_{DW}	γ_{PL}	γ_{LL}	γ_{SL}	γ_{WS}	γ_{EQ}	γ_{WA}	Notes
1	Strength I (PL)	*1.25*	*1.50*	*1.75*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	
2	Strength I (LL)	*1.25*	*1.50*	*0.00*	*1.75*	*0.00*	*0.00*	*0.00*	*0.00*	
3	Strength III	*1.25*	*1.50*	*0.00*	*0.00*	*0.00*	*1.40*	*0.00*	*0.00*	
4	Extreme Event I	*1.00*	*1.00*	*0.25*	*0.00*	*0.00*	*0.00*	*1.00*	*0.00*	See Note 1 & ABDS 6.5.5
5	Flood	*1.25*	*1.50*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*1.00*	
	Fatigue	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.32*	*0.00*	*0.00*	
	Service	*1.00*	*1.00*	*1.30*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	Used for Splice Slip only

Note 1: Per AASHTO, single span bridges need only the connection between bridge span and the abutment designed for seismic loads.
Do not apply LC 4 to the bridge unless the project specifications require it.

BIG R BRIDGE	Project:	PRESSENTIN PARK BRIDGE 1	By:	ENL
	Job No.:	BR19-00321/1	Date:	12/24/2019
	Subject:	AASHTO SEISMIC LOADING	Page:	5 of 46

Reference

Design Response Spectrum, Fig 3.10.4.1-1



Site Class = ***D***

$A_s = F_{PGA}PGA =$ 0.3168 (3.10.4.2-2)

$S_{DS} = F_aS_S =$ 0.748 (3.10.4.2-3)

$S_{D1} = F_vS_1 =$ 0.3744 (3.10.4.2-6)

$T_o = 0.2T_s =$ 0.1001 sec

$T_s = S_{D1}/S_{DS} =$ 0.5005 sec

Use $C_{sm} =$ 0.748 at T = 0.2767 sec

PGA =	0.24	Figure 3.10.2.1-1
$S_S =$	0.55	Figure 3.10.2.1-2
$S_1 =$	0.18	Figure 3.10.2.1-3
$F_{PGA} =$	1.32	Table 3.10.3.2-1
$F_a =$	1.36	Table 3.10.3.2-2
$F_v =$	2.08	Table 3.10.3.2-3

Connection Between Superstructure and Abutment

Seismic Load = $C_{sm}W/R =$ 51056 lbs (for Abutment Connection)

Seismic Load = $C_{sm}W =$ 40845 lbs (for Bridge Reaction)

$W = P_{DC}+P_{DW}+\gamma_{PL}P_{PL}+\gamma_{SL}P_{SL} =$ 54605 lbs

Modification Factor, R = ***0.8*** Table 3.10.7.1-2

$g_{PL} =$ 0.25

$g_{SL} =$ 0.00

Reference

Maximum Deflections

$\Delta_{DL} = \Delta_{DC} + \Delta_{DW} =$ ***1.08*** in vertical   Node: ***N006***   L = 83.292 ft

$\Delta_{PL} =$ ***1.15*** in vertical   Node: ***N006***

$\Delta_{WS} =$ ***2.33*** in horizontal   Node: ***N006***

Allowable LL Deflection = L/X = 2.7764 in > Δ_{PL} **OK**   X = ***360***   AGS 5

Allowable WL Deflection = L/X = 2.7764 in > Δ_{WL} **OK**   X = ***360***

Camber: Use a minimum of 150% Δ_{DL} or 1.05% L + Δ_{DL}

Minimum Camber = 11.575 in use ***11.75*** in

Vibrations (Vertical Direction)

$f \approx 0.18(g/\Delta_{DL})^{1/2} =$ 3.4047 Hz > 3Hz **OK**   AGS 6

g = ***32.2*** ft/sec^2

Vibrations (Lateral Direction)

$\Delta_{DL\ lat} = 5WL^3/(384EI) =$ 0.7492 in $f \approx 0.18(g/\Delta_{DL\ lat})^{1/2} =$ 4.0877 Hz > 1.3 Hz **OK**   AGS 6

$I_{y\text{-}truss} =$ 25559 in^4

W = 43.361 k

U-Frame Calculations (Stability)   AGS 7.1.2

Int Frame:

b =	77 in	I_v =	7.8	E =	29000 ksi
h =	60.57 in	I_b =	61.9	L =	8.3333 ft (Bay Spacing)

Maximum Top Chord Compression

$P_{Max} =$ ***117.4*** $FS(P_{Max}) =$ 156.14 k   FS = ***1.33***

$P_c =$ 156.14 k

$C_{furn} = E/(h^2((h/3I_v)+(b/2I_b))) =$ 2.4622

$CL/P_c =$ 1.5769

1/K = 0.7796   AGS Tbl 7.1.2-1

K = 1.2826 < 1.3   Use K = **1.3**

0.01/K = 0.0078 >= 0.003   Use 0.01/K = 0.0078   AGS 7.1.1

Reference: AASHTO LRFD GUIDE SPECIFICATIONS FOR DESIGN OF PEDESTRIAN BRIDGES, Table 7.1.2-1

1/K	n = 4	n = 6	n = 8	n = 10	n = 12	n = 14	n = 16
1.000	3.686	3.616	3.660	3.714	3.754	3.785	3.809
0.980		3.284	2.944	2.806	2.787	2.771	2.774
0.960		3.000	2.665	2.542	2.456	2.454	2.479
0.950			2.595				
0.940		2.754		2.303	2.252	2.254	2.828
0.920		2.643		2.146	2.094	2.101	2.121
0.900	3.352	2.593	2.263	2.045	1.951	1.968	1.981
0.850		2.460	2.013	1.794	1.709	1.681	1.694
0.800	2.961	2.313	1.889	1.629	1.480	1.456	1.465
0.750		2.147	1.750	1.501	1.344	1.273	1.262
0.700	2.448	1.955	1.595	1.359	1.200	1.111	1.088
0.650		1.739	1.442	1.236	1.087	0.988	0.940
0.600	2.035	1.639	1.338	1.133	0.985	0.878	0.808
0.550		1.517	1.211	1.007	0.860	0.768	0.708
0.500	1.750	1.362	1.047	0.847	0.750	0.668	0.600
0.450		1.158	0.829	0.714	0.624	0.537	0.500
0.400	1.232	0.886	0.627	0.555	0.454	0.428	0.383
0.350		0.530	0.434	0.352	0.323	0.292	0.280
0.300	0.121	0.187	0.249	0.170	0.203	0.183	0.187
0.293	0						
0.259		0					
0.250			0.135	0.107	0.103	0.121	0.112
0.200			0.045	0.068	0.055	0.053	0.070
0.180			0				
0.150				0.017	0.031	0.029	0.025
0.139				0			
0.114					0		
0.100						0.003	0.010
0.097						0	
0.085							0

Int Frame:

n = 10

CL/P_c = 1.5769

1/K = 0.7796

n =	10	n =	10
1/K	CL/P_c	1/K	CL/P_c
0.75	1.501	0.75	1.501
0.8	1.629	0.8	1.629
1/K =	0.7796	1/K =	0.7796

Deck Loading (assume 3 span continuous deck) — Reference

Average Deck Thickness = 5 in — Decking = VULCRAFT 1.5C18

Design Deck Thickness = t_d = 5 in — Decking Thickness = t_{dk} = 1.5 in

Concrete Unit Weight = γ_c = 150 pcf — Decking Weight = 2.7 psf

Span = s = 8.3333 ft

Deck Width = W_1 = 6 ft

Dead Load (DC) — Concrete = 0.0563 ksf

Decking Weight = 0.0027 ksf — $M_{DC}(-) = 0.1ws^2$ = 0.4094 ft-k

Total DL = 0.059 ksf — $M_{DC}(+) = 0.08ws^2$ = 0.3275 ft-k

Dead Load (DW) — DW = 0 ksf — $M_{DW}(-) = 0.121ws^2$ = 0 ft-k

$M_{DW}(+) = 0.101ws^2$ = 0 ft-k

Pedestrian Live Load (PL) — PL = 0.09 ksf — $M_{PL}(-) = 0.121ws^2$ = 0.7563 ft-k

$M_{PL}(+) = 0.101ws^2$ = 0.6313 ft-k

Vehicle Load (LL)

P_1 = 1 k — Use E = 2 ft — $E = w+5(L_1W_1)^{1/2}$ = 3.324 ft — ABDS 4.6.2.3

P_2 = 1 k — $L_1 = s-b_f/2$ = 8.1146 ft — E = 1/2 Deck Width = 3 ft

Wheel Width = 5 in — b_f = 5.25 in — E = 0.75 Wheel Spacing = 2 ft

Wheel Spacing = 2.6667 ft — E = 0.6S+Wheel Width = 5.2854 ft — Structural Engineers Handbook, 4th Ed.

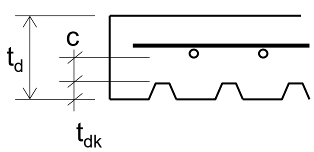
$M_{LL}(-) = (P_1f_1+P_2f_2)/E$ = 0.6633 ft-k — f_1 = -0.533 — f_2 = -0.793 — WB_R = N/A ft

$M_{LL}(+) = (P_1f_1+P_2f_2)/E$ = 0.9413 ft-k — f_1 = 1.7013 — f_2 = 0.1813 — WB_R = N/A ft

f_1 and f_2 are from Influence Lines

$M_{u(LC\ 1\ OR\ 2)}(-)$ = 1.8352 ft-k

$M_{u(LC\ 1\ OR\ 2)}(+)$ = 2.0567 ft-k



Reinforced Concrete Section Properties:

f'_c = ***4000*** psi — Try # ***5*** bars

f_y = ***60000*** psi — bar dia. = d_b = 0.625 in — Transverse bar # ***4*** bars

β_1 = 0.85 — bar area = 0.31 in^2 — bar dia. = d_{Tr} = 0.5 in

Effective Deck Thickness = $h = t_d - t_{dk}/2$ = 4.25 in — b = ***12*** in

c = ***0.875*** in — Cover = 1.5 in

$d(+) = t_d - t_{dk} - c - d_b/2$ = 2.3125 in — $d(-) = c+(t_{dk}+d_b)/2$ = 1.9375 in

Flexure Capacity (+)

$c = A_sf_y/(0.85f'_c\beta_1 b)$ = 0.5363 — ε_t = 0.0099 — c/d = 0.2319 — ABDS 5.7.2.1

A_s = 0.31 in^2 — ϕ = 0.9 — ABDS 5.5.4.2

$a = \beta_1 c$ = 0.4559 in — Max Bar Spacing = 12 in — 0.8513 — ABDS 5.7.2.2

$\phi M_n = \phi(A_sf_y(d-a/2))$ = 34896 in-lb = 2.908 ft-k > $M_u(+)$ — **OK** — ABDS 5.7.3.2.3

Flexure Capacity (-)

$c = A_sf_y/(0.85f'_c\beta_1 b)$ = 0.5363 — ε_t = 0.0078 — c/d = 0.2768

A_s = 0.31 in^2 — ϕ = 0.9 — ABDS 5.5.4.2

$a = \beta_1 c$ = 0.4559 in — Max Bar Spacing = 12 in — 0.5497 — ABDS 5.7.2.2

$\phi M_n = \phi(A_sf_y(d-a/2))$ = 28618 in-lb = 2.3848 ft-k > $M_u(-)$ — **OK** — ABDS 5.7.3.2.3

Use # 5 bars at 12 in spacing

Project:	PRESSENTIN PARK BRIDGE 1	By:	ENL
Job No.:	BR19-00321/1	Date:	12/24/2019
Subject:	INFLUENCE LINES, 3 SPAN	Page:	9 of 46

P

A 1.1 1.2 1.3 1.4 1.5 1.6 1.7 1.8 1.9 B 2.1 2.2 2.3 2.4 2.5 2.6 2.7 2.8 2.9 C 3.1 3.2 3.3 3.4 3.5 3.6 3.7 3.8 3.9 D

Span 1 Span 2 Span 3

Span 1 Length = 8.3333 Span 2 Length = 8.3333 Span 3 Length = 8.3333

Moments/P

	A	1.1	1.2	1.3	1.4	1.5	1.6	1.7	1.8	1.9	B	2.1	2.2	2.3	2.4	2.5	2.6	2.7	2.8	2.9	C	3.1	3.2	3.3	3.4	3.5	3.6	3.7	3.8	3.9	D	+ Area	- Area	Total Ar
A	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000			
1.1	0.0000	0.7280	0.6240	0.5227	0.4253	0.3333	0.2480	0.1707	0.1027	0.0453	0.0000	-0.0325	-0.0533	-0.0642	-0.0667	-0.0625	-0.0533	-0.0408	-0.0267	-0.0125	0.0000	0.0095	0.0160	0.0198	0.0213	0.0208	0.0187	0.0152	0.0107	0.0055	0.0000			
1.2	0.0000	0.6227	1.2480	1.0453	0.8507	0.6667	0.4960	0.3413	0.2053	0.0907	0.0000	-0.0650	-0.1067	-0.1283	-0.1333	-0.1250	-0.1067	-0.0817	-0.0533	-0.0250	0.0000	0.0190	0.0320	0.0397	0.0427	0.0417	0.0373	0.0303	0.0213	0.0110	0.0000			
1.3	0.0000	0.5173	1.0387	1.5680	1.2760	1.0000	0.7440	0.5120	0.3080	0.1360	0.0000	-0.0975	-0.1600	-0.1925	-0.2000	-0.1875	-0.1600	-0.1225	-0.0800	-0.0375	0.0000	0.0285	0.0480	0.0595	0.0640	0.0625	0.0560	0.0455	0.0320	0.0165	0.0000			
1.4	0.0000	0.4120	0.8293	1.2573	1.7013	1.3333	0.9920	0.6827	0.4107	0.1813	0.0000	-0.1300	-0.2133	-0.2567	-0.2667	-0.2500	-0.2133	-0.1633	-0.1067	-0.0500	0.0000	0.0380	0.0640	0.0793	0.0853	0.0833	0.0747	0.0607	0.0427	0.0220	0.0000			
1.5	0.0000	0.3067	0.6200	0.9467	1.2933	1.6667	1.2400	0.8533	0.5133	0.2267	0.0000	-0.1625	-0.2667	-0.3208	-0.3333	-0.3125	-0.2667	-0.2042	-0.1333	-0.0625	0.0000	0.0475	0.0800	0.0992	0.1067	0.1042	0.0933	0.0758	0.0533	0.0275	0.0000			
1.6	0.0000	0.2013	0.4107	0.6360	0.8853	1.1667	1.4880	1.0240	0.6160	0.2720	0.0000	-0.1950	-0.3200	-0.3850	-0.4000	-0.3750	-0.3200	-0.2450	-0.1600	-0.0750	0.0000	0.0570	0.0960	0.1190	0.1280	0.1250	0.1120	0.0910	0.0640	0.0330	0.0000			
1.7	0.0000	0.0960	0.2013	0.3253	0.4773	0.6667	0.9027	1.1947	0.7187	0.3173	0.0000	-0.2275	-0.3733	-0.4492	-0.4667	-0.4375	-0.3733	-0.2858	-0.1867	-0.0875	0.0000	0.0665	0.1120	0.1388	0.1493	0.1458	0.1307	0.1062	0.0747	0.0385	0.0000			
1.8	0.0000	-0.0093	-0.0080	0.0147	0.0693	0.1667	0.3173	0.5320	0.8213	0.3627	0.0000	-0.2600	-0.4267	-0.5133	-0.5333	-0.5000	-0.4267	-0.3267	-0.2133	-0.1000	0.0000	0.0760	0.1280	0.1587	0.1707	0.1667	0.1493	0.1213	0.0853	0.0440	0.0000			
1.9	0.0000	-0.1147	-0.2173	-0.2960	-0.3387	-0.3333	-0.2680	-0.1307	0.0907	0.4080	0.0000	-0.2925	-0.4800	-0.5775	-0.6000	-0.5625	-0.4800	-0.3675	-0.2400	-0.1125	0.0000	0.0855	0.1440	0.1785	0.1920	0.1875	0.1680	0.1365	0.0960	0.0495	0.0000			
B	0.0000	-0.2200	-0.4267	-0.6067	-0.7467	-0.8333	-0.8533	-0.7933	-0.6400	-0.3800	0.0000	-0.3250	-0.5333	-0.6417	-0.6667	-0.6250	-0.5333	-0.4083	-0.2667	-0.1250	0.0000	0.0950	0.1600	0.1983	0.2133	0.2083	0.1867	0.1517	0.1067	0.0550	0.0000	1.1574	-8.1019	-6.9444
2.1	0.0000	-0.1925	-0.3733	-0.5308	-0.6533	-0.7292	-0.7467	-0.6942	-0.5600	-0.3325	0.0000	0.4450	0.1600	-0.0350	-0.1533	-0.2083	-0.2133	-0.1817	-0.1267	-0.0617	0.0000	0.0475	0.0800	0.0992	0.1067	0.1042	0.0933	0.0758	0.0533	0.0275	0.0000			
2.2	0.0000	-0.1650	-0.3200	-0.4550	-0.5600	-0.6250	-0.6400	-0.5950	-0.4800	-0.2850	0.0000	0.3817	0.8533	0.5717	0.3600	0.2083	0.1067	0.0450	0.0133	0.0017	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000			
2.3	0.0000	-0.1375	-0.2667	-0.3792	-0.4667	-0.5208	-0.5333	-0.4958	-0.4000	-0.2375	0.0000	0.3183	0.7133	1.1783	0.8733	0.6250	0.4267	0.2717	0.1533	0.0650	0.0000	-0.0475	-0.0800	-0.0992	-0.1067	-0.1042	-0.0933	-0.0758	-0.0533	-0.0275	0.0000			
2.4	0.0000	-0.1100	-0.2133	-0.3033	-0.3733	-0.4167	-0.4267	-0.3967	-0.3200	-0.1900	0.0000	0.2550	0.5733	0.9517	1.3867	1.0417	0.7467	0.4983	0.2933	0.1283	0.0000	-0.0950	-0.1600	-0.1983	-0.2133	-0.2083	-0.1867	-0.1517	-0.1067	-0.0550	0.0000			
2.5	0.0000	-0.0825	-0.1600	-0.2275	-0.2800	-0.3125	-0.3200	-0.2975	-0.2400	-0.1425	0.0000	0.1917	0.4333	0.7250	1.0667	1.4583	1.0667	0.7250	0.4333	0.1917	0.0000	-0.1425	-0.2400	-0.2975	-0.3200	-0.3125	-0.2800	-0.2275	-0.1600	-0.0825	0.0000			
2.6	0.0000	-0.0550	-0.1067	-0.1517	-0.1867	-0.2083	-0.2133	-0.1983	-0.1600	-0.0950	0.0000	0.1283	0.2933	0.4983	0.7467	1.0417	1.3867	0.9517	0.5733	0.2550	0.0000	-0.1900	-0.3200	-0.3967	-0.4267	-0.4167	-0.3733	-0.3033	-0.2133	-0.1100	0.0000			
2.7	0.0000	-0.0275	-0.0533	-0.0758	-0.0933	-0.1042	-0.1067	-0.0992	-0.0800	-0.0475	0.0000	0.0650	0.1533	0.2717	0.4267	0.6250	0.8733	1.1783	0.7133	0.3183	0.0000	-0.2375	-0.4000	-0.4958	-0.5333	-0.5208	-0.4667	-0.3792	-0.2667	-0.1375	0.0000			
2.8	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0017	0.0133	0.0450	0.1067	0.2083	0.3600	0.5717	0.8533	0.3817	0.0000	-0.2850	-0.4800	-0.5950	-0.6400	-0.6250	-0.5600	-0.4550	-0.3200	-0.1650	0.0000			
2.9	0.0000	0.0275	0.0533	0.0758	0.0933	0.1042	0.1067	0.0992	0.0800	0.0475	0.0000	-0.0617	-0.1267	-0.1817	-0.2133	-0.2083	-0.1533	-0.0350	0.1600	0.4450	0.0000	-0.3325	-0.5600	-0.6942	-0.7467	-0.7292	-0.6533	-0.5308	-0.3733	-0.1925	0.0000			
C	0.0000	0.0550	0.1067	0.1517	0.1867	0.2083	0.2133	0.1983	0.1600	0.0950	0.0000	-0.1250	-0.2667	-0.4083	-0.5333	-0.6250	-0.6667	-0.6417	-0.5333	-0.3250	0.0000	-0.3800	-0.6400	-0.7933	-0.8533	-0.8333	-0.7467	-0.6067	-0.4267	-0.2200	0.0000	1.1574	-8.1019	-6.9444
3.1	0.0000	0.0495	0.0960	0.1365	0.1680	0.1875	0.1920	0.1785	0.1440	0.0855	0.0000	-0.1125	-0.2400	-0.3675	-0.4800	-0.5625	-0.6000	-0.5775	-0.4800	-0.2925	0.0000	0.4080	0.0907	-0.1307	-0.2680	-0.3333	-0.3387	-0.2960	-0.2173	-0.1147	0.0000			
3.2	0.0000	0.0440	0.0853	0.1213	0.1493	0.1667	0.1707	0.1587	0.1280	0.0760	0.0000	-0.1000	-0.2133	-0.3267	-0.4267	-0.5000	-0.5333	-0.5133	-0.4267	-0.2600	0.0000	0.3627	0.8213	0.5320	0.3173	0.1667	0.0693	0.0147	-0.0080	-0.0093	0.0000			
3.3	0.0000	0.0385	0.0747	0.1062	0.1307	0.1458	0.1493	0.1388	0.1120	0.0665	0.0000	-0.0875	-0.1867	-0.2858	-0.3733	-0.4375	-0.4667	-0.4492	-0.3733	-0.2275	0.0000	0.3173	0.7187	1.1947	0.9027	0.6667	0.4773	0.3253	0.2013	0.0960	0.0000			
3.4	0.0000	0.0330	0.0640	0.0910	0.1120	0.1250	0.1280	0.1190	0.0960	0.0570	0.0000	-0.0750	-0.1600	-0.2450	-0.3200	-0.3750	-0.4000	-0.3850	-0.3200	-0.1950	0.0000	0.2720	0.6160	1.0240	1.4880	1.1667	0.8853	0.6360	0.4107	0.2013	0.0000			
3.5	0.0000	0.0275	0.0533	0.0758	0.0933	0.1042	0.1067	0.0992	0.0800	0.0475	0.0000	-0.0625	-0.1333	-0.2042	-0.2667	-0.3125	-0.3333	-0.3208	-0.2667	-0.1625	0.0000	0.2267	0.5133	0.8533	1.2400	1.6667	1.2933	0.9467	0.6200	0.3067	0.0000			
3.6	0.0000	0.0220	0.0427	0.0607	0.0747	0.0833	0.0853	0.0793	0.0640	0.0380	0.0000	-0.0500	-0.1067	-0.1633	-0.2133	-0.2500	-0.2667	-0.2567	-0.2133	-0.1300	0.0000	0.1813	0.4107	0.6827	0.9920	1.3333	1.7013	1.2573	0.8293	0.4120	0.0000			
3.7	0.0000	0.0165	0.0320	0.0455	0.0560	0.0625	0.0640	0.0595	0.0480	0.0285	0.0000	-0.0375	-0.0800	-0.1225	-0.1600	-0.1875	-0.2000	-0.1925	-0.1600	-0.0975	0.0000	0.1360	0.3080	0.5120	0.7440	1.0000	1.2760	1.5680	1.0387	0.5173	0.0000			
3.8	0.0000	0.0110	0.0213	0.0303	0.0373	0.0417	0.0427	0.0397	0.0320	0.0190	0.0000	-0.0250	-0.0533	-0.0817	-0.1067	-0.1250	-0.1333	-0.1283	-0.1067	-0.0650	0.0000	0.0907	0.2053	0.3413	0.4960	0.6667	0.8507	1.0453	1.2480	0.6227	0.0000			
3.9	0.0000	0.0055	0.0107	0.0152	0.0187	0.0208	0.0213	0.0198	0.0160	0.0095	0.0000	-0.0125	-0.0267	-0.0408	-0.0533	-0.0625	-0.0667	-0.0642	-0.0533	-0.0325	0.0000	0.0453	0.1027	0.1707	0.2480	0.3333	0.4253	0.5227	0.6240	0.7280	0.0000			
D	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000			

		A	1.1	1.2	1.3	1.4	1.5	1.6	1.7	1.8	1.9	B	2.1	2.2	2.3	2.4	2.5	2.6	2.7	2.8	2.9	C	3.1	3.2	3.3	3.4	3.5	3.6	3.7	3.8	3.9	D	+ Area	- Area	Total Ar
Reactions/P	R_A	0.0000	0.8736	0.7488	0.6272	0.5104	0.4000	0.2976	0.2048	0.1232	0.0544	0.0000	-0.0390	-0.0640	-0.0770	-0.0800	-0.0750	-0.0640	-0.0490	-0.0320	-0.0150	0.0000	0.0114	0.0192	0.0238	0.0256	0.0250	0.0224	0.0182	0.0128	0.0066	0.0000	3.7500	-0.4167	3.3333
	R_B	0.0000	0.1594	0.3152	0.4638	0.6016	0.7250	0.8304	0.9142	0.9728	1.0026	1.0000	0.9630	0.8960	0.8050	0.6960	0.5750	0.4480	0.3210	0.2000	0.0910	0.0000	-0.0684	-0.1152	-0.1428	-0.1536	-0.1500	-0.1344	-0.1092	-0.0768	-0.0396	0.0000	10.0000	-0.8333	9.1667
	R_C	0.0000	-0.0396	-0.0768	-0.1092	-0.1344	-0.1500	-0.1536	-0.1428	-0.1152	-0.0684	0.0000	0.0910	0.2000	0.3210	0.4480	0.5750	0.6960	0.8050	0.8960	0.9630	1.0000	1.0026	0.9728	0.9142	0.8304	0.7250	0.6016	0.4638	0.3152	0.1594	0.0000	10.0000	-0.8333	9.1667
	R_D	0.0000	0.0066	0.0128	0.0182	0.0224	0.0250	0.0256	0.0238	0.0192	0.0114	0.0000	-0.0150	-0.0320	-0.0490	-0.0640	-0.0750	-0.0800	-0.0770	-0.0640	-0.0390	0.0000	0.0544	0.1232	0.2048	0.2976	0.4000	0.5104	0.6272	0.7488	0.8736	1.0000	3.7500	-0.4167	3.3333
Shears/P	V_{AB}	0.0000	0.8736	0.7488	0.6272	0.5104	0.4000	0.2976	0.2048	0.1232	0.0544	0.0000	-0.0390	-0.0640	-0.0770	-0.0800	-0.0750	-0.0640	-0.0490	-0.0320	-0.0150	0.0000	0.0114	0.0192	0.0238	0.0256	0.0250	0.0224	0.0182	0.0128	0.0066	0.0000	3.7500	-0.4167	3.3333
	V_{BA}	0.0000	-0.1264	-0.2512	-0.3728	-0.4896	-0.6000	-0.7024	-0.7952	-0.8768	-0.9456	-1 / 0	-0.0390	-0.0640	-0.0770	-0.0800	-0.0750	-0.0640	-0.0490	-0.0320	-0.0150	0.0000	0.0114	0.0192	0.0238	0.0256	0.0250	0.0224	0.0182	0.0128	0.0066	0.0000	0.1389	-5.1389	-5.0000
	V_{BC}	0.0000	0.0330	0.0640	0.0910	0.1120	0.1250	0.1280	0.1190	0.0960	0.0570	0 / 1	0.9240	0.8320	0.7280	0.6160	0.5000	0.3840	0.2720	0.1680	0.0760	0.0000	-0.0570	-0.0960	-0.1190	-0.1280	-0.1250	-0.1120	-0.0910	-0.0640	-0.0330	0.0000	4.8611	-0.6944	4.1667
	V_{CB}	0.0000	0.0330	0.0640	0.0910	0.1120	0.1250	0.1280	0.1190	0.0960	0.0570	0.0000	-0.0760	-0.1680	-0.2720	-0.3840	-0.5000	-0.6160	-0.7280	-0.8320	-0.9240	-1 / 0	-0.0570	-0.0960	-0.1190	-0.1280	-0.1250	-0.1120	-0.0910	-0.0640	-0.0330	0.0000	0.6944	-4.8611	-4.1667
	V_{CD}	0.0000	-0.0066	-0.0128	-0.0182	-0.0224	-0.0250	-0.0256	-0.0238	-0.0192	-0.0114	0.0000	0.0150	0.0320	0.0490	0.0640	0.0750	0.0800	0.0770	0.0640	0.0390	0 / 1	0.9456	0.8768	0.7952	0.7024	0.6000	0.4896	0.3728	0.2512	0.1264	0.0000	5.1389	-0.1389	5.0000
	V_{DC}	0.0000	-0.0066	-0.0128	-0.0182	-0.0224	-0.0250	-0.0256	-0.0238	-0.0192	-0.0114	0.0000	0.0150	0.0320	0.0490	0.0640	0.0750	0.0800	0.0770	0.0640	0.0390	0.0000	-0.0544	-0.1232	-0.2048	-0.2976	-0.4000	-0.5104	-0.6272	-0.7488	-0.8736	-1.0000	0.4167	-3.7500	-3.3333

Reference

Lateral Loads:

				Reference
Half-Through Truss:	End Frame:	$P_{LAT} = 0.01P_{EV}$	$M_{LAT} = P_{LAT}h$	AGS 7.1.1
	Int Frame:	$P_{LAT} = P_{TC}/(100K)$	$M_{LAT} = P_{LAT}h$	AGS 7.1.1
Full-Through (Box) Truss:	End Frame:	$P_{LAT} = WS_{Pin}$	$M_{Lat} = P_{LAT}M_{MD}$	
	Int Frame:	$P_{LAT} = P_{TC}/(100)$	$M_{Lat} = P_{LAT}M_{MD}$	

		1st Int Frame		Int Frame	
$P_{(EV\ LC\ 1)}$ =	***32.6*** k	$P_{(TC\ LC\ 1)}$ =	***117.4*** k	$P_{(TC\ LC\ 1)}$ =	***117.4*** k
$P_{(EV\ LC\ 2)}$ =	***18.9*** k	$P_{(TC\ LC\ 2)}$ =	***62*** k	$P_{(TC\ LC\ 2)}$ =	***62*** k
$P_{(EV\ LC\ 3)}$ =	***20.8*** k	$P_{(TC\ LC\ 3)}$ =	***64.4*** k	$P_{(TC\ LC\ 3)}$ =	***64.4*** k
$P_{(EV\ LC\ 4)}$ =	***0*** k	$P_{(TC\ LC\ 4)}$ =	***0*** k	$P_{(TC\ LC\ 4)}$ =	***0*** k
$P_{(EV\ LC\ 5)}$ =	***0*** k	$P_{(TC\ LC\ 5)}$ =	***0*** k	$P_{(TC\ LC\ 5)}$ =	***0*** k
		K =	1.2826	K =	1.2826

h = 5.0475 ft

WS_{Pin} = 1.9596 k (1/2 Force at top of End Portal assuming all int portals are pinned)

End Frame/Portal

	P_{LAT}	M_{LAT} Floor Beam	M_{LAT} Vertical	Portal Strut
LC 1:	0.326 k	1.6455 ft-k	1.6455 ft-k	N/A ft-k
LC 2:	0.189 k	0.954 ft-k	0.954 ft-k	N/A ft-k
LC 3:	0.208 k	1.0499 ft-k	1.0499 ft-k	N/A ft-k
LC 4:	0 k	0 ft-k	0 ft-k	N/A ft-k
LC 5:	0 k	0 ft-k	0 ft-k	N/A ft-k

1st Int Frame/Portal

	P_{LAT}	M_{LAT} Floor Beam	M_{LAT} Vertical	Portal Strut
LC 1:	0.9153 k	4.62 ft-k	4.62 ft-k	N/A ft-k
LC 2:	0.4834 k	2.4399 ft-k	2.4399 ft-k	N/A ft-k
LC 3:	0.5021 k	2.5343 ft-k	2.5343 ft-k	N/A ft-k
LC 4:	0 k	0 ft-k	0 ft-k	N/A ft-k
LC 5:	0 k	0 ft-k	0 ft-k	N/A ft-k

Int Frame/Portal

	P_{LAT}	M_{LAT} Floor Beam	M_{LAT} Vertical	Portal Strut
LC 1:	0.9153 k	4.62 ft-k	4.62 ft-k	N/A ft-k
LC 2:	0.4834 k	2.4399 ft-k	2.4399 ft-k	N/A ft-k
LC 3:	0.5021 k	2.5343 ft-k	2.5343 ft-k	N/A ft-k
LC 4:	0 k	0 ft-k	0 ft-k	N/A ft-k
LC 5:	0 k	0 ft-k	0 ft-k	N/A ft-k

Reference

w_{DC} =	279.1	lb/ft	V_{DC} =	0.8373	k	M_{DC} =	1.26	ft-k
w_{DW} =	0	lb/ft	V_{DW} =	0	k	M_{DW} =	0.00	ft-k
w_{PL} =	383.44	lb/ft	V_{PL} =	1.1503	k	M_{PL} =	1.73	ft-k
P_{LL} =	1506.4	lb	V_{LL} =	1.9667	k	M_{LL} =	2.7025	ft-k

Span = L_b = 6 ft

Moment and Shear

	V_{SS}	M_{SS}	M_{LAT}	$M_{SS}+M_{LAT}$
LC 1:	3.0597 k	4.5895 ft-k	1.6455 ft-k	6.235 ft-k
LC 2:	4.4884 k	6.2993 ft-k	0.954 ft-k	7.2533 ft-k
LC 3:	1.0466 k	1.5699 ft-k	1.0499 ft-k	2.6198 ft-k
LC 4:	1.1249 k	1.6873 ft-k	0 ft-k	1.6873 ft-k
LC 5:	1.0466 k	1.5699 ft-k	0 ft-k	1.5699 ft-k
V_r =	4.60 k		M_r =	10.45 ft-k

Beam Data

Beam Size =	W8x18		F_y =	***50***	ksi
Z_x =	17	in^3	E =	***29000***	ksi
S_x =	15.2	in^3	$D = d-2t_f$ =	7.48	in
b_f =	5.25	in	$D_c = D_{cp} = D/2$ =	3.74	in
t_f =	0.33	in	$h = d-t_f$ =	7.81	in
d =	8.14	in			
t_w =	0.23	in	$M_p = F_yZ_x$ =	850	k-in
I_x =	61.9	in^4	$M_y = F_yS_x$ =	760	k-in
			$F_{yr} = 0.7F_{yc}$ =	35	ksi

Vertical Data

	Orientation	Height (in)	Width (in)	Thickness (in)
Vertical: HSS5x5x1/4	X	H = 5	B = 5	t = 0.233
		F_y = 50000 psi		
		F_u = 70000 psi		

Resistance Factors ABDS 6.5.4.2

ϕ_f = 1 ϕ_v = 1 ϕ_{e2} = 0.8

Check Flexure Capacity (Use the Provisions of Appendix A6):

F_y		<=	***70*** ksi		OK	ABDS A6.1
$2D_c/t_w$ =	32.522	<	$5.7(E/F_{yc})^{1/2}$ =	137.27	OK	ABDS (A6.1-1)
I_{yc}/I_{yt} =	***1***	>=	0.3		OK	ABDS (A6.1-2)

							Reference
Compression Flange							
$M_u+(1/3)f_lS_{xc}$ =	**23.12**	**ft-k**	**<=**	ϕ_fM_{nc} =	**62.47 ft-k**	**OK**	ABDS (A6.1.1-1)
Tension Flange							
$M_u+(1/3)f_lS_{xt}$ =	**23.117**	**ft-k**	**<=**	ϕ_fM_{nt} =	**70.833 ft-k**	**OK**	ABDS (A6.1.2-1)

Web Plastification Factors

						Reference
$2D_{cp}/t_w$ =	32.522	<=	$\lambda_{pw(Dcp)}$ =	91.175	**Section is Compact**	ABDS (A6.2.1-1)
$\lambda_w = 2D_c/t_w$ =	32.522	<	λ_{rw} =	137.27		ABDS (A6.2.2-1)

					Reference
$\lambda_{pw(Dcp)} = (E/F_{yc})^{1/2}/(0.54(M_p/(R_hM_y))-.09)^2$ =	91.175	<=	$\lambda_{rw}(D_{cp}/D_c)$ Use $\lambda_{pw(Dcp)}$ =	91.175	ABDS (A6.2.1-2)
$\lambda_{pw(Dc)} = \lambda_{pw(Dcp)}(D_c/D_{cp})$ =	91.175	<=	λ_{rw} Use $\lambda_{pw(Dc)}$ =	91.175	ABDS (A6.2.2-6)

		Reference
R_h =	***1***	ABDS 6.10.1.10.1
$\lambda_{rw} = 5.7(E/F_{yc})^{1/2}$ =	137.27	ABDS (A6.2.1-3 & A6.2.2-3)
$R_{pc} = R_{pt} = M_p/M_y$ =	1.1184	ABDS (A6.2.1-4 & A6.2.1-5)

Local Buckling Resistance

					Reference
λ_f <= λ_{pf}		$M_{nc} = R_{pc}M_{yc}$ =	850	k-in	ABDS(A6.3.2-1)
		$M_{nc}= [1-(1-(F_{yr}S_x)/(R_{pc}M_{yc}))((\lambda_f-\lambda_{pf})/(\lambda_{rf}-\lambda_{pf}))]R_{pc}M_{yc}$ =	N/A	k-in	ABDS(A6.3.2-2)

		Reference
$\lambda_f = b_{fc}/(2t_{fc})$ =	7.9545	ABDS (A6.3.2-3)
$\lambda_{pf} = 0.38(E/F_{yc})^{1/2}$ =	9.1516	ABDS (A6.3.2-4)
$\lambda_{rf} = 0.95(Ek_c/F_y)^{0.5}$ =	19.945	ABDS (A6.3.2-5)
k_c =	***0.76***	ABDS (A6.3.2)

Lateral Torsional Buckling Resistance

			Reference
Use M_{nc} =	749.64	k-in	ABDS (A6.3.3-2)

				Reference
L_b > L_p	$M_{nc} = R_{pc}M_{yc}$ =	N/A	k-in	ABDS (A6.3.3-1)
L_b <= L_r	$M_{nc} =C_b[1-(1-F_{yr}S_{xc}/(R_{pc}M_{yc}))((L_b-L_p)/(L_r-L_p))]R_{pc}M_{yc}$ =	749.64	k-in	ABDS (A6.3.3-2)
	$M_{nc} = F_{cr}S_x$ =	N/A	k-in	ABDS (A6.3.3-3)

			Reference
L_b =	72	in	
L_p = 1.0 $r_t(E/F_y)^{1/2}$ =	33.809	in	ABDS (A6.3.3-4)
$L_r = 1.95r_t(E/F_{yr})(J/(S_{xc}h))^{.5}(1+(1+6.76(F_{yr}S_{xc}h/(EJ))^2)^{.5})^{.5}$ =	154.83	in	ABDS (A6.3.3-5)
$r_t = b_{fc}/(12(1+D_ct_w/(3b_{fc}t_{fc})))^{1/2}$ =	1.4038	in	ABDS (A6.3.3-10)
$J = Dt_w^3/3+b_{fc}t_{fc}^3(1-0.63t_{fc}/b_{fc})/3+b_{ft}t_{ft}^3(1-0.63t_{ft}/b_{ft})/3$ =	0.1511	in^4	ABDS (A6.3.3-9)
$F_{cr} = (C_b\pi^2E/(L_b/r_t)^2)(1+0.078J(L_b/r_t)^2/(S_xh))^{0.5}$ =	122.19	ksi	ABDS (A6.3.3-8)
C_b =	***1***		

Reference

Flexural Resistance on Tension Flange Yielding

$M_{nt} = R_{pt}M_{yt} =$ 850 k-in — ABDS (A6.4-1)

Flange Lateral Bending Stress

Use $f_l =$ *30* ksi

Check Shear (Unstiffened Webs)

$\phi_v V_n =$ 0.58C $\phi_v F_y A_w =$ 49.892 k > $V_u =$ 4.60 k — OK — ABDS 6.10.9.2

$A_w = Dt_w =$ 1.7204 in^2

$\lambda_{w1} = 1.12(Ek/F_{yw})^{1/2} =$ 60.314 $\lambda_{w2} = 1.4(Ek/F_{yw})^{1/2} =$ 75.392

If $\lambda_w \le \lambda_{w1}$	C =	1	ABDS (6.10.9.3.2-4)
If $\lambda_w > \lambda_{w1}$ and $\le \lambda_{w2}$,	$C = \lambda_{w1}/\lambda_w =$	1.8546	ABDS (6.10.9.3.2-5)
If $\lambda_w > \lambda_{w2}$,	$C = 1.51(Ek/F_{yw})/\lambda_w^2 =$	4.1403	ABDS (6.10.9.3.2-6)

λ_{w1} >= λ_w >= λ_{w2}, Use C = 1

k = ***5***

Check Floor Beam to Vertical Connection (Use the provisions of AISC K1)

V =	***4.6***	k	Load Case =	**3**
$M_{Joint\ Fixity}$ =	***9.4***	ft-k	Member =	**FB001**
$M_{U-Frame}$ =	1.0499	ft-k		
M_{Total} =	10.45	ft-k	Flange Force = P = $M_{Total}/(d-t_f)$ =	16.056 k

Check Applicability: — AISC Tbl K1.2A

Strength:	F_y <= 52 ksi		**OK**
Ductility:	F_y/F_u =	0.7 <= 0.8	**OK**
Width Ratio:	B_p/B =	1 >= 0.25	**OK**
	B_p/B =	1 <= 1	**OK**
$B_p = b_f$ = 5.25 in > B,	use B_p =	5 in	
Wall Slenderness:	B/t =	18.5 <= 35	**OK**

Check Local Yielding of Plate

$R_n = (10F_y t/(B/t))B_p =$ 31.486 k <= $F_{yp}t_pB_p =$ 82.5 k, use 31.486 k — SSSB (K1-7)

$\phi R_n =$ 29.912 k >= P — OK

$\phi =$ ***0.95***

Reference

Check Shear Yielding (Punching)

$B-2t =$ 4.534 < B_p Limit State is Not Applicable

$0.85B =$ 4 <= B_p Check Limit State

$R_n = (0.6F_y t(2t_p+2B_{ep}) =$ 42.397 k — SSSB (K1-8)

$B_{ep} = 10B_p/(B/t) =$ 2.7027 in <= B_p, use 2.7027 in — SSSB (K1-18)

$\phi R_n =$ N/A

$\phi =$ ***0.95***

Check Sidewall Local Yielding

$B_p/B =$ 1 = 1 Check Limit State

$R_n = 2F_y t(5k+t_p) =$ 48.406 k — SSSB (K1-9)

$k = 1.5t$ 0.3495 in

$\phi R_n =$ 48.406 k >= P **OK**

$\phi =$ ***1***

Check Sidewall Local Crippling

$B_p/B =$ 1 = 1 Check Limit State

$R_n = 1.6t^2(1+3t_p/(H-3t))(EF_y)^{1/2}Q_f =$ 128.67 k — SSSB (K1-10)

$Q_f = 1.3-0.4U/\beta =$ 1.1818 > 1 Use $Q_f =$ 1

$U =$ 0.2956

$\phi R_n =$ 96.504 k >= P **OK**

$\phi =$ ***0.75***

Check Weld Connection

Weld Material Strength: $F_{EXX} =$ ***70*** ksi

Flange Weld Capacity (Moment) = $R_n = R_r A_w =$ **23.46 k >= P** **OK**

Effective Weld Length = $L_e = 2(10/(B/t))(F_y t/(F_{yp}t_p))B_p+2t_p =$ 3.9502 in — SSSB (K4-4)

Fillet Weld Size = t = ***0.25*** in

$t_e = 0.707t =$ 0.1768 in

$A_w = L_e t_e =$ 0.6982 in^2

$R_r = \alpha\phi_{e2}F_{EXX} =$ 33.6 ksi — ABDS 6.13.3.2.4

$\alpha =$ 0.6

Web Weld Capacity (Shear) = $R_n = R_r A_w =$ **88.844 k >= V** **OK**

Effective Weld Length = $l_w = 2(d-2t_f) =$ 14.96 in

Fillet Weld Size = t = ***0.25*** in

$t_e = 0.707t =$ 0.1768 in

$A_w = L_w t_e =$ 2.6442 in^2

$R_r = \alpha\phi_{e2}F_{EXX} =$ 33.6 ksi — ABDS 6.13.3.2.4

$\alpha =$ 0.6

Reference

w_{DC} = 528.71 lb/ft	V_{DC} = 1.6082 k	M_{DC} = 2.45 ft-k	
w_{DW} = 0 lb/ft	V_{DW} = 0 k	M_{DW} = 0.00 ft-k	
w_{PL} = 750 lb/ft	V_{PL} = 2.2813 k	M_{PL} = 3.47 ft-k	
P_{LL} = 1520 lb	V_{LL} = 1.9989 k	M_{LL} = 2.7763 ft-k	

Span = l = 6.0833 ft

Moment and Shear

	V_{SS}	M_{SS}	M_{LAT}	$M_{SS}+M_{LAT}$
LC 1:	6.0024 k	9.1286 ft-k	4.62 ft-k	13.749 ft-k
LC 2:	5.5083 k	7.9156 ft-k	2.4399 ft-k	10.355 ft-k
LC 3:	2.0102 k	3.0572 ft-k	2.5343 ft-k	5.5915 ft-k
LC 4:	2.1785 k	3.3131 ft-k	0 ft-k	3.3131 ft-k
LC 5:	2.0102 k	3.0572 ft-k	0 ft-k	3.0572 ft-k
V_r =	6.0024 k		M_r =	13.75 ft-k

Beam Data

Beam Size = W8x18	F_y = ***50*** ksi
Z_x = 17 in^3	E = ***29000*** ksi
S_x = 15.2 in^3	$D = d-2t_f$ = 7.48 in
b_f = 5.25 in	$D_c = D_{cp} = D/2$ = 3.74 in
t_f = 0.33 in	$h = d-t_f$ = 7.81 in
d = 8.14 in	
t_w = 0.23 in	$M_p = F_yZ_x$ = 850 k-in
I_x = 61.9 in^4	$M_y = F_yS_x$ = 760 k-in
	$F_{yr} = 0.7F_{yc}$ = 35 ksi

Vertical Data

	Orientation	Height (in)	Width (in)	Thickness (in)
Vertical: HSS4x4x1/4	X	H = 4	B = 4	t = 0.233
		F_y = 50000 psi		
		F_u = 70000 psi		

Resistance Factors — ABDS 6.5.4.2

ϕ_f = 1 ϕ_v = 1 ϕ_{e2} = 0.8

Check Flexure Capacity (Use the Provisions of Appendix A6):

F_y	<=	***70*** ksi		**OK**	ABDS A6.1
$2D_c/t_w$ = 32.522	<	$5.7(E/F_{yc})^{1/2}$ =	137.27	**OK**	ABDS (A6.1-1)
I_{yc}/I_{yt} = ***1***	>=	0.3		**OK**	ABDS (A6.1-2)

Reference

Compression Flange

$M_u+(1/3)f_lS_{xc}$ = **26.42 ft-k** <= $\phi_f M_{nc}$ = **62.251 ft-k** **OK** — ABDS (A6.1.1-1)

Tension Flange

$M_u+(1/3)f_lS_{xt}$ = **26.415 ft-k** <= $\phi_f M_{nt}$ = **70.833 ft-k** **OK** — ABDS (A6.1.2-1)

Web Plastification Factors

$2D_{cp}/t_w$ = 32.522 <= $\lambda_{pw(Dcp)}$ = 91.175 — ABDS (A6.2.1-1)

$\lambda_w = 2D_c/t_w$ = 32.522 < λ_{rw} = 137.27 — ABDS (A6.2.2-1)

Section is Compact

$\lambda_{pw(Dcp)} = (E/F_{yc})^{1/2}/(0.54(M_p/(R_hM_y))-.09)^2$ = 91.175 <= $\lambda_{rw}(D_{cp}/D_c)$ Use $\lambda_{pw(Dcp)}$ = 91.175 — ABDS (A6.2.1-2)

$\lambda_{pw(Dc)} = \lambda_{pw(Dcp)}(D_c/D_{cp})$ = 91.175 <= λ_{rw} Use $\lambda_{pw(Dc)}$ = 91.175 — ABDS (A6.2.2-6)

R_h = ***1*** — ABDS 6.10.1.10.1

$\lambda_{rw} = 5.7(E/F_{yc})^{1/2}$ = 137.27 — ABDS (A6.2.1-3 & A6.2.2-3)

$R_{pc} = R_{pt} = M_p/M_y$ = 1.1184 — ABDS (A6.2.1-4 & A6.2.1-5)

Local Buckling Resistance

λ_f <= λ_{pf} $M_{nc} = R_{pc}M_{yc}$ = 850 k-in — ABDS(A6.3.2-1)

$M_{nc}= [1-(1-(F_{yr}S_x)/(R_{pc}M_{yc}))((\lambda_f-\lambda_{pf})/(\lambda_{rf}-\lambda_{pf}))]R_{pc}M_{yc}$ = N/A k-in — ABDS(A6.3.2-2)

$\lambda_f = b_{fc}/(2t_{fc})$ = 7.9545 — ABDS (A6.3.2-3)

$\lambda_{pf} = 0.38(E/F_{yc})^{1/2}$ = 9.1516 — ABDS (A6.3.2-4)

$\lambda_{rf} = 0.95(Ek_c/F_y)^{0.5}$ = 19.945 — ABDS (A6.3.2-5)

k_c = ***0.76*** — ABDS (A6.3.2)

Lateral Torsional Buckling Resistance

Use M_{nc} = 747.02 k-in — ABDS (A6.3.3-2)

L_b > L_p $M_{nc} = R_{pc}M_{yc}$ = N/A k-in — ABDS (A6.3.3-1)

L_b <= L_r $M_{nc} = C_b[1-(1-F_{yr}S_{xc}/(R_{pc}M_{yc}))((L_b-L_p)/(L_r-L_p))]R_{pc}M_{yc}$ = 747.02 k-in — ABDS (A6.3.3-2)

$M_{nc} = F_{cr}S_x$ = N/A k-in — ABDS (A6.3.3-3)

L_b = 73 in

L_p = 1.0 $r_t(E/F_y)^{1/2}$ = 33.809 in — ABDS (A6.3.3-4)

$L_r = 1.95r_t(E/F_{yr})(J/(S_{xc}h))^{.5}(1+(1+6.76(F_{yr}S_{xc}h/(EJ))^2)^{.5})^{.5}$ = 154.83 in — ABDS (A6.3.3-5)

$r_t = b_{fc}/(12(1+D_ct_w/(3b_{fc}t_{fc})))^{1/2}$ = 1.4038 in — ABDS (A6.3.3-10)

$J = Dt_w^3/3+b_{fc}t_{fc}^3(1-0.63t_{fc}/b_{fc})/3+b_{ft}t_{ft}^3(1-0.63t_{ft}/b_{ft})/3$ = 0.1511 in^4 — ABDS (A6.3.3-9)

$F_{cr} = (C_b\pi^2E/(L_b/r_t)^2)(1+0.078J(L_b/r_t)^2/(S_xh))^{0.5}$ = 119.21 ksi — ABDS (A6.3.3-8)

C_b = ***1***

Reference

Flexural Resistance on Tension Flange Yielding

$M_{nt} = R_{pt}M_{yt} =$ 850 k-in — ABDS (A6.4-1)

Flange Lateral Bending Stress

Use $f_l =$ ***30*** ksi

Check Shear (Unstiffened Webs)

$\phi_v V_n =$ 0.58C $\phi_v F_y A_w =$ 49.892 k > $V_u =$ 6.00 k — **OK** — ABDS 6.10.9.2

$A_w = Dt_w =$ 1.7204 in^2

$\lambda_{w1} = 1.12(Ek/F_{yw})^{1/2} =$ 60.314 $\lambda_{w2} = 1.4(Ek/F_{yw})^{1/2} =$ 75.392

If $\lambda_w \le \lambda_{w1}$	C =	1	ABDS (6.10.9.3.2-4)
If $\lambda_w > \lambda_{w1}$ and $\le \lambda_{w2}$,	$C = \lambda_{w1}/\lambda_w =$	1.8546	ABDS (6.10.9.3.2-5)
If $\lambda_w > \lambda_{w2}$,	$C = 1.51(Ek/F_{yw})/\lambda_w^2 =$	4.1403	ABDS (6.10.9.3.2-6)

λ_{w1} >= λ_w >= λ_{w2}, Use C = 1

k = ***5***

Check Floor Beam to Vertical Connection (Use the provisions of AISC K1)

V = ***6*** k Load Case = **3**

$M_{Joint\ Fixity} =$ ***9.3*** ft-k Member = ***FB005***

$M_{U\text{-}Frame} =$ 2.5343 ft-k

$M_{Total} =$ 11.834 ft-k Flange Force = $P = M_{Total}/(d-t_f) =$ 18.183 k

Check Applicability: — AISC Tbl K1.2A

Strength:	F_y <= 52 ksi		**OK**
Ductility:	$F_y/F_u =$	0.7 <= 0.8	**OK**
Width Ratio:	$B_p/B =$	1 >= 0.25	**OK**
	$B_p/B =$	1 <= 1	**OK**

$B_p = b_f =$ 5.25 in > B, use $B_p =$ 4 in

Wall Slenderness: B/t = 14.2 <= 35 **OK**

Check Local Yielding of Plate

$R_n = (10F_yt/(B/t))B_p =$ 32.817 k <= $F_{yp}t_pB_p =$ 66 k, use 32.817 k — SSSB (K1-7)

$\phi R_n =$ 31.176 k >= P — **OK**

$\phi =$ ***0.95***

Reference

Check Shear Yielding (Punching)

$B-2t =$ 3.534 < B_p Limit State is Not Applicable

$0.85B =$ 3.4 <= B_p Check Limit State

$R_n = (0.6F_y t(2t_p+2B_{ep}) =$ 43.994 k — SSSB (K1-8)

$B_{ep} = 10B_p/(B/t) =$ 2.8169 in <= B_p, use 2.8169 in — SSSB (K1-18)

$\phi R_n =$ N/A

$\phi =$ ***0.95***

Check Sidewall Local Yielding

$B_p/B =$ 1 = 1 Check Limit State

$R_n = 2F_y t(5k+t_p) =$ 48.406 k — SSSB (K1-9)

$k = 1.5t$ 0.3495 in

$\phi R_n =$ 48.406 k >= P **OK**

$\phi =$ ***1***

Check Sidewall Local Crippling

$B_p/B =$ 1 = 1 Check Limit State

$R_n = 1.6t^2(1+3t_p/(H-3t))(EF_y)^{1/2}Q_f =$ 135.97 k — SSSB (K1-10)

$Q_f = 1.3-0.4U/\beta =$ 1.0364 > 1 Use $Q_f =$ 1

$U =$ 0.6589

$\phi R_n =$ 101.97 k >= P **OK**

$\phi =$ ***0.75***

Check Weld Connection

Weld Material Strength: $F_{EXX} =$ ***70*** ksi

Flange Weld Capacity (Moment) = $R_n = R_r A_w =$ **23.46 k >= P** **OK**

Effective Weld Length = $L_e = 2(10/(B/t))(F_y t/(F_{yp} t_p))B_p+2t_p =$ 3.9502 in — SSSB (K4-4)

Fillet Weld Size = t = ***0.25*** in

$t_e = 0.707t =$ 0.1768 in

$A_w = L_e t_e =$ 0.6982 in^2

$R_r = \alpha\phi_{e2}F_{EXX} =$ 33.6 ksi — ABDS 6.13.3.2.4

$\alpha =$ 0.6

Web Weld Capacity (Shear) = $R_n = R_r A_w =$ **88.844 k >= V** **OK**

Effective Weld Length = $l_w = 2(d-2t_f) =$ 14.96 in

Fillet Weld Size = t = ***0.25*** in

$t_e = 0.707t =$ 0.1768 in

$A_w = L_w t_e =$ 2.6442 in^2

$R_r = \alpha\phi_{e2}F_{EXX} =$ 33.6 ksi — ABDS 6.13.3.2.4

$\alpha =$ 0.6

Reference

F_y = 50000 psi Top Chord = HSS5x5x1/4 A = 4.3 in^2
E = 29000 ksi Orientation = X t_c = 0.233 in

Plating: N

Thickness	Width	Sides	Configuration
N/A	N/A	N/A	N/A

In-Plane						Out-of-Plane					
b_i	b/t_i	I_i	Z_i	S_i	r_i	b_o	b/t_o	I_o	Z_o	S_o	r_o
5	18.5	16	7.61	6.41	1.93	5	18.5	16	7.61	6.41	1.93

Load Case = ***1*** Member: ***TC005***
P_u = ***117.4*** k
M_{ui} = ***1.3*** ft-k K_i = ***1*** KL/r_i = 51.813 <= 120 **OK** ABDS 6.9.3
M_{uo} = ***0.4*** ft-k K_o = 1.3 KL/r_o = 67.358 <= 120 **OK** ABDS 6.9.3
V_u = ***3.4*** k L = 100 in

Resistance Factors ϕ_f = 1 ϕ_c = 0.9 ϕ_v = 1 ABDS 6.5.4.2

Check Axial Compression Capacity
P_e/P_o = 1.2617 $P_n = (0.658^{(Po/Pe)})P_oA_g$ = 154.3 k ABDS 6.9.4.1-1
$P_e = \pi^2E/(KL/r)^2$ = 63.085 ksi $P_n = 0.877P_eA_g$ = N/A k ABDS 6.9.4.1-2
$P_o = QF_y$ = 50 ksi $P_r = \phi_cP_n$ = 138.87 k
Q = ***1*** ABDS 6.9.4.2

Check Moment Capacity ABDS 6.12.2.2.2
$M_{ni} = M_p = F_yZ_i$ = 31.708 ft-k λ_{pf} >= $\lambda_{f\text{-}In}$ =< λ_{rf}
$M_{ni} = M_p-(M_p-F_yS_i)(3.57\lambda_{f\text{-}In}(F_y/E)^{1/2}-4.0)$ = N/A ft-k ϕ_fM_{ni} = 31.708 ft-k
$M_{no} = M_p = F_yZ_o$ = 31.708 ft-k λ_{pf} >= $\lambda_{f\text{-}Out}$ =< λ_{rf}
$M_{no} = M_p-(M_p-F_yS_o)(3.57\lambda_{f\text{-}Out}(F_y/E)^{1/2}-4.0)$ = N/A ft-k ϕ_fM_{no} = 31.708 ft-k

Check Shear Capacity
$V_r = \phi_vV_n = \phi 0.58 F_yA_vC_v$ = 64.421 k ABDS 6.10.9.2
$A_v = 2(b_i-t_c)t_c$ = 2.2214 in^2
C_v = 1 ABDS 6.10.9.3.2
$1.12(kE/F_y)^{1/2}$ = 59.237 >= h/t
k_v = ***5***

Combined Axial Compression & Flexure P_u/P_r = 0.8454 >= 0.2 ABDS 6.9.2.2
$P_u/2.0P_r + M_{ui}/M_{ri} + M_{uo}/M_{ro}$ = N/A
$P_u/P_r + (8/9)(M_{ui}/M_{ri} + M_{uo}/M_{ro})$ = 0.893 <= 1 **OK**

Combined Shear, Flexure & Axial Force
$(P_u/P_r+M_{ui}/M_{ri}+M_{uo}/M_{ro})+(V_u/V_r)^2$ = 0.9018 <= 1 **OK** SSSB H3.2

Find the Utilization Ratio SSSB (K1-6)
$U = P_r/(A_gF_y)+M_i/(S_iF_c)+M_o/(S_oF_c)$ = 0.6097

Reference

F_y = 50000 psi   Bottom Chord = HSS5x5x1/4   A = 4.3 in^2

F_u = 70000 psi   Orientation = X t_c = 0.233 in

E = 29000 ksi   Plating: N

Thickness	Width	Sides	Configuration
N/A	N/A	N/A	N/A

In-Plane						Out-of-Plane					
b_i	b/t_i	I_i	Z_i	S_i	r_i	b_o	b/t_o	I_o	Z_o	S_o	r_o
5	18.5	16	7.61	6.41	1.93	5	18.5	16	7.61	6.41	1.93

Load Case = ***1***

P_u = ***117.1*** k   Member: ***BC005***

M_{ui} = ***1.5*** ft-k

M_{uo} = ***0.6*** ft-k   L = 100 in

V_u = ***3.1*** k

Resistance Factors ϕ_f = 1 ϕ_y = 0.95 ϕ_u = 0.8 ϕ_v = 1   ABDS 6.5.4.2

Check Axial Tension Capacity

$P_r = \phi_y P_{ny} = \phi_y F_y A$ = 204.25 k A_n = A = 4.3 in^2 ABDS 6.8.2.1-1

$P_r = \phi_u P_{nu} = \phi_u F_u A_n R_p U$ = 240.8 k R_p = ***1***   ABDS 6.8.2.1-2

Use P_r = 204.25 k   U = ***1***

Check Moment Capacity   ABDS 6.12.2.2.2

$M_{ni} = M_p = F_y Z_i$ = 31.708 ft-k λ_{pf} >= $\lambda_{f\text{-}In}$ =< λ_{rf}

$M_{ni} = M_p-(M_p-F_y S_i)(3.57\lambda_{f\text{-}In}(F_y/E)^{1/2}-4.0)$ = N/A ft-k $\phi_f M_{ni}$ = 31.708 ft-k

$M_{no} = M_p = F_y Z_o$ = 31.708 ft-k λ_{pf} >= $\lambda_{f\text{-}Out}$ =< λ_{rf}

$M_{no} = M_p-(M_p-F_y S_o)(3.57\lambda_{f\text{-}Out}(F_y/E)^{1/2}-4.0)$ = N/A ft-k $\phi_f M_{no}$ = 31.708 ft-k

Check Shear Capacity

$V_r = \phi_v V_n = \phi 0.58 F_y A_v C_v$ = 64.421 k   ABDS 6.10.9.2

$A_v = 2(b_i-t_c)t_c$ = 2.2214 in^2

C_v = 1   ABDS 6.10.9.3.2

$1.12(k_v E/F_y)^{1/2}$ = 60.314 >= h/t

k_v = ***5***

Combined Axial Tension & Flexure P_u/P_r = 0.5733 >= 0.2   ABDS 6.9.2.2

$P_u/2.0P_r + M_{ui}/M_{ri} + M_{uo}/M_{ro}$ = N/A

$P_u/P_r + (8/9)(M_{ui}/M_{ri} + M_{uo}/M_{ro})$ = 0.6322 <= 1   **OK**

Combined Shear, Flexure & Axial Force

$(P_u/P_r+M_{ui}/M_{ri}+M_{uo}/M_{ro})+(V_u/V_r)^2$ = 0.6419 <= 1   **OK**   SSSB H3.2

Reference

F_y = 50000 psi   Vertical = HSS5x5x1/4   A = 4.3 in^2

E = 29000 ksi   Orientation = X t_c = 0.233 in

In-Plane						Out-of-Plane					
b_i	b/t_i	I_i	Z_i	S_i	r_i	b_o	b/t_o	I_o	Z_o	S_o	r_o
5	18.5	16	7.61	6.41	1.93	5	18.5	16	7.61	6.41	1.93

Load Case = ***1***

P = ***32.6*** k   Member: ***EV1***

M_i = ***2*** ft-k

M_{oa} = ***0.2*** ft-k $M_o = M_{oa} + M_{Lat}$ = 1.8455 ft-k M_{Lat} = 1.6455 ft-k

V_u = ***0.7*** k

K_i = ***1*** L_i = 69 in KL_i/r_i = 35.751 <= 120   **OK**   ABDS 6.9.3

K_o = ***2*** L_o = 60.57 in KL_o/r_o = 62.767 <= 120   **OK**   ABDS 6.9.3

Resistance Factors ϕ_f = 1 ϕ_c = 0.9 ϕ_v = 1 ϕ_{e1} = 0.85   ABDS 6.5.4.2

Check Axial Compression Capacity

P_e/P_o = 1.453 $P_n = (0.658^{(Po/Pe)})P_oA_g$ = 161.19 k   ABDS 6.9.4.1-1

$P_e = \pi^2E/(KL/r)^2$ = 72.65 ksi $P_n = 0.877P_eA_g$ = N/A k   ABDS 6.9.4.1-2

$P_o = QF_y$ = 50 ksi $P_r = \phi_cP_n$ = 145.07 k

Q = ***1***   ABDS 6.9.4.2

Check Moment Capacity   ABDS 6.12.2.2.2

$M_{ni} = M_p = F_yZ_i$ = 31.708 ft-k λ_{pf} >= $\lambda_{f\text{-}In}$ =< λ_{rf}

$M_{ni} = M_p-(M_p-F_yS_i)(3.57\lambda_{f\text{-}In}(F_y/E)^{1/2}-4.0)$ = N/A ft-k ϕ_fM_{ni} = 31.708 ft-k

$M_{no} = M_p = F_yZ_o$ = 31.708 ft-k λ_{pf} >= $\lambda_{f\text{-}Out}$ =< λ_{rf}

$M_{no} = M_p-(M_p-F_yS_o)(3.57\lambda_{f\text{-}Out}(F_y/E)^{1/2}-4.0)$ = N/A ft-k ϕ_fM_{no} = 31.708 ft-k

Check Shear Capacity

$V_r = \phi_vV_n = \phi 0.58 F_yA_vC_v$ = 64.421 k   ABDS 6.10.9.2

$A_v = 2(b_i-t_c)t_c$ = 2.2214 in^2

C_v = 1   ABDS 6.10.9.3.2

$1.12(kE/F_y)^{1/2}$ = 59.237 >= h/t

k_v = ***5***

Combined Axial Compression & Flexure P_u/P_r = 0.2247 >= 0.2   ABDS 6.9.2.2

$P_u/2.0P_r + M_{ui}/M_{ri} + M_{uo}/M_{ro}$ = N/A

$P_u/P_r + (8/9)(M_{ui}/M_{ri} + M_{uo}/M_{ro})$ = 0.3325 <= 1   **OK**

Combined Shear, Flexure & Axial Force

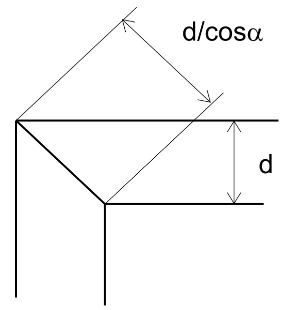
$(P_u/P_r+M_{ui}/M_{ri}+M_{uo}/M_{ro})+(V_u/V_r)^2$ = 0.3461 <= 1   **OK**   SSSB H3.2

Find the Utilization Ratio   SSSB (K1-6)

$U = P_r/(A_gF_y)+M_i/(S_iF_c)+M_o/(S_oF_c)$ = 0.2956

Check Chord Connection

$P_u =$ 16.3 k   Use only 1/2 P due to double mitered diagonal
$M_i =$ 2 k-ft $\alpha =$ 40
$M_o =$ 0.2 k-ft



Overlapped Diagonal = Y
d = 5 in
w = 5 in

Weld Length = $l_w = 2d/\cos\alpha =$ 13.054 in
$S_{iw} = (d/\cos\alpha)^2/3 =$ 14.201 in^2
$S_{ow} = (d/\cos\alpha)w =$ 32.635 in^2

$f_w = (P_u/l_w + M_i/S_{iw})/t_e =$ 12.612 ksi
$f_w = (P_u/l_w + M_o/S_{ow})/t_e =$ 5.6746 ksi

$t_e = t_c =$ 0.233 in

$R_r = \alpha\phi_{e1}F_{EXX} =$ 35.7 ksi <= F_y, Use 35.7 ksi > f_w **OK**   ABDS 6.13.3.2.2
$F_{EXX} =$ ***70*** ksi
$\alpha =$ 0.6

Reference

F_y = 50000 psi Vertical = HSS4x4x1/4 A = 3.37 in^2

E = 29000 ksi Orientation = X t_c = 0.233 in

In-Plane						Out-of-Plane					
b_i	b/t_i	I_i	Z_i	S_i	r_i	b_o	b/t_o	I_o	Z_o	S_o	r_o
4	14.2	7.8	4.69	3.9	1.52	4	14.2	7.8	4.69	3.9	1.52

Load Case = ***1***

P = ***28.9*** k Member: ***V002***

M_i = ***2.8*** ft-k

M_o = ***0.5*** ft-k $M_o = M_{oa} + M_{Lat}$ = 5.12 ft-k M_{Lat} = 4.62 ft-k

V_u = ***1*** k

K_i = ***1*** L_i = 69 in KL_i/r_i = 45.395 <= 120 **OK** ABDS 6.9.3

K_o = ***2*** L_o = 60.57 in KL_o/r_o = 79.697 <= 120 **OK** ABDS 6.9.3

Resistance Factors ϕ_f = 1 ϕ_c = 0.9 ϕ_v = 1 ϕ_{e2} = 0.8 ABDS 6.5.4.2

Check Axial Compression Capacity

P_e/P_o = 0.9012 $P_n = (0.658^{(Po/Pe)})P_oA_g$ = 105.9 k ABDS 6.9.4.1-1

$P_e = \pi^2E/(KL/r)^2$ = 45.062 ksi $P_n = 0.877P_eA_g$ = N/A k ABDS 6.9.4.1-2

$P_o = QF_y$ = 50 ksi $P_r = \phi_cP_n$ = 95.312 k

Q = ***1*** ABDS 6.9.4.2

Check Moment Capacity ABDS 6.12.2.2.2

$M_{ni} = M_p = F_yZ_i$ = 19.542 ft-k λ_{pf} >= $\lambda_{f\text{-}In}$ =< λ_{rf}

$M_{ni} = M_p-(M_p-F_yS_i)(3.57\lambda_{f\text{-}In}(F_y/E)^{1/2}-4.0)$ = N/A ft-k ϕ_fM_{ni} = 19.542 ft-k

$M_{no} = M_p = F_yZ_o$ = 19.542 ft-k λ_{pf} >= $\lambda_{f\text{-}Out}$ =< λ_{rf}

$M_{no} = M_p-(M_p-F_yS_o)(3.57\lambda_{f\text{-}Out}(F_y/E)^{1/2}-4.0)$ = N/A ft-k ϕ_fM_{no} = 19.542 ft-k

Check Shear Capacity

$V_r = \phi_vV_n$ = $\phi 0.58\, F_yA_vC_v$ = 50.907 k ABDS 6.10.9.2

$A_v = 2(b_i-t_c)t_c$ = 1.7554 in^2

C_v = 1 ABDS 6.10.9.3.2

$1.12(kE\ /F_y)^{1/2}$ = 59.237 >= h/t

k_v = ***5***

Combined Axial Compression & Flexure P_u/P_r = 0.3032 >= 0.2 ABDS 6.9.2.2

$P_u/2.0P_r + M_{ui}/M_{ri} + M_{uo}/M_{ro}$ = N/A

$P_u/P_r + (8/9)(M_{ui}/M_{ri} + M_{uo}/M_{ro})$ = 0.6635 <= 1 **OK**

Combined Shear, Flexure & Axial Force

$(P_u/P_r+M_{ui}/M_{ri}+M_{uo}/M_{ro})+(V_u/V_r)^2$ = 0.7089 <= 1 **OK** SSSB H3.2

Find the Utilization Ratio SSSB (K1-6)

$U = P_r/(A_gF_y)+M_i/(S_iF_c)+M_o/(S_oF_c)$ = 0.6589

Reference

Check Chord Connection

P_u = 28.9 k

M_i = 2.8 k-ft

M_o = 0.5 k-ft

Overlapped Diagonal = ***N***

$\beta = B_b/B$ = 0.8

d = 4 in

θ = 90 ^{o}

b = 4 in

$b_{eoi} = [10/(B/t)][F_y t/(F_y t_p)]B_p]$ = 1.864 in

Use b_{eoi} = 1.864 in

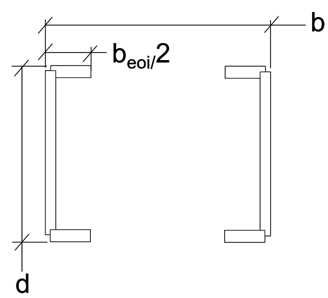
when $\beta > 0.85$ or $\theta > 50^o$, $b_{eoi}/2$ shall not exceed 2t = 0.466 in

Side Weld Size = t_w = ***0.25*** in

$t_{ed} = .707t_w$ or t = 0.1768 in

Face Fillet Weld Size = t_w = ***0.25*** in

$t_{eb} = .707t_w$ = 0.1768 in



Weld Area = $l_w = 2dt_{ed}+2b_{eoi}t_{eb}$ = 2.0729 in^2 — SSSB Tbl K4.1

$S_{iw} = t_{ed}d^2/3+t_{eb}b_{eoi}d$ = 2.2605 in^3 — SSSB Tbl K4.1

$S_{ow} = t_{ed}db+t_{eb}(b^2/3-(b-b_{eoi})^3/(3b))$ = 3.6271 in^3 — SSSB Tbl K4.1

(tension) $f_w = (M_i/S_{iw}+Mo/S_{ow})$ = 16.518 ksi

(compression) $f_w = (P_u/l_w+M_i/S_{iw}+M_o/S_{ow})$ = 30.46 ksi

$R_r = \alpha\phi_{e2}F_{EXX}$ = 33.6 ksi <= F_y, Use 33.6 ksi > f_w **OK** — ABDS 6.13.3.2.4

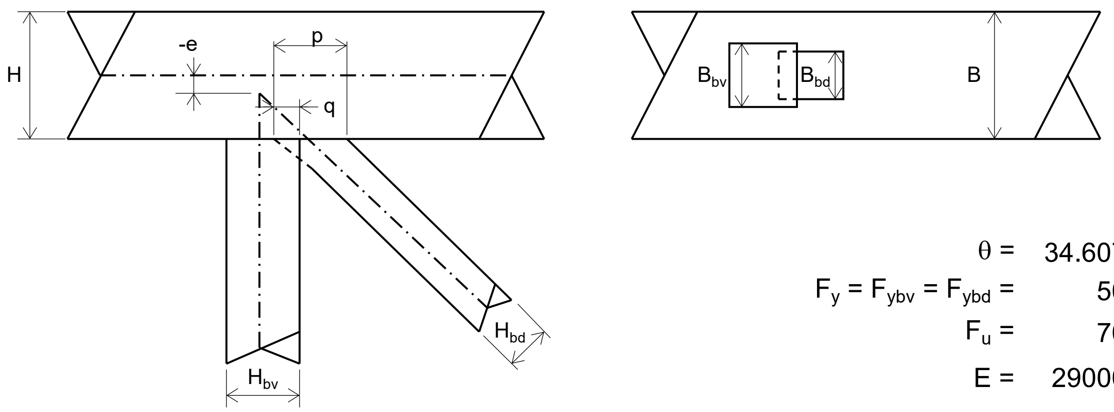
F_{EXX} = ***70*** ksi

α = 0.6

(compression) $R_r = \phi_c F_y$ = 45 ksi > f_w **OK**

Reference

		Orientation	Thickness (in)		Height (in)		Width (in)	
Top Chord :	HSS5x5x1/4	X	t =	0.233	H =	5	B =	5
Vertical:	HSS5x5x1/4	X	t_{bv} =	0.233	H_{bv} =	5	B_{bv} =	5
Diagonal:	HSS4x3x1/4	Y	t_{bd} =	0.233	H_{bd} =	3	B_{bd} =	4



θ = 34.607 deg

$F_y = F_{ybv} = F_{ybd}$ = 50 ksi

F_u = 70 ksi

E = 29000 ksi

Area of Diagonal = A_g = 2.91 in^2

Load Case = ***1*** Member: ***D001***

Load Applied to Diagonal = P = ***50*** k *T* (T = Tension, C = Compression)

q = 2.6411 in O_v = q/p = 50.00%

p = $H_{bd}/\sin\theta$ = 5.2822 in e = -0.775

Check Applicability: SSSB Tbl K2.2A

Joint Eccentricity:	-.55H =	-2.75	<= e	**OK**
	0.25H =	1.25	>= e	**OK**
Branch Angle:	θ >= 30°			**OK**
Chord Wall Slenderness:	B/t=	18.5	<= 30	**OK**
	H/t=	18.5	<= 35	**OK**
Tension Branch Wall Slenderness:	B_{bd}/t_{bd} =	14.2	<= 35	**OK**
Comp Branch Wall Slenderness:	B_{bd}/t_{bd} =	14.2	N/A	**N/A**
	$1.1(E/F_y)^{0.5}$ = 26.492	>=	B_{bd}/t_{bd}	**N/A**
Width Ratio:	B_{bd}/B & H_{bd}/B =	0.6	>= 0.25	**OK**
Aspect Ratio:	H/B & H_{bd}/B_{bd} =	0.75	>= 0.5	**OK**
	H/B & H_{bd}/B_{bd} =	1	<= 2.0	**OK**
Overlap:	O_v =	50.00%	>=25%	**OK**
	O_v =	50.00%	<=100%	**OK**
Branch Width Ratio:	B_{bd}/B_{bv} =	0.8	>= 0.75	**OK**
Branch Thickness Ratio:	t_{bd}/t_{bv} =	1	<=1	**OK**
Strength:	F_y <= 52 ksi			**OK**
Ductility:	F_y/F_u =	0.71	<= 0.8	**OK**

Reference

Check Connection for Local Yielding due to Uneven Load Distribution: SSSB Tbl K2.2

$b_{eoi} = (10/(B/t))((F_y t)/(F_y t_{bd}))B_{bd} =$ 2.1622 in <= B_{bd} use 2.1622 in — SSSB (K2-20)

$b_{eov} = (10/(B_{bv}/t_{bv}))((F_y t_{bv})/(F_y t_{bd}))B_{bd} =$ 2.1622 in <= B_{bd} use 2.1622 in — SSSB (K2-21)

25% <= O_v < 50%

$P_n = \phi F_y t_{bd}((O_v/50)(2H_{bd}-4t_{bd})+b_{eoi}+b_{eov}) =$ N/A N/A **N/A** — SSSB (K2-17)

50% <= O_v < 80%

$P_n = \phi F_y t_{bd}(2H_{bd}-4t_{bd}+b_{eoi}+b_{eov}) =$ 103.95 k >=P **OK** — SSSB (K2-18)

80% <= O_v <= 100%

$P_n = \phi F_y t_{bd}(2H_{bd}-4t_{bd}+B_{bd}+b_{eov}) =$ N/A N/A **N/A** — SSSB (K2-19)

$\phi =$ ***0.95***

Resistance Factors ABDS 6.5.4.2

$\phi_y =$ 0.95 $\phi_u =$ 0.8 $\phi_{e2} =$ 0.8

Check Axial Tension Capacity

$P_r = \phi_y P_{ny} = \phi_y F_y A =$ 138.23 k — ABDS 6.8.2.1-1

$P_r = \phi_u P_{nu} = \phi_u F_u A_n R_p U =$ 162.96 k Use $P_r =$ 138.23 k >=P **OK** — ABDS 6.8.2.1-2

$A_n = A_g =$ 2.91 in^2

$R_p =$ ***1***

$U =$ ***1***

Check Connection

$l_w = 2O_v/50[(1-O_v/100)(H_{bd}/\sin\theta)+O_v/100(H_{bd}/\sin(\theta+\beta))]+b_{eoi}+b_{eov} =$ N/A in

$l_w = 2[(1-O_v/100)(H_{bd}/\sin\theta)+O_v/100(H_{bd}/\sin(\theta+\beta))]+b_{eoi}+b_{eov} =$ 13.251 in

$l_w = 2[(1-O_v/100)(H_{bd}/\sin\theta)+O_v/100(H_{bd}/\sin(\theta+\beta))]+B_b+b_{eov} =$ N/A in

Use $l_w =$ 13.251 in — SSSB Tbl K4.1

when B_{bd}/B > 0.85, $b_{eoi}/2$ shall not exceed 2t = 0.466 in Use $b_{eoi} =$ 2.1622 in

and when B_{bd}/B_{bv} > 0.85, $b_{eov}/2$ shall not exceed $2t_{bv}$ = 0.466 in Use $b_{eov} =$ 2.1622 in

Fillet Weld Size = t = ***0.25*** in

$t_e = 0.707t =$ 0.1768 in

$f_w = (P/l_w)/t_e =$ 21.347 ksi

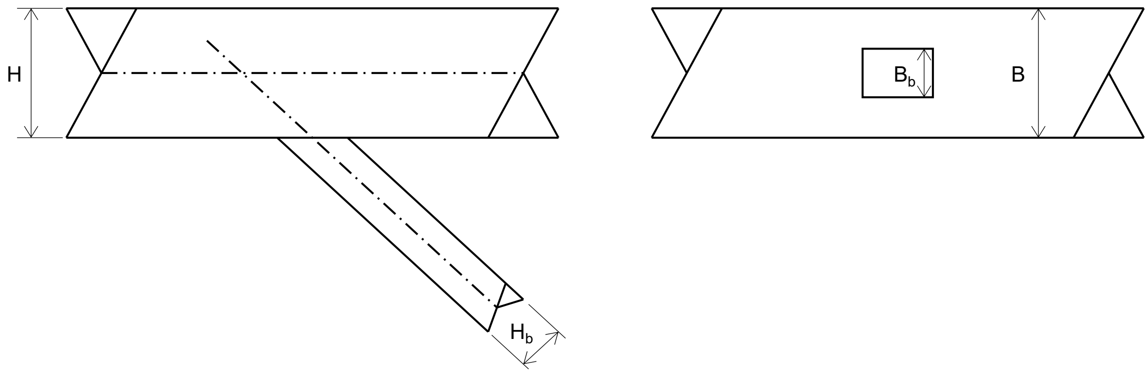
$R_r = \alpha\phi_{e2}F_{EXX} =$ 33.6 ksi <= F_y, Use 33.6 ksi > f_w **OK** — ABDS 6.13.3.2.4

$F_{EXX} =$ ***70*** ksi

$\alpha =$ 0.6

Reference

	Orientation	A	t_c	In-Plane b	In-Plane S	Out-of-Plane b	Out-of-Plane S
Chord: HSS5x5x1/4	X	4.3	0.233	5	6.41	5	6.41
Branch: HSS3x2x1/4	Y	1.97	0.233	2	1.11	3	1.42



B = 5 H = 5 t = 0.233 θ = 35.403

B_b = 3 H_b = 2 t_b = 0.233

$\beta = B_b/B =$ 0.6 $F_y = F_{yb} =$ 50 ksi $F_u =$ 70 ksi

$\gamma = B/2t =$ 10.73 E = 29000 ksi

$\eta = H_b/B\sin\theta =$ 0.6905

Load Case = ***1*** Member: ***D002***

Load Applied to Diagonal = P = ***39.1*** k *T* (T = Tension, C = Compression)

Chord-Stress Interaction Parameter:

$Q_f =$ 0.8935 (Q_f = 1 if Chord is in Tension, $Q_f = 1.3-0.4U/\beta$ if Chord is in Compression) SSSB K1-5a

U = 0.6097

Check Applicability: SSSB Tbl K2.2

Branch Angle:		θ >= 30°		OK
Chord Wall Slenderness:	B/t & H/t=	18.5	<= 35	OK
Tension Branch Wall Slenderness:	B_b/t_b =	9.88	<= 35	OK
Comp Branch Wall Slenderness:	B_b/t_b =	9.88	N/A	N/A
	$1.25(E/F_y)^{0.5}$ =	30.104	>= B_b/t_b	N/A
Width Ratio:	B_{bd}/B & H_{bd}/B =	0.4	>= 0.25	OK
Aspect Ratio:	H/B & H_{bd}/B_{bd} =	0.6667	>= 0.5	OK
	H/B & H_{bd}/B_{bd} =	1	<= 2.0	OK
Strength:		F_y <= 52 ksi		OK
Ductility:	F_y/F_u =	0.71	<= 0.8	OK

Reference

Check Chord Wall Plastification: SSSB Tbl K2.2

β <= 0.85, Check Limit State

$P_n = \phi(F_y t^2(2\eta/(1-\beta)+4/(1-\beta)^{0.5})Q_f/\sin\theta) =$ 40.933 k >=P **OK** SSSB (K2-7)

$\phi =$ ***1***

Check Shear Yielding (Punching):

$(1-1/\gamma) =$ 0.9068 >= β Check Limit State

β < 0.85 & B/t >= 10 Limit State is Not Applicable

$P_n = \phi(0.6F_y tB(2\eta+2\beta_{eop})/\sin\theta) =$ N/A **N/A** SSSB (K2-8)

$\phi =$ ***0.95***

$\beta_{eop} = 5\beta/\gamma =$ 0.2796 <= β, use $\beta_{oep} =$ 0.2796

Check Sidewall Strength:

β <> 1, Limit State is Not Applicable

(i) Local Yielding:

$P_n = \phi(2F_y t(5k+l_b)/\sin\theta) =$ N/A **N/A** SSSB (K2-9)

$\phi =$ ***1***

$k = 1.5t =$ 0.3495 in

$l_b = H_b/\sin\theta =$ 3.4523 in

(ii) Sidewall Local Crippling

$P_n = \phi(1.6t^2(1+3l_b/(H-3t))(EF_y)^{0.5}Q_f/\sin\theta) =$ N/A **N/A** SSSB (K2-10)

$\phi =$ ***0.75***

Check Local Yielding due to Uneven Load Distribution:

β < 0.85, Limit State is Not Applicable

$P_n = \phi(F_{yb}t_b(2H_b+2b_{eoi}-4t_b)) =$ N/A **N/A** SSSB (K2-12)

$\phi =$ ***0.95***

$b_{eoi} = (10/(B/t))(F_y t/(F_{yb} tb))B_b <= B_b =$ 1.398 in SSSB (K2-13)

Resistance Factors ABDS 6.5.4.2

$\phi_y =$ 0.95 $\phi_u =$ 0.8 $\phi_{e2} =$ 0.8

Check Axial Tension Capacity

$P_r = \phi_y P_{ny} = \phi_y F_y A =$ 93.575 k ABDS 6.8.2.1-1

$P_r = \phi_u P_{nu} = \phi_u F_u A_n R_p U =$ 71.176 k Use $P_r =$ 71.176 k >=P **OK** ABDS 6.8.2.1-2

$A_n = Ag - t_b B_b =$ 1.271 in^2 (Assume only 3 sides are welded)

$R_p =$ ***1***

$U =$ ***1***

Reference

Check Connection

Weld Length = $l_w = 2H_{bd}/\sin\theta + b_{eoi}$ = 8.3026 in (Assume only 3 sides are welded) — SSSB Tbl K4.1

when $\beta > 0.85$ or $\theta > 50^o$, $b_{eoi}/2$ shall not exceed 2t = 0.466 in Use b_{eoi} = 1.398 in

Fillet Weld Size = t = ***0.25*** in

$t_e = 0.707t$ = 0.1768 in

$f_w = (P/l_w)/t_e$ = 26.644 ksi

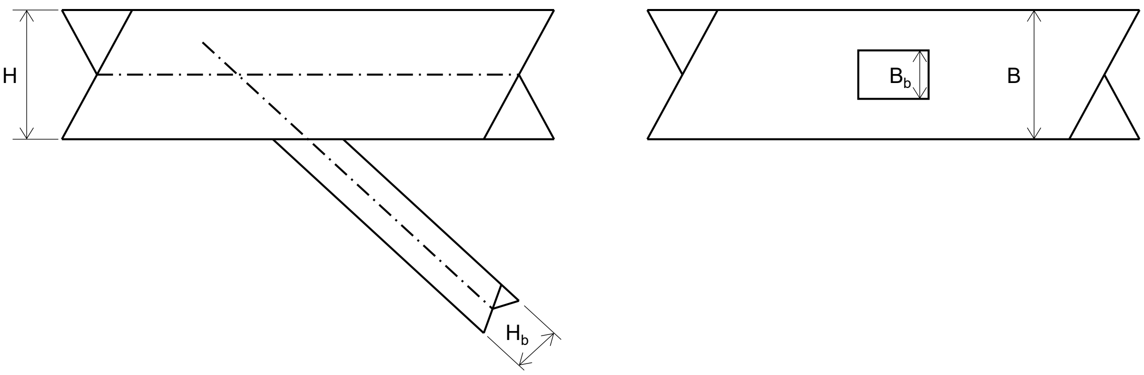
$R_r = \alpha\phi_{e2}F_{EXX}$ = 33.6 ksi <= F_y, Use 33.6 ksi > f_w **OK** — ABDS 6.13.3.2.4

F_{EXX} = ***70*** ksi

α = 0.6

Reference

	Orientation	A	t_c	In-Plane b	In-Plane S	Out-of-Plane b	Out-of-Plane S
Chord : HSS5x5x1/4	Y	4.3	0.233	5	6.41	5	6.41
Branch: HSS3x3x1/4	X	2.44	0.233	3	2.01	3	2.01



B = 5 H = 5 t = 0.233 θ = 37.596

B_b = 3 H_b = 3 t_b = 0.233

$\beta = B_b/B$ = 0.6 $F_y = F_{yb}$ = 50 ksi F_u = 70 ksi

$\gamma = B/2t$ = 10.73 E = 29000 ksi

$\eta = H_b/B\sin\theta$ = 0.9835

Load Case = ***3***

P = ***23.7*** k Member: ***BD001***

Chord-Stress Interaction Parameter:

Q_f = ***1*** (Q_f = 1 if Chord is in Tension, $Q_f = 1.3-0.4U/\beta$ if Chord is in Compression) SSSB Tbl K2.2

Check Applicability: SSSB Tbl K2.2

Branch Angle:		θ >= 30°	OK
Chord Wall Slenderness:	B/t & H/t=	18.5 <= 35	OK
Tension Branch Wall Slenderness:	B_b/t_b =	9.88 <= 35	OK
Comp Branch Wall Slenderness:	B_b/t_b =	9.88 <= 35	OK
	$1.25(E/F_y)^{0.5}$ =	30.104 >= B_b/t_b	OK
Width Ratio:	B_{bd}/B & H_{bd}/B =	0.6 >= 0.25	OK
Aspect Ratio:	H/B & H_{bd}/B_{bd} =	1 >= 0.5	OK
	H/B & H_{bd}/B_{bd} =	1 <= 2.0	OK
Strength:		F_y <= 52 ksi	OK
Ductility:	F_y/F_u =	0.71 <= 0.8	OK

Reference

Check Chord Wall Plastification: — SSSB Tbl K2.2

β <= 0.85, Check Limit State

$P_n = \phi(F_y t^2(2\eta/(1-\beta)+4/(1-\beta)^{0.5})Q_f/\sin\theta) =$ 50.018 k >=P — **OK** — SSSB (K2-7)

$\phi =$ ***1***

Check Shear Yielding (Punching):

$(1-1/\gamma) =$ 0.9068 >= β — Check Limit State

β < 0.85 & B/t >= 10 — Limit State is Not Applicable

$P_n = \phi(0.6F_y tB(2\eta+2\beta_{eop})/\sin\theta) =$ N/A — **N/A** — SSSB (K2-8)

$\phi =$ ***0.95***

$\beta_{eop} = 5\beta/\gamma =$ 0.2796 <= β, use $\beta_{oep} =$ 0.2796

Check Sidewall Strength:

β <> 1, Limit State is Not Applicable

(i) Local Yielding:

$P_n = \phi(2F_y t(5k+l_b)/\sin\theta) =$ N/A — **N/A** — SSSB (K2-9)

$\phi =$ ***1***

k = 1.5t = 0.3495 in

$l_b = H_b/\sin\theta =$ 4.9173 in

(ii) Sidewall Local Crippling

$P_n = \phi(1.6t^2(1+3l_b/(H-3t))(EF_y)^{0.5}Q_f/\sin\theta) =$ N/A — **N/A** — SSSB (K2-10)

$\phi =$ ***0.75***

Check Local Yielding due to Uneven Load Distribution:

β < 0.85, Limit State is Not Applicable

$P_n = \phi(F_{yb}t_b(2H_b+2b_{eoi}-4t_b)) =$ N/A — **N/A** — SSSB (K2-12)

$\phi =$ ***0.95***

$b_{eoi} = (10/(B/t))(F_y t/(F_{yb} tb))B_b <= B_b =$ 1.398 in — SSSB (K2-13)

Resistance Factors — ABDS 6.5.4.2

$\phi_y =$ 0.95 $\phi_u =$ 0.8 $\phi_c =$ 0.9 $\phi_{e2} =$ 0.8

Check Axial Tension Capacity

$P_r = \phi_y P_{ny} = \phi_y F_y A =$ 115.9 k — ABDS 6.8.2.1-1

$P_r = \phi_u P_{nu} = \phi_u F_u A_n R_p U =$ 97.496 k — Use $P_r =$ 97.496 k >=P — **OK** — ABDS 6.8.2.1-2

$A_n = Ag - t_b B_b =$ 1.741 in^2 (Assume only 3 sides are welded)

$R_p =$ ***1***

$U =$ ***1***

Reference

Check Axial Compression Capacity

K = ***1***

L = 121.97 in KL/r = 109.88 <= 140 **OK** ABDS 6.9.3

r = 1.11 in^3

P_e/P_o = 0.4741 $P_n = (0.658^{(Po/Pe)})P_oA_g$ = 50.459 k ABDS 6.9.4.1-1

$P_e = \pi^2E/(KL/r)^2$ = 23.704 ksi $P_n = 0.877P_eA_g$ = N/A k ABDS 6.9.4.1-2

$P_o = QF_y$ = 50 ksi $P_r = \phi_c P_n$ = 45.413 k **OK**

Q = ***1*** ABDS 6.9.4.2

Check Connection

Weld Length = $l_w = 2H_{bd}/\sin\theta + b_{eoi}$ = 11.233 in (Assume only 3 sides are welded) SSSB Tbl K4.1

when $\beta > 0.85$ or $\theta > 50^o$, $b_{eoi}/2$ shall not exceed 2t = 0.466 in Use b_{eoi} = 1.398 in

Fillet Weld Size = t = ***0.25*** in

$t_e = 0.707t$ = 0.1768 in

$f_w = (P/l_w)/t_e$ = 11.937 ksi

$R_r = \alpha\phi_{e2}F_{EXX}$ = 33.6 ksi <= F_y, Use 33.6 ksi > f_w **OK** ABDS 6.13.3.2.4

F_{EXX} = ***70*** ksi

α = 0.6

Check Connection for Fatigue ABDS 6.6.1.2.5-1

P = ***3.7*** k Load Case = ***Fatigue***

Member = ***BD001***

Constant-Amplitude Fatique Threshold = $(\Delta F)_{TH}$ = 4.5 ksi ABDS Table 6.6.1.2.5-3

Detail Category = ***E***

$f_w = (P/l_w)/t_e$ = 1.8636 **ksi < F** **OK for Infinite Life**

Reference

Structure Information:

Expansion Coefficient = α = ***0.0000065*** /°F

Expansion Length = L = 83.292 ft

Skew = 0 °

Temperature Information:

Mean High = T_H = ***120*** °F

Mean Low = T_L = ***-30*** °F

Max Base = T_{BMax} = ***55*** °F   Min Base = T_{BMin} = ***35*** °F

Total Movements:

$\Delta_{Rise} = \alpha(T_H - T_{BMin})Lm$ = 0.5522 in

$\Delta_{Fall} = \alpha(T_{BMax} - T_L)Lm$ = 0.5522 in

Perpendicular Movements:

$\Delta_{P\ Rise} = \Delta_{Rise}Cos(Skew)$ = 0.5522 in

$\Delta_{P\ Fall} = \Delta_{Fall}Cos(Skew)$ = 0.5522 in

1.1044 in

Racking Movements:

$\Delta_{R\ Rise} = \Delta_{Rise}Sin(Skew)$ = 0 in

$\Delta_{R\ Fall} = \Delta_{Fall}Sin(Skew)$ = 0 in

0 in

Gaps:

Gap at T_B = G_B = 1.25 in

Minimum Installation Gap = G_M = ***0.125*** in

Minimum Gap = $G_B - \Delta_{P\ Rise}$ = 0.6978 in > ***0.125*** in **OK**

Maximum Gap = $G_B + \Delta_{P\ Fall}$ = 1.8022 in > ***1.5*** in **N.G.**

Cover Plate or Expansion Joint Requires

Maximum Temperature for Installation Gap:

$T_{Max} = T_B + (G_B - 1/4 - G_M)/(\alpha LmCos(Skew))$ = 189.68 °F

Gap Variance per 10°F:

$G_V = \alpha LmCos(Skew)10$ = 0.065 in

Bearing Force:

R_{LL} = 11.3 k (Unfactored w/o IM)

R_{DL} = 10.9 k (Unfactored)

R = 22.2 k (Unfactored)

Anchor Bolt Checks

Reference

Horizontal Loads:

WS_H =	5.8 k	R_u (LC 3) = $(\gamma_{WS}WS_H^2+\gamma_{TU}TU_L^2)^{1/2}$ =	9.3721 k	ABDS Tbl 3.4.1-1
WA =	0 k	R_u (LC 4) = $\gamma_{EQ}(0.3EQ_H^2+EQ_L^2)^{1/2}$ =	25.886 k	ABDS 3.8.10
EQ_H/R =	12.8 k	R_u (LC 5) = $\gamma_{WA}WA$ =	0 k	ABDS Tbl 3.4.1-1
EQ_L/R =	25.6 k			
TU_L =	3.9 k	R_u = 25.886 k		

Uplift Load:

DC =	-10.9 k	Pu (LC 3) = $\gamma_{DC}DC+\gamma_{DW}DW+\gamma_{WS}WS_H$ =	3.21 k
DW =	0 k	P_u (LC 5) = $\gamma_{WA}WA$ =	0 k
WS_H =	9.3 k		
WA =	0 k	P_u = 3.21 k	

Load Factors

γ_{DC}	γ_{DW}	γ_{WS}	γ_{EQ}	γ_{WA}	γ_{TU}
0.9	***0.65***	*1.4*	*1*	*1*	***1.2***

Bearing Plate Thickness = t = 0.75 in

Bearing Plate Clear Distance = L_c = 1.125 in

Bearing Plate Tensile Strength = F_u = ***70*** ksi

Number of Bolts = n = 2

Anchor Bolt Diameter = d = 1 in

Area of Bolt = A_b = 0.7854 in^2

F_{ub} = 75 ksi (F1554 Grade 55 Bolts) — ABDS 6.4.3

Resistance Factors — ABDS 6.5.4.2

ϕ_f	ϕ_v	ϕ_{bb}	ϕ_t	ϕ_s	ϕ_{e2}
1	***1***	***0.8***	***0.8***	***0.75***	*0.8*

Bolt Capacity in Shear

$\phi_s R_n$ = 0.8)0.48 $\phi_s A_b F_{ub} N_s n$ = 33.929 k >= R_u **OK** — ABDS 6.13.2.12

N_s = ***1***

Bolt Capacity in Tension

$\phi_t T_n$ = 0.76 $\phi_t A_b F_{ub} n$ = 71.628 k >= P_u **OK** — ABDS 6.13.2.10

Bearing Resistance at Bolt Holes

$\phi_{bb}R_{nb} = \phi_{bb}L_c t F_u n$ = 94.5 k >= R_u **OK** — ABDS 6.13.2.9

$\phi_{bb}R_{nb} = \phi_{bb}2.0dtF_u n$ = 168 k >= R_u **OK** — ABDS 6.13.2.9

Capacity of Weld

$R_r = (0.6\phi_{e2}F_{EXX})(0.707t)l_w$ = 89.082 k >= γR_u **OK** — ABDS 6.13.3.2.4

Weld Length = l_w = 15 in

Weld Size = t = ***0.25*** in

F_{EXX} = ***70*** ksi

BR19-00321-1

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Company: BIG R BRIDGE, LLC   Engineer: Eva Leong

VisualAnalysis 12.00.0020 Report

Model Summary

Structure Type: Space Frame

74 Nodes, and 617 Degrees of Freedom

101 Member Elements

The model is linear.

The model will have 437 unique mode shapes.

The size of the model is:

82.88 ft, in the X direction

5.750 ft, in the Y direction

6 ft, in the Z direction

Nodes

Node	X	Y	Z	Fix DX	Fix DY	Fix DZ	Fix RX	Fix RY	Fix RZ
	ft	ft	ft						
N001	0	0	0	No	Yes	No	No	No	No
N001-0	0	0	-6	Yes	Yes	Yes	No	No	No
N002	8.104	0	0	No	No	No	No	No	No
N002-0	8.104	0	-6	No	No	No	No	No	No
N003	16.438	0	0	No	No	No	No	No	No
N003-0	16.438	0	-6	No	No	No	No	No	No
N004	24.771	0	0	No	No	No	No	No	No
N004-0	24.771	0	-6	No	No	No	No	No	No
N005	33.104	0	0	No	No	No	No	No	No
N005-0	33.104	0	-6	No	No	No	No	No	No
N006	41.438	0	0	No	No	No	No	No	No
N006-0	41.438	0	-6	No	No	No	No	No	No
N007	49.771	0	0	No	No	No	No	No	No
N007-0	49.771	0	-6	No	No	No	No	No	No
N008	58.104	0	0	No	No	No	No	No	No
N008-0	58.104	0	-6	No	No	No	No	No	No
N009	66.438	0	0	No	No	No	No	No	No
N009-0	66.438	0	-6	No	No	No	No	No	No
N010	74.771	0	0	No	No	No	No	No	No
N010-0	74.771	0	-6	No	No	No	No	No	No
N011	82.875	0	0	No	Yes	No	No	No	No
N011-0	82.875	0	-6	No	Yes	Yes	No	No	No
N101	0	5.75	0	No	No	No	No	No	No
N101-0	0	5.75	-6	No	No	No	No	No	No

N102	8.104	5.75	0	No	No	No	No	No	No
N102-0	8.104	5.75	-6	No	No	No	No	No	No
N103	16.438	5.75	0	No	No	No	No	No	No
N103-0	16.438	5.75	-6	No	No	No	No	No	No
N104	24.771	5.75	0	No	No	No	No	No	No
N104-0	24.771	5.75	-6	No	No	No	No	No	No
N105	33.104	5.75	0	No	No	No	No	No	No
N105-0	33.104	5.75	-6	No	No	No	No	No	No
N106	41.438	5.75	0	No	No	No	No	No	No
N106-0	41.438	5.75	-6	No	No	No	No	No	No
N107	49.771	5.75	0	No	No	No	No	No	No
N107-0	49.771	5.75	-6	No	No	No	No	No	No
N108	58.104	5.75	0	No	No	No	No	No	No
N108-0	58.104	5.75	-6	No	No	No	No	No	No
N109	66.438	5.75	0	No	No	No	No	No	No
N109-0	66.438	5.75	-6	No	No	No	No	No	No
N110	74.771	5.75	0	No	No	No	No	No	No
N110-0	74.771	5.75	-6	No	No	No	No	No	No
N111	82.875	5.75	0	No	No	No	No	No	No
N111-0	82.875	5.75	-6	No	No	No	No	No	No
NB001	0	0.702	0	No	No	No	No	No	No
NB001-0	0	0.702	-6	No	No	No	No	No	No
NB002	8.104	0.702	0	No	No	No	No	No	No
NB002-0	8.104	0.702	-6	No	No	No	No	No	No
NB003	16.438	0.702	0	No	No	No	No	No	No
NB003-0	16.438	0.702	-6	No	No	No	No	No	No
NB004	24.771	0.702	0	No	No	No	No	No	No
NB004-0	24.771	0.702	-6	No	No	No	No	No	No
NB005	33.104	0.702	0	No	No	No	No	No	No
NB005-0	33.104	0.702	-6	No	No	No	No	No	No
NB006	41.438	0.702	0	No	No	No	No	No	No
NB006-0	41.438	0.702	-6	No	No	No	No	No	No
NB007	49.771	0.702	0	No	No	No	No	No	No
NB007-0	49.771	0.702	-6	No	No	No	No	No	No
NB008	58.104	0.702	0	No	No	No	No	No	No
NB008-0	58.104	0.702	-6	No	No	No	No	No	No
NB009	66.438	0.702	0	No	No	No	No	No	No
NB009-0	66.438	0.702	-6	No	No	No	No	No	No
NB010	74.771	0.702	0	No	No	No	No	No	No
NB010-0	74.771	0.702	-6	No	No	No	No	No	No
NB011	82.875	0.702	0	No	No	No	No	No	No
NB011-0	82.875	0.702	-6	No	No	No	No	No	No
NB012	33.229	5.75	0	No	No	No	No	No	No
NB013	24.896	5.75	0	No	No	No	No	No	No

NB014	16.563	5.75	0	No	No	No	No	No	No
NB015	24.646	0	0	No	No	No	No	No	No
NB016	32.979	0	0	No	No	No	No	No	No
NB017	41.313	0	0	No	No	No	No	No	No
NB018	8.229	5.75	0	No	No	No	No	No	No
NB019	16.313	0	0	No	No	No	No	No	No

Member Elements

Member	Section	Material	(1)Node	(2)Node	Rz1	Ry1	Rx1	Rz2	Ry2	Rx2
BC001	HSS5x5x1/4	ASTM A847	N001	N002	Rigid	Rigid	Rigid	Rigid	Rigid	Rigid
BC001-0	HSS5x5x1/4	ASTM A847	N001-0	N002-0	Rigid	Rigid	Rigid	Rigid	Rigid	Rigid
BC002	HSS5x5x1/4	ASTM A847	N002	N003	Rigid	Rigid	Rigid	Rigid	Rigid	Rigid
BC002-0	HSS5x5x1/4	ASTM A847	N002-0	N003-0	Rigid	Rigid	Rigid	Rigid	Rigid	Rigid
BC003	HSS5x5x1/4	ASTM A847	N003	N004	Rigid	Rigid	Rigid	Rigid	Rigid	Rigid
BC003-0	HSS5x5x1/4	ASTM A847	N003-0	N004-0	Rigid	Rigid	Rigid	Rigid	Rigid	Rigid
BC004	HSS5x5x1/4	ASTM A847	N004	N005	Rigid	Rigid	Rigid	Rigid	Rigid	Rigid
BC004-0	HSS5x5x1/4	ASTM A847	N004-0	N005-0	Rigid	Rigid	Rigid	Rigid	Rigid	Rigid
BC005	HSS5x5x1/4	ASTM A847	N005	N006	Rigid	Rigid	Rigid	Rigid	Rigid	Rigid
BC005-0	HSS5x5x1/4	ASTM A847	N005-0	N006-0	Rigid	Rigid	Rigid	Rigid	Rigid	Rigid
BC006	HSS5x5x1/4	ASTM A847	N006	N007	Rigid	Rigid	Rigid	Rigid	Rigid	Rigid
BC006-0	HSS5x5x1/4	ASTM A847	N006-0	N007-0	Rigid	Rigid	Rigid	Rigid	Rigid	Rigid
BC007	HSS5x5x1/4	ASTM A847	N007	N008	Rigid	Rigid	Rigid	Rigid	Rigid	Rigid
BC007-0	HSS5x5x1/4	ASTM A847	N007-0	N008-0	Rigid	Rigid	Rigid	Rigid	Rigid	Rigid
BC008	HSS5x5x1/4	ASTM A847	N008	N009	Rigid	Rigid	Rigid	Rigid	Rigid	Rigid
BC008-0	HSS5x5x1/4	ASTM A847	N008-0	N009-0	Rigid	Rigid	Rigid	Rigid	Rigid	Rigid
BC009	HSS5x5x1/4	ASTM A847	N009	N010	Rigid	Rigid	Rigid	Rigid	Rigid	Rigid
BC009-0	HSS5x5x1/4	ASTM A847	N009-0	N010-0	Rigid	Rigid	Rigid	Rigid	Rigid	Rigid
BC010	HSS5x5x1/4	ASTM A847	N010	N011	Rigid	Rigid	Rigid	Rigid	Rigid	Rigid
BC010-0	HSS5x5x1/4	ASTM A847	N010-0	N011-0	Rigid	Rigid	Rigid	Rigid	Rigid	Rigid
BD001	HSS3x3x1/4	ASTM A847	N001-0	N002	Free	Free	Free	Free	Free	Rigid
BD002	HSS3x3x1/4	ASTM A847	N002	N003-0	Free	Free	Free	Free	Free	Rigid
BD003	HSS3x3x1/4	ASTM A847	N003-0	N004	Free	Free	Free	Free	Free	Rigid
BD004	HSS3x3x1/4	ASTM A847	N004	N005-0	Free	Free	Free	Free	Free	Rigid
BD007	HSS3x3x1/4	ASTM A847	N007-0	N008	Free	Free	Free	Free	Free	Rigid
BD008	HSS3x3x1/4	ASTM A847	N008	N009-0	Free	Free	Free	Free	Free	Rigid
BD009	HSS3x3x1/4	ASTM A847	N009-0	N010	Free	Free	Free	Free	Free	Rigid
BD010	HSS3x3x1/4	ASTM A847	N010	N011-0	Free	Free	Free	Free	Free	Rigid
D001	HSS4x3x1/4	ASTM A847	N101	N002	Free	Free	Free	Free	Free	Rigid
D001-0	HSS4x3x1/4	ASTM A847	N101-0	N002-0	Free	Free	Free	Free	Free	Rigid
D002	HSS3x2x1/4	ASTM A847	NB018	NB019	Free	Free	Free	Free	Free	Rigid
D002-0	HSS3x2x1/4	ASTM A847	N102-0	N003-0	Free	Free	Free	Free	Free	Rigid
D003	HSS3x2x1/4	ASTM A847	NB014	NB015	Free	Free	Free	Free	Free	Rigid
D003-0	HSS3x2x1/4	ASTM A847	N103-0	N004-0	Free	Free	Free	Free	Free	Rigid
D004	HSS3x2x1/4	ASTM A847	NB013	NB016	Free	Free	Free	Free	Free	Rigid

D004-0	HSS3x2x1/4	ASTM A847	N104-0	N005-0	Free	Free	Free	Free	Free	Rigid
D005	HSS3x2x1/4	ASTM A847	NB012	NB017	Free	Free	Free	Free	Free	Rigid
D005-0	HSS3x2x1/4	ASTM A847	N105-0	N006-0	Free	Free	Free	Free	Free	Rigid
D006	HSS3x2x1/4	ASTM A847	N006	N107	Free	Free	Free	Free	Free	Rigid
D006-0	HSS3x2x1/4	ASTM A847	N006-0	N107-0	Free	Free	Free	Free	Free	Rigid
D007	HSS3x2x1/4	ASTM A847	N007	N108	Free	Free	Free	Free	Free	Rigid
D007-0	HSS3x2x1/4	ASTM A847	N007-0	N108-0	Free	Free	Free	Free	Free	Rigid
D008	HSS3x2x1/4	ASTM A847	N008	N109	Free	Free	Free	Free	Free	Rigid
D008-0	HSS3x2x1/4	ASTM A847	N008-0	N109-0	Free	Free	Free	Free	Free	Rigid
D009	HSS3x2x1/4	ASTM A847	N009	N110	Free	Free	Free	Free	Free	Rigid
D009-0	HSS3x2x1/4	ASTM A847	N009-0	N110-0	Free	Free	Free	Free	Free	Rigid
D010	HSS4x3x1/4	ASTM A847	N010	N111	Free	Free	Free	Free	Free	Rigid
D010-0	HSS4x3x1/4	ASTM A847	N010-0	N111-0	Free	Free	Free	Free	Free	Rigid
EV1	HSS5x5x1/4	ASTM A847	N001	N101	Rigid	Rigid	Rigid	Rigid	Rigid	Rigid
EV1-0	HSS5x5x1/4	ASTM A847	N001-0	N101-0	Rigid	Rigid	Rigid	Rigid	Rigid	Rigid
EV2	HSS5x5x1/4	ASTM A847	N011	N111	Rigid	Rigid	Rigid	Rigid	Rigid	Rigid
EV2-0	HSS5x5x1/4	ASTM A847	N011-0	N111-0	Rigid	Rigid	Rigid	Rigid	Rigid	Rigid
FB001	W8x18	ASTM A847	NB001	NB001-0	Rigid	Rigid	Rigid	Rigid	Rigid	Rigid
FB002	W8x18	ASTM A847	NB002	NB002-0	Rigid	Rigid	Rigid	Rigid	Rigid	Rigid
FB003	W8x18	ASTM A847	NB003	NB003-0	Rigid	Rigid	Rigid	Rigid	Rigid	Rigid
FB004	W8x18	ASTM A847	NB004	NB004-0	Rigid	Rigid	Rigid	Rigid	Rigid	Rigid
FB005	W8x18	ASTM A847	NB005	NB005-0	Rigid	Rigid	Rigid	Rigid	Rigid	Rigid
FB006	W8x18	ASTM A847	NB006	NB006-0	Rigid	Rigid	Rigid	Rigid	Rigid	Rigid
FB007	W8x18	ASTM A847	NB007	NB007-0	Rigid	Rigid	Rigid	Rigid	Rigid	Rigid
FB008	W8x18	ASTM A847	NB008	NB008-0	Rigid	Rigid	Rigid	Rigid	Rigid	Rigid
FB009	W8x18	ASTM A847	NB009	NB009-0	Rigid	Rigid	Rigid	Rigid	Rigid	Rigid
FB010	W8x18	ASTM A847	NB010	NB010-0	Rigid	Rigid	Rigid	Rigid	Rigid	Rigid
FB011	W8x18	ASTM A847	NB011	NB011-0	Rigid	Rigid	Rigid	Rigid	Rigid	Rigid
TC001	HSS5x5x1/4	ASTM A847	N101	N102	Rigid	Rigid	Rigid	Rigid	Rigid	Rigid
TC001-0	HSS5x5x1/4	ASTM A847	N101-0	N102-0	Rigid	Rigid	Rigid	Rigid	Rigid	Rigid
TC002	HSS5x5x1/4	ASTM A847	N102	N103	Rigid	Rigid	Rigid	Rigid	Rigid	Rigid
TC002-0	HSS5x5x1/4	ASTM A847	N102-0	N103-0	Rigid	Rigid	Rigid	Rigid	Rigid	Rigid
TC003	HSS5x5x1/4	ASTM A847	N103	N104	Rigid	Rigid	Rigid	Rigid	Rigid	Rigid
TC003-0	HSS5x5x1/4	ASTM A847	N103-0	N104-0	Rigid	Rigid	Rigid	Rigid	Rigid	Rigid
TC004	HSS5x5x1/4	ASTM A847	N104	N105	Rigid	Rigid	Rigid	Rigid	Rigid	Rigid
TC004-0	HSS5x5x1/4	ASTM A847	N104-0	N105-0	Rigid	Rigid	Rigid	Rigid	Rigid	Rigid
TC005	HSS5x5x1/4	ASTM A847	N105	N106	Rigid	Rigid	Rigid	Rigid	Rigid	Rigid
TC005-0	HSS5x5x1/4	ASTM A847	N105-0	N106-0	Rigid	Rigid	Rigid	Rigid	Rigid	Rigid
TC006	HSS5x5x1/4	ASTM A847	N106	N107	Rigid	Rigid	Rigid	Rigid	Rigid	Rigid
TC006-0	HSS5x5x1/4	ASTM A847	N106-0	N107-0	Rigid	Rigid	Rigid	Rigid	Rigid	Rigid
TC007	HSS5x5x1/4	ASTM A847	N107	N108	Rigid	Rigid	Rigid	Rigid	Rigid	Rigid
TC007-0	HSS5x5x1/4	ASTM A847	N107-0	N108-0	Rigid	Rigid	Rigid	Rigid	Rigid	Rigid
TC008	HSS5x5x1/4	ASTM A847	N108	N109	Rigid	Rigid	Rigid	Rigid	Rigid	Rigid
TC008-0	HSS5x5x1/4	ASTM A847	N108-0	N109-0	Rigid	Rigid	Rigid	Rigid	Rigid	Rigid

TC009	HSS5x5x1/4	ASTM A847	N109	N110	Rigid	Rigid	Rigid	Rigid	Rigid	Rigid
TC009-0	HSS5x5x1/4	ASTM A847	N109-0	N110-0	Rigid	Rigid	Rigid	Rigid	Rigid	Rigid
TC010	HSS5x5x1/4	ASTM A847	N110	N111	Rigid	Rigid	Rigid	Rigid	Rigid	Rigid
TC010-0	HSS5x5x1/4	ASTM A847	N110-0	N111-0	Rigid	Rigid	Rigid	Rigid	Rigid	Rigid
V002	HSS4x4x1/4	ASTM A847	N002	N102	Rigid	Rigid	Rigid	Rigid	Rigid	Rigid
V002-0	HSS4x4x1/4	ASTM A847	N002-0	N102-0	Rigid	Rigid	Rigid	Rigid	Rigid	Rigid
V003	HSS4x4x1/4	ASTM A847	N003	N103	Rigid	Rigid	Rigid	Rigid	Rigid	Rigid
V003-0	HSS4x4x1/4	ASTM A847	N003-0	N103-0	Rigid	Rigid	Rigid	Rigid	Rigid	Rigid
V004	HSS4x4x1/4	ASTM A847	N004	N104	Rigid	Rigid	Rigid	Rigid	Rigid	Rigid
V004-0	HSS4x4x1/4	ASTM A847	N004-0	N104-0	Rigid	Rigid	Rigid	Rigid	Rigid	Rigid
V005	HSS4x4x1/4	ASTM A847	N005	N105	Rigid	Rigid	Rigid	Rigid	Rigid	Rigid
V005-0	HSS4x4x1/4	ASTM A847	N005-0	N105-0	Rigid	Rigid	Rigid	Rigid	Rigid	Rigid
V006	HSS4x4x1/4	ASTM A847	N006	N106	Rigid	Rigid	Rigid	Rigid	Rigid	Rigid
V006-0	HSS4x4x1/4	ASTM A847	N006-0	N106-0	Rigid	Rigid	Rigid	Rigid	Rigid	Rigid
V007	HSS4x4x1/4	ASTM A847	N007	N107	Rigid	Rigid	Rigid	Rigid	Rigid	Rigid
V007-0	HSS4x4x1/4	ASTM A847	N007-0	N107-0	Rigid	Rigid	Rigid	Rigid	Rigid	Rigid
V008	HSS4x4x1/4	ASTM A847	N008	N108	Rigid	Rigid	Rigid	Rigid	Rigid	Rigid
V008-0	HSS4x4x1/4	ASTM A847	N008-0	N108-0	Rigid	Rigid	Rigid	Rigid	Rigid	Rigid
V009	HSS4x4x1/4	ASTM A847	N009	N109	Rigid	Rigid	Rigid	Rigid	Rigid	Rigid
V009-0	HSS4x4x1/4	ASTM A847	N009-0	N109-0	Rigid	Rigid	Rigid	Rigid	Rigid	Rigid
V010	HSS4x4x1/4	ASTM A847	N010	N110	Rigid	Rigid	Rigid	Rigid	Rigid	Rigid
V010-0	HSS4x4x1/4	ASTM A847	N010-0	N110-0	Rigid	Rigid	Rigid	Rigid	Rigid	Rigid

Load Combination Summary

Factored Combination: Fatigue

Factor : Service Case

0.22 x WS

Factored Combination: LC 1) Strength I (PL)

Factor : Service Case

1.25 x DC

1.75 x PL

Factored Combination: LC 2) Strength I (LL)

Factor : Service Case

1.25 x DC

1.75 x LL

Factored Combination: LC 3) Strength III

Factor : Service Case

1.25 x DC

1.40 x WS

Member Uniform Loads

Load Ca	Member	Direction	Offset	d Offset	Force
			ft	ft	K/ft
DC	FB001	Force Y	0	6	-0.261
DC	FB002	Force Y	0	6	-0.511
DC	FB003	Force Y	0	6	-0.511
DC	FB004	Force Y	0	6	-0.511
DC	FB005	Force Y	0	6	-0.511
DC	FB006	Force Y	0	6	-0.511
DC	FB007	Force Y	0	6	-0.511
DC	FB008	Force Y	0	6	-0.511
DC	FB009	Force Y	0	6	-0.511
DC	FB010	Force Y	0	6	-0.511
DC	FB011	Force Y	0	6	-0.261
PL	FB001	Force Y	0	6	-0.383
PL	FB002	Force Y	0	6	-0.75
PL	FB003	Force Y	0	6	-0.75
PL	FB004	Force Y	0	6	-0.75
PL	FB005	Force Y	0	6	-0.75
PL	FB006	Force Y	0	6	-0.75
PL	FB007	Force Y	0	6	-0.75
PL	FB008	Force Y	0	6	-0.75
PL	FB009	Force Y	0	6	-0.75
PL	FB010	Force Y	0	6	-0.75
PL	FB011	Force Y	0	6	-0.383
WS	BC001	Force Z	0	8.104	0.07
WS	BC001-0	Force Z	0	8.104	0.07
WS	BC002	Force Z	0	8.333	0.07
WS	BC002-0	Force Z	0	8.333	0.07
WS	BC003	Force Z	0	8.333	0.07
WS	BC003-0	Force Z	0	8.333	0.07
WS	BC004	Force Z	0	8.333	0.07
WS	BC004-0	Force Z	0	8.333	0.07
WS	BC005	Force Z	0	8.333	0.07
WS	BC005-0	Force Z	0	8.333	0.07
WS	BC006	Force Z	0	8.333	0.07
WS	BC006-0	Force Z	0	8.333	0.07
WS	BC007	Force Z	0	8.333	0.07
WS	BC007-0	Force Z	0	8.333	0.07
WS	BC008	Force Z	0	8.333	0.07
WS	BC008-0	Force Z	0	8.333	0.07
WS	BC009	Force Z	0	8.333	0.07
WS	BC009-0	Force Z	0	8.333	0.07
WS	BC010	Force Z	0	8.104	0.07

WS	BC010-0	Force Z	0	8.104	0.07
WS	TC001	Force Z	0	8.104	0.07
WS	TC001-0	Force Z	0	8.104	0.07
WS	TC002	Force Z	0	8.333	0.07
WS	TC002-0	Force Z	0	8.333	0.07
WS	TC003	Force Z	0	8.333	0.07
WS	TC003-0	Force Z	0	8.333	0.07
WS	TC004	Force Z	0	8.333	0.07
WS	TC004-0	Force Z	0	8.333	0.07
WS	TC005	Force Z	0	8.333	0.07
WS	TC005-0	Force Z	0	8.333	0.07
WS	TC006	Force Z	0	8.333	0.07
WS	TC006-0	Force Z	0	8.333	0.07
WS	TC007	Force Z	0	8.333	0.07
WS	TC007-0	Force Z	0	8.333	0.07
WS	TC008	Force Z	0	8.333	0.07
WS	TC008-0	Force Z	0	8.333	0.07
WS	TC009	Force Z	0	8.333	0.07
WS	TC009-0	Force Z	0	8.333	0.07
WS	TC010	Force Z	0	8.104	0.07
WS	TC010-0	Force Z	0	8.104	0.07

Member Point Loads

Load Ca	Member	Direction	Offset	Force
			ft	K
LL	FB001	Force Y	0.75	-1.52
LL	FB001	Force Y	3.417	-1.52
LL	FB005	Force Y	0.75	-0.24
LL	FB005	Force Y	3.417	-0.24
LL	FB006	Force Y	0.75	-1.52
LL	FB006	Force Y	3.417	-1.52
LL	FB007	Force Y	0.75	-0.24
LL	FB007	Force Y	3.417	-0.24

Nodal Loads

Load Ca	Node	Direction	Force
			K
DC	N101	DY	-0.06
DC	N101-0	DY	-0.06
DC	N102	DY	-0.118
DC	N102-0	DY	-0.118
DC	N103	DY	-0.118
DC	N103-0	DY	-0.118
DC	N104	DY	-0.118

DC	N104-0	DY	-0.118
DC	N105	DY	-0.118
DC	N105-0	DY	-0.118
DC	N106	DY	-0.118
DC	N106-0	DY	-0.118
DC	N107	DY	-0.118
DC	N107-0	DY	-0.118
DC	N108	DY	-0.118
DC	N108-0	DY	-0.118
DC	N109	DY	-0.118
DC	N109-0	DY	-0.118
DC	N110	DY	-0.118
DC	N110-0	DY	-0.118
DC	N111	DY	-0.06
DC	N111-0	DY	-0.06

BR19-00321-1

C:\Users\eleong\Downloads\BR19-00321-1.vap

Company: BIG R BRIDGE, LLC Engineer: Eva Leong

VisualAnalysis 12.00.0020 Report

Nodal Displacements

Node	Result Case Nam	DX	DY	DZ
		in	in	in
N006	DC	0.084	-1.075	0.044
N006	LL	0.009	-0.212	0.035
N006	PL	**0.09**	-1.143	0.049
N006	WS	-0.137	-0.787	**1.468**

Member End Reactions

Member	Result Case Nam	Offset	Fx	Vy	Vz	Mx	My	Mz
		ft	K	K	K	K-ft	K-ft	K-ft
FB001	LC 1) Strength I (PL	0	-0.156	3.039	**-0.082**	0	0.251	0.19
FB001	LC 1) Strength I (PL	6	-0.156	-3.079	-0.082	0	-0.24	0.069
FB001	LC 2) Strength I (LL	0	-0.059	4.612	-0.018	-0.001	0.051	-0.529
FB001	LC 2) Strength I (LL	6	-0.059	-2.801	-0.018	-0.001	-0.057	0.025
FB001	LC 3) Strength III	0	1.136	3.959	**0.847**	**-0.016**	**-2.526**	**-8.068**
FB001	LC 3) Strength III	6	1.136	1.866	0.847	-0.016	**2.557**	**9.407**
FB005	LC 1) Strength I (PL	0	**-0.509**	**5.827**	0.27	**0**	-0.814	-0.091
FB005	LC 1) Strength I (PL	6	-0.509	**-6.013**	0.27	0	0.808	-0.651
FB005	LC 2) Strength I (LL	0	-0.249	2.448	0.133	0	-0.404	0.204
FB005	LC 2) Strength I (LL	6	-0.249	-2.357	0.133	0	0.395	-0.295
FB005	LC 3) Strength III	0	**2.381**	3.184	0.539	-0.004	-1.621	-2.388
FB005	LC 3) Strength III	6	2.381	-0.781	0.539	-0.004	1.613	4.821

Member Internal Forces

Member	Result Case Nam	Offset	Fx	Vy	Vz	Mx	My	Mz
		ft	K	K	K	K-ft	K-ft	K-ft
BC005	LC 1) Strength I (PL	0	112.561	0.054	0.026	-0.034	-0.513	1.205
BC005	LC 1) Strength I (PL	2.083	112.561	0.016	0.026	-0.034	-0.458	1.277
BC005	LC 1) Strength I (PL	4.167	112.561	-0.022	0.026	-0.034	-0.403	1.27
BC005	LC 1) Strength I (PL	6.25	112.561	-0.061	0.026	-0.034	-0.348	1.183
BC005	LC 1) Strength I (PL	8.333	117.09	3.081	0.026	-0.034	-0.293	1.414
BC005	LC 2) Strength I (LL	0	57.769	0.082	0.003	-0.066	-0.228	0.526
BC005	LC 2) Strength I (LL	2.083	57.769	0.044	0.003	-0.066	-0.221	0.658
BC005	LC 2) Strength I (LL	4.167	57.769	0.006	0.003	-0.066	-0.214	0.711
BC005	LC 2) Strength I (LL	6.25	57.769	-0.032	0.003	-0.066	-0.207	0.684
BC005	LC 2) Strength I (LL	8.333	61.913	2.836	0.003	-0.066	-0.201	0.941

BC005	LC 3) Strength III	0	117.782	-0.019	-1.015	0.265	1.82	1.098
BC005	LC 3) Strength III	2.083	117.782	-0.057	-0.811	0.265	-0.078	1.019
BC005	LC 3) Strength III	4.167	117.782	-0.095	-0.606	0.265	-1.55	0.861
BC005	LC 3) Strength III	6.25	117.782	-0.134	-0.4	0.265	-2.605	0.621
BC005	LC 3) Strength III	8.333	**120.384**	1.638	-0.195	0.265	-3.223	0.53
BD001	Fatigue	0	3.676	0	0	0	0	0
BD001	Fatigue	2.521	3.676	0	0	0	0	0
BD001	Fatigue	5.042	3.676	0	0	0	0	0
BD001	Fatigue	7.563	3.676	0	0	0	0	0
BD001	Fatigue	10.084	3.676	0	0	0	0	0
BD001	LC 1) Strength I (PL	0	0.507	0.052	0	0	0	0
BD001	LC 1) Strength I (PL	2.521	0.507	0.026	0	0	0	0.099
BD001	LC 1) Strength I (PL	5.042	0.507	0	0	0	0	0.132
BD001	LC 1) Strength I (PL	7.563	0.507	-0.026	0	0	0	0.099
BD001	LC 1) Strength I (PL	10.084	0.507	-0.052	0	0	0	0
BD001	LC 2) Strength I (LL	0	0.208	0.052	0	0	0	0
BD001	LC 2) Strength I (LL	2.521	0.208	0.026	0	0	0	0.099
BD001	LC 2) Strength I (LL	5.042	0.208	0	0	0	0	0.132
BD001	LC 2) Strength I (LL	7.563	0.208	-0.026	0	0	0	0.099
BD001	LC 2) Strength I (LL	10.084	0.208	-0.052	0	0	0	0
BD001	LC 3) Strength III	0	23.582	0.052	0	0	0	0
BD001	LC 3) Strength III	2.521	23.582	0.026	0	0	0	0.099
BD001	LC 3) Strength III	5.042	23.582	0	0	0	0	0.132
BD001	LC 3) Strength III	7.563	23.582	-0.026	0	0	0	0.099
BD001	LC 3) Strength III	10.084	23.582	-0.052	0	0	0	0
D001	LC 1) Strength I (PL	0	50.086	0	-0.05	0	0	0
D001	LC 1) Strength I (PL	2.484	50.069	0	-0.025	0	-0.094	0
D001	LC 1) Strength I (PL	4.968	50.051	0	0	0	-0.125	0
D001	LC 1) Strength I (PL	7.453	50.033	0	0.025	0	-0.094	0
D001	LC 1) Strength I (PL	9.937	50.015	0	0.05	0	0	0
D001	LC 2) Strength I (LL	0	23.883	0	-0.05	0	0	0
D001	LC 2) Strength I (LL	2.484	23.865	0	-0.025	0	-0.094	0
D001	LC 2) Strength I (LL	4.968	23.847	0	0	0	-0.125	0
D001	LC 2) Strength I (LL	7.453	23.829	0	0.025	0	-0.094	0
D001	LC 2) Strength I (LL	9.937	23.811	0	0.05	0	0	0
D001	LC 3) Strength III	0	28.307	0	-0.05	0	0	0
D001	LC 3) Strength III	2.484	28.289	0	-0.025	0	-0.094	0
D001	LC 3) Strength III	4.968	28.272	0	0	0	-0.125	0
D001	LC 3) Strength III	7.453	28.254	0	0.025	0	-0.094	0
D001	LC 3) Strength III	9.937	28.236	0	0.05	0	0	0
D002	LC 1) Strength I (PL	0	39.157	0	-0.034	0	0	0
D002	LC 1) Strength I (PL	2.48	39.145	0	-0.017	0	-0.063	0
D002	LC 1) Strength I (PL	4.96	39.133	0	0	0	-0.084	0
D002	LC 1) Strength I (PL	7.44	39.121	0	0.017	0	-0.063	0

D002	LC 1) Strength I (Pl	9.92	39.109	0	0.034	0	0	0
D002	LC 2) Strength I (LL	0	19.428	0	-0.034	0	0	0
D002	LC 2) Strength I (LL	2.48	19.416	0	-0.017	0	-0.063	0
D002	LC 2) Strength I (LL	4.96	19.404	0	0	0	-0.084	0
D002	LC 2) Strength I (LL	7.44	19.392	0	0.017	0	-0.063	0
D002	LC 2) Strength I (LL	9.92	19.38	0	0.034	0	0	0
D002	LC 3) Strength III	0	22.16	0	-0.034	0	0	0
D002	LC 3) Strength III	2.48	22.148	0	-0.017	0	-0.063	0
D002	LC 3) Strength III	4.96	22.136	0	0	0	-0.084	0
D002	LC 3) Strength III	7.44	22.124	0	0.017	0	-0.063	0
D002	LC 3) Strength III	9.92	22.112	0	0.034	0	0	0
EV1	LC 1) Strength I (Pl	0	-32.584	-0.544	-0.118	-0.215	0.082	1.903
EV1	LC 1) Strength I (Pl	1.438	-29.519	-0.626	0.039	0.036	-0.163	1.082
EV1	LC 1) Strength I (Pl	2.875	-29.493	-0.626	0.039	0.036	-0.108	0.182
EV1	LC 1) Strength I (Pl	4.313	-29.466	-0.626	0.039	0.036	-0.051	-0.739
EV1	LC 1) Strength I (Pl	5.75	-29.44	-0.626	0.039	0.036	0.005	-1.638
EV1	LC 2) Strength I (LL	0	-18.847	-0.289	-0.078	-0.206	-0.228	0.947
EV1	LC 2) Strength I (LL	1.438	-14.21	-0.308	-0.019	-0.155	0.233	0.527
EV1	LC 2) Strength I (LL	2.875	-14.184	-0.308	-0.019	-0.155	0.206	0.085
EV1	LC 2) Strength I (LL	4.313	-14.157	-0.308	-0.019	-0.155	0.177	-0.367
EV1	LC 2) Strength I (LL	5.75	-14.13	-0.308	-0.019	-0.155	0.15	-0.809
EV1	LC 3) Strength III	0	-20.79	**-1.144**	0.364	0.265	-2.345	1.405
EV1	LC 3) Strength III	1.438	-16.806	-0.297	-0.773	**-2.261**	**5.436**	0.378
EV1	LC 3) Strength III	2.875	-16.78	-0.297	-0.773	-2.261	4.326	-0.048
EV1	LC 3) Strength III	4.313	-16.753	-0.297	-0.773	-2.261	3.189	-0.485
EV1	LC 3) Strength III	5.75	-16.726	-0.297	-0.773	-2.261	2.079	-0.911
TC005	LC 1) Strength I (Pl	0	-112.79	**3.369**	-0.026	-0.035	-0.178	0.549
TC005	LC 1) Strength I (Pl	2.083	-117.32	0.069	-0.026	-0.035	-0.232	1.138
TC005	LC 1) Strength I (Pl	4.167	-117.32	0.03	-0.026	-0.035	-0.287	1.242
TC005	LC 1) Strength I (Pl	6.25	-117.32	-0.008	-0.026	-0.035	-0.341	1.266
TC005	LC 1) Strength I (Pl	8.333	-117.32	-0.046	-0.026	-0.035	-0.396	1.209
TC005	LC 2) Strength I (LL	0	-57.908	3.106	0.005	0.006	-0.19	0.021
TC005	LC 2) Strength I (LL	2.083	-62.053	0.079	0.005	0.006	-0.179	0.596
TC005	LC 2) Strength I (LL	4.167	-62.053	0.04	0.005	0.006	-0.167	0.721
TC005	LC 2) Strength I (LL	6.25	-62.053	0.002	0.005	0.006	-0.156	0.765
TC005	LC 2) Strength I (LL	8.333	-62.053	-0.036	0.005	0.006	-0.145	0.73
TC005	LC 3) Strength III	0	-63.199	1.887	-0.612	-0.039	-0.304	0.814
TC005	LC 3) Strength III	2.083	-65.801	-0.043	-0.409	-0.039	-1.354	1
TC005	LC 3) Strength III	4.167	-65.801	-0.082	-0.203	-0.039	-1.996	0.869
TC005	LC 3) Strength III	6.25	-65.801	-0.12	0.002	-0.039	-2.204	0.66
TC005	LC 3) Strength III	8.333	-65.801	-0.158	0.209	-0.039	-1.983	0.368
V002	LC 1) Strength I (Pl	0	-28.899	-0.981	-0.654	0.297	-0.061	**2.379**
V002	LC 1) Strength I (Pl	1.438	-22.858	-0.893	-0.118	0.031	0.322	1.063
V002	LC 1) Strength I (Pl	2.875	-22.837	-0.893	-0.118	0.031	0.152	-0.22

V002	LC 1) Strength I (PL	4.313	-22.816	-0.893	-0.118	0.031	-0.021	-1.533
V002	LC 1) Strength I (PL	5.75	-22.795	-0.893	-0.118	0.031	-0.191	**-2.816**
V002	LC 2) Strength I (LL	0	-13.595	-0.488	-0.278	0.076	0.086	1.161
V002	LC 2) Strength I (LL	1.438	-11.546	-0.433	-0.024	-0.086	0.026	0.513
V002	LC 2) Strength I (LL	2.875	-11.526	-0.433	-0.024	-0.086	-0.008	-0.11
V002	LC 2) Strength I (LL	4.313	-11.504	-0.433	-0.024	-0.086	-0.043	-0.747
V002	LC 2) Strength I (LL	5.75	-11.484	-0.433	-0.024	-0.086	-0.077	-1.37
V002	LC 3) Strength III	0	-16.273	-1.016	**-2.337**	**0.49**	0.353	1.436
V002	LC 3) Strength III	1.438	-13.057	-0.407	-0.654	-1.342	2.737	0.421
V002	LC 3) Strength III	2.875	-13.036	-0.407	-0.654	-1.342	1.797	-0.164
V002	LC 3) Strength III	4.313	-13.015	-0.407	-0.654	-1.342	0.836	-0.763
V002	LC 3) Strength III	5.75	-12.994	-0.407	-0.654	-1.342	-0.104	-1.349

BRIDGE DESIGN CALCULATIONS

FOR

PRESSENTIN PARK BRIDGE 2

SKAGIT COUNTY PUBLIC WORKS

78.292' X 12' HALF-THROUGH H-SECTION WEATHERING STEEL BRIDGE

MARBLEMOUNT, WA

BIG R BRIDGE JOB NO. BR19-00321/2

Design Specifications: LRFD GUIDE SPECIFICATIONS FOR DESIGN OF PEDESTRIAN BRIDGES BY AASHTO, DECEMBER 2009 (AGS)

Other Specifications:

AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS, 7TH EDITION, 2014 (ABDS)

AASHTO STANDARD SPECIFICATIONS FOR STRUCTURAL SUPPORTS FOR HIGHWAY SIGNS, LUMINAIRES, AND TRAFFIC SIGNALS, 6TH EDITION, 2013 (ASHS)

STEEL CONSTRUCTION MANUAL BY AISC, 14TH EDITION (AISC)

SPECIFICATION FOR STRUCTURAL STEEL BUILDINGS, 2010 (SSSB)

Structural Steel Material:

TUBING: A847
SHAPES: A588
PLATES: A588

December 24, 2019

Truss Layout

CL Bridge Length =	78.29167	ft
Low End Deck Cantilever =	0	ft
High End Deck Cantilever =	0	ft
Bridge Width = W =	12	ft
Bridge Height = H =	54	in
Roof Height =	0	in
Rail Height =	54	in
Total Bridge Width =	13	ft
Total Truss Height =	6.333333	ft
Number of Bays =	9	ea

	Length	End Bay 1	End Bay 2
Front Truss (ft) :	78.29167	8.5625	8.5625
Rear Truss (ft) :	78.29167	8.5625	8.5625

Mid Bay Spacing =	8.666667	ft
CL to CL Chord Width = b =	150	in
CL TC to CL FB Max = h =	62.1	in
CL TC to CL FB Ave = h =	62.1	in
x =	1.8	in
Rise in Bearing Elevations =	0	in
Total Camber =	3 1/2	in
DL Camber =	1	in

Bridge Skew 1 =	0 °	End FB 1 Skew =	0 °
Bridge Skew 2 =	0 °	End FB 2 Skew =	0 °
		Int FB Skew =	0 °

Members

Members		In-Plane Orientation	Number of Bays	Plated
End Top Chord =	HSS6x6x3/8	X	0	N
Top Chord =	HSS6x6x3/8	X		N
End Bottom Chord =	HSS6x4x3/8	Y	0	N
Bottom Chord =	HSS6x4x3/8	Y		N
End Verticals =	HSS6x6x3/8	X		
1st Verticals =	HSS5x5x1/4	X	0	
Verticals =	HSS5x5x1/4	X		
End Diagonals =	HSS5x3x1/4	Y	1	
Overlapped Diagonals =	HSS3x3x1/4	X	0	
Gapped Diagonals =	HSS3x3x1/4	X		
End Brace Diags. =	HSS4x3x1/4	X	1	
Brace Diagonals =	HSS4x3x1/4	X	2	
Stacked End Floor Beam =	N/A	N/A		
End Floor Beams =	W10x22	X		
1st Floor Beams =	W10x22	X	0	
Floor Beams =	W10x22	X		
End Top Brace Diagonals =	N/A			
Top Brace Diagonals =	N/A			
End Portal Struts =	N/A			
Portal Struts =	N/A			
Stringers =	N/A			
Shipping Struts =	N/A			
TC Plating =	N/A			
BC Plating =	N/A			

Interior Bay Gap = 1.5 in Starting at bay 2

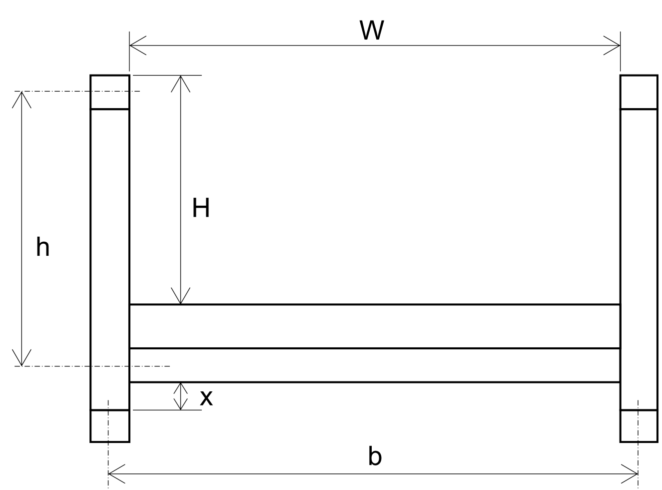
	Front Truss	Rear Truss
End Diagonal Angle =	34.1633 °	34.1633 °
End Diagonal Angle =	34.1633 °	34.1633 °
Overlapped Diagonal Angle =	34.3008 °	34.3008 °
Gapped Diagonal Angle =	35.98413 °	35.98413 °

End Brace Diagonal Gap From End FB = 0.75 in

Brace Diagonal Gap From CL = 0.75 in

Deck Layout:

Type =	Concrete			
Decking =	VULCRAFT 2C18			
Thickness of Deck at Edge =	6 in,	at CL =	6	in
Concrete Top Cover at Edge =	2 in,	at CL =	2	in
Top of Decking to Rebar =	0.625 in			
Rebar Size =	7			
Rebar Spacing =	12			
Stringer Spacing =	N/A in			



Bridge Length =	78.292 ft	Bridge Inside Width =	12 ft	Total Deck Area =	939.5 sf
Bay Length =	8.6667 ft	Clear Deck Width =	12 ft	Usable Deck Area =	939.5 sf
		Bridge Roof Width =	13 ft	Total Roof Area =	1017.8 sf

Dead Loads (DC)

Rail + Curb Weight =	14.186	lb/ft
Roof Weight =	0	psf
Deck Weight =	66.507	psf
Truss Weight =	15476	lb
Deck Load to End Floor Beam 1 =	301.36	lb/ft
Deck Load to End Floor Beam 2 =	301.36	lb/ft
Deck Load to Floor Beam =	576.39	lb/ft
Rail Load to End Vertical =	64.279	lb
Rail Load to Vertical =	122.94	lb
Roof Load to End Portal Strut 1 =	0	lb/ft
Roof Load to End Portal Strut 2 =	0	lb/ft
Roof Load to Portal Strut =	0	lb/ft
Total DC =	80181	lb

Wind Loads (WSH) (ASHS 3.8 & 3.9)

$P_z = 0.00256K_zGV^2I_rC_d$ =	46.214	psf
Basic Wind Speed = V =	90	mph
Design Life =	50	yr
$I_r = I_F$ =	1.15	
K_z =	1	
Max Height above grade =	32.8	ft
G =	***1.14***	
C_d =	***1.7***	
Projected Area of Truss =	228.2	sf
Projected Area of Deck & Rail =	268.06	sf
Projected Area of Roof =	0	sf
Total Projected Area = A_P =	496.25	sf
Wind Load to Top Chord =	73.233	lb/ft
Wind Load to Bottom Chord =	73.233	lb/ft
Total WS = P_zA_P =	22934	lb

Wind Loads (WSV) (ABDS 3.8.2)

P_V =	***20***	psf uplift over deck area
Uplift on Leeward Truss =	177.6	plf
Uplift on windward Truss =	62.4	plf

Wearing Surface & Utilities (DW)

DW Load to Verticals =	0	lb/ft
DW Load to Deck =	0	psf
DW to End Floor Beam 1 =	0	lb/ft
DW to End Floor Beam 2 =	0	lb/ft
DW to Floor Beam =	0	lb/ft
DW Load to End Vertical =	0	lb
DW Load toVertical =	0	lb
Total DW =	0	lb

Pedestrian Live Load (PL) (AGS 3.1)

Pedestrian Live Load =	90	psf
PL Reduction = $(0.25+15/A_T^{1/2})$ =	N/A	
Reduced Pedestrian Live Load (PL) =	90	psf
PL to End Floor Beam 1 =	407.81	lb/ft
PL to End Floor Beam 2 =	407.81	lb/ft
PL to Floor Beam =	780	lb/ft
Total PL =	84555	lb

Vehicle Live Load (LL) (AGS 3.2)

Vehicle =	15000	
IM =	1	
Weight =	15000	lb
Front Axle Spacing = WB =	10	ft
Rear Axle Spacing = WB_R =	0	ft
Wheel Spacing = T =	6	ft
Edge = C =	1.5	ft
P_F =	3000	lb
P_R =	4500	lb
P_{RR} =	0	lb

Snow Load (SL)

Snow Load (SL) =	50	psf
SL to End Floor Beam 1 =	226.56	lb/ft
SL to End Floor Beam 2 =	226.56	lb/ft
SL to Floor Beam =	433.33	lb/ft
Total SL =	46975	lb

Fatigue Live Load (FLL) (ASHS 11)

$P_{NW} = 5.2C_dI_F$ = 10.166 psf

Horiz Fatigue Load to Top Chord = 16.109 lb/ft

Horiz Fatigue Load to Btm Chord = 16.109 lb/ft

Total Horizontal Fatigue Load = 5044.9 lb

V_T (Truck Speed if Over Road) = 0 mph

$P_{TG} = 18.8C_d(V_T/65)^2I_F$ = 0 psf

Vertical Fatigue Load to Btm Chord = 0 lb/ft

Stream Load (WA) (ABDS 3.7.3)

Stream Velocity = V = 0 fps

at 0 ft above deck

$P_{max} = C_DV^2$ = 0 psf

C_D = 1.4

Stream Force to Bottom Chord = 0 lb/ft

Stream Force to Top Chord = 0 lb/ft

Total Stream Load = 0 lb

Seismic Loads (EQ)

Design to ABDS 3.10

* See Seismic Loading Page for Details

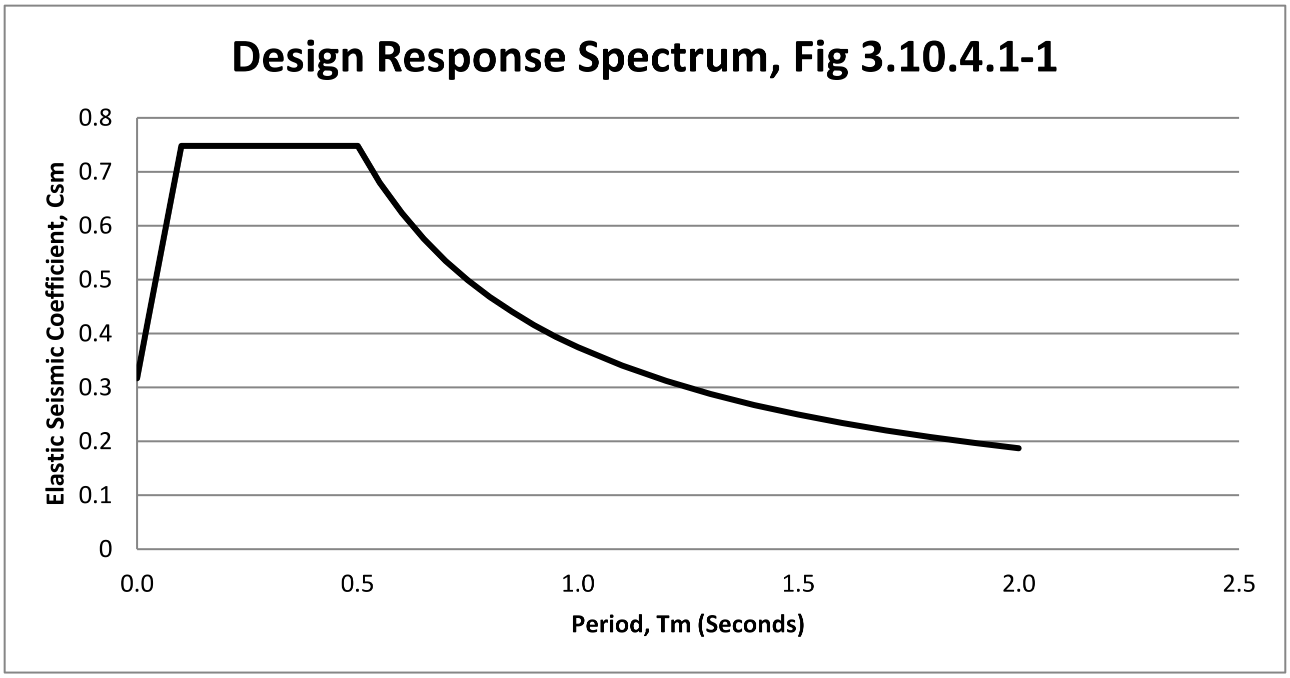
For Load Factors and Combinations, use ABDS Table 3.4.1-1

Basic Load Combination = $\gamma_{DC}DC+\gamma_{DW}DW+\gamma_{PL}PL+\gamma_{LL}LL+\gamma_{SL}SL+\gamma_{WS}WS+\gamma_{EQ}EQ+\gamma_{WA}WA$

Load Combination		Load Factors								
Number	Name	γ_{DC}	γ_{DW}	γ_{PL}	γ_{LL}	γ_{SL}	γ_{WS}	γ_{EQ}	γ_{WA}	Notes
1	Strength I (PL)	*1.25*	*1.50*	*1.75*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	
2	Strength I (LL)	*1.25*	*1.50*	*0.00*	*1.75*	*0.00*	*0.00*	*0.00*	*0.00*	
3	Strength III	*1.25*	*1.50*	*0.00*	*0.00*	*0.00*	*1.40*	*0.00*	*0.00*	
4	Extreme Event I	*1.00*	*1.00*	*0.25*	*0.00*	*0.00*	*0.00*	*1.00*	*0.00*	See Note 1 & ABDS 6.5.5
5	Flood	*1.25*	*1.50*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*1.00*	
	Fatigue	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.22*	*0.00*	*0.00*	
	Service	*1.00*	*1.00*	*1.30*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	Used for Splice Slip only

Note 1: Per AASHTO, single span bridges need only the connection between bridge span and the abutment designed for seismic loads.
Do not apply LC 4 to the bridge unless the project specifications require it.

Reference



Site Class = ***D***

$A_s = F_{PGA}PGA =$	0.3168	(3.10.4.2-2)
$S_{DS} = F_aS_S =$	0.748	(3.10.4.2-3)
$S_{D1} = F_vS_1 =$	0.3744	(3.10.4.2-6)
$T_o = 0.2T_s =$	0.1001 sec	
$T_s = S_{D1}/S_{DS} =$	0.5005 sec	

Use C_{sm} = 0.748 at T = 0.139 sec

PGA =	0.24	Figure 3.10.2.1-1
S_S =	0.55	Figure 3.10.2.1-2
S_1 =	0.18	Figure 3.10.2.1-3
F_{PGA} =	1.32	Table 3.10.3.2-1
F_a =	1.36	Table 3.10.3.2-2
F_v =	2.08	Table 3.10.3.2-3

Connection Between Superstructure and Abutment

Seismic Load = $C_{sm}W/R$ = 94734 lbs (for Abutment Connection)

Seismic Load = $C_{sm}W$ = 75787 lbs (for Bridge Reaction)

$W = P_{DC}+P_{DW}+\gamma_{PL}P_{PL}+\gamma_{SL}P_{SL}$ =	101320 lbs	
Modification Factor, R =	***0.8***	Table 3.10.7.1-2
g_{PL} =	0.25	
g_{SL} =	0.00	

Reference

Maximum Deflections

$\Delta_{DL} = \Delta_{DC} + \Delta_{DW} =$ ***1.03*** in vertical — Node: ***N006*** — L = 78.292 ft

$\Delta_{PL} =$ ***1.11*** in vertical — Node: ***N006***

$\Delta_{WS} =$ ***0.53*** in horizontal — Node: ***N006***

Allowable LL Deflection = L/X = 2.6097 in > Δ_{PL} **OK** X = ***360*** — AGS 5

Allowable WL Deflection = L/X = 2.6097 in > Δ_{WL} **OK** X = ***360***

Camber: Use a minimum of 2% Δ_{DL} or 0.25% L + Δ_{DL}

Minimum Camber = 3.3788 in use ***3.5*** in

Vibrations (Vertical Direction)

$f \approx 0.18(g/\Delta_{DL})^{1/2} =$ 3.4864 Hz > 3Hz **OK** — AGS 6

g = ***32.2*** ft/sec^2

Vibrations (Lateral Direction)

$\Delta_{DL\ lat} = 5WL^3/(384EI) =$ 0.189 in — $f \approx 0.18(g/\Delta_{DL\ lat})^{1/2} =$ 8.1384 Hz > 1.3 Hz **OK** — AGS 6

$I_{y\text{-truss}} =$ 154936 in^4

W = 80.181 k

U-Frame Calculations (Stability) — AGS 7.1.2

Int Frame:

b =	150 in	I_v =	16	E =	29000 ksi
h =	62.1 in	I_b =	118	L =	8.6667 ft (Bay Spacing)

Maximum Top Chord Compression

$P_{Max} =$ ***197.7*** $FS(P_{Max}) =$ 262.94 k FS = ***1.33***

$P_c =$ 262.94 k

$C_{furn} = E/(h^2((h/3I_v)+(b/2I_b))) =$ 3.8977

$CL/P_c =$ 1.5416

1/K = 0.7242 — AGS Tbl 7.1.2-1

K = 1.3808 >= 1.3 Use K = **1.3808**

0.01/K = 0.0072 >= 0.003 Use 0.01/K = 0.0072 — AGS 7.1.1

Reference: AASHTO LRFD GUIDE SPECIFICATIONS FOR DESIGN OF PEDESTRIAN BRIDGES, Table 7.1.2-1

1/K	n = 4	n = 6	n = 8	n = 10	n = 12	n = 14	n = 16
1.000	3.686	3.616	3.660	3.714	3.754	3.785	3.809
0.980		3.284	2.944	2.806	2.787	2.771	2.774
0.960		3.000	2.665	2.542	2.456	2.454	2.479
0.950			2.595				
0.940		2.754		2.303	2.252	2.254	2.828
0.920		2.643		2.146	2.094	2.101	2.121
0.900	3.352	2.593	2.263	2.045	1.951	1.968	1.981
0.850		2.460	2.013	1.794	1.709	1.681	1.694
0.800	2.961	2.313	1.889	1.629	1.480	1.456	1.465
0.750		2.147	1.750	1.501	1.344	1.273	1.262
0.700	2.448	1.955	1.595	1.359	1.200	1.111	1.088
0.650		1.739	1.442	1.236	1.087	0.988	0.940
0.600	2.035	1.639	1.338	1.133	0.985	0.878	0.808
0.550		1.517	1.211	1.007	0.860	0.768	0.708
0.500	1.750	1.362	1.047	0.847	0.750	0.668	0.600
0.450		1.158	0.829	0.714	0.624	0.537	0.500
0.400	1.232	0.886	0.627	0.555	0.454	0.428	0.383
0.350		0.530	0.434	0.352	0.323	0.292	0.280
0.300	0.121	0.187	0.249	0.170	0.203	0.183	0.187
0.293	0						
0.259		0					
0.250			0.135	0.107	0.103	0.121	0.112
0.200			0.045	0.068	0.055	0.053	0.070
0.180			0				
0.150				0.017	0.031	0.029	0.025
0.139				0			
0.114					0		
0.100						0.003	0.010
0.097						0	
0.085							0

Int Frame:

n = 9

CL/P_c = 1.5416

1/K = 0.7242

n = 8		n = 10	
1/K	CL/P_c	1/K	CL/P_c
0.65	1.442	0.75	1.501
0.7	1.595	0.8	1.629
1/K =	0.6826	1/K =	0.7659

Deck Loading (assume 3 span continuous deck) — Reference

Average Deck Thickness = 6 in — Decking = VULCRAFT 2C18

Design Deck Thickness = t_d = 6 in — Decking Thickness = t_{dk} = 2 in

Concrete Unit Weight = γ_c = 150 pcf — Decking Weight = 2.51 psf

Span = s = 8.6667 ft

Deck Width = W_1 = 12 ft

Dead Load (DC) — Concrete = 0.0625 ksf

Decking Weight = 0.0025 ksf — $M_{DC}(-) = 0.1ws^2$ = 0.4883 ft-k

Total DL = 0.065 ksf — $M_{DC}(+) = 0.08ws^2$ = 0.3906 ft-k

Dead Load (DW) — DW = 0 ksf — $M_{DW}(-) = 0.121ws^2$ = 0 ft-k

$M_{DW}(+) = 0.101ws^2$ = 0 ft-k

Pedestrian Live Load (PL) — PL = 0.09 ksf — $M_{PL}(-) = 0.121ws^2$ = 0.818 ft-k

$M_{PL}(+) = 0.101ws^2$ = 0.6828 ft-k

Vehicle Load (LL)

P_1 = 3 k — Use E = 4.5 ft — $E = w+5(L_1W_1)^{1/2}$ = 4.8984 ft — ABDS 4.6.2.3

P_2 = 4.5 k — $L_1 = s-b_f/2$ = 8.4271 ft — E = 1/2 Deck Width = 6 ft

Wheel Width = 8.5 in — b_f = 5.75 in — E = 0.75 Wheel Spacing = 4.5 ft

Wheel Spacing = 6 ft — E = 0.6S+Wheel Width = 5.7646 ft — Structural Engineers Handbook, 4th Ed.

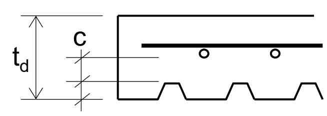
$M_{LL}(-) = (P_1f_1+P_2f_2)/E$ = 1.1498 ft-k — f_1 = -0.4247 — f_2 = -0.8667 — WB_R = N/A ft

$M_{LL}(+) = (P_1f_1+P_2f_2)/E$ = 1.7694 ft-k — f_1 = 0 — f_2 = 1.7694 — WB_R = N/A ft

f_1 and f_2 are from Influence Lines

$M_{u(LC\ 1\ OR\ 2)}(-)$ = 2.6225 ft-k

$M_{u(LC\ 1\ OR\ 2)}(+)$ = 3.5847 ft-k



Reinforced Concrete Section Properties:

f'_c = ***4000*** psi — Try # ***7*** bars

f_y = ***60000*** psi — bar dia. = d_b = 0.875 in — Transverse bar # ***4*** bars

β_1 = 0.85 — bar area = 0.6 in^2 — bar dia. = d_{Tr} = 0.5 in

Effective Deck Thickness = $h = t_d - t_{dk}/2$ = 5 in — b = ***12*** in

c = ***0.625*** in — Cover = 2 in

$d(+) = t_d - t_{dk} - c - d_b/2$ = 2.9375 in — $d(-) = c+(t_{dk}+d_b)/2$ = 2.0625 in

Flexure Capacity (+)

$c = A_sf_y/(0.85f'_c\beta_1 b)$ = 1.0381 — ε_t = 0.0055 — c/d = 0.3534 — ABDS 5.7.2.1

A_s = 0.6 in^2 — ϕ = 0.9 — ABDS 5.5.4.2

$a = \beta_1 c$ = 0.8824 in — Max Bar Spacing = 12 in — 3.1553 — ABDS 5.7.2.2

$\phi M_n = \phi(A_sf_y(d-a/2))$ = 80881 in-lb = 6.7401 ft-k > $M_u(+)$ — **OK** — ABDS 5.7.3.2.3

Flexure Capacity (-)

$c = A_sf_y/(0.85f'_c\beta_1 b)$ = 1.0381 — ε_t = 0.003 — c/d = 0.5033

A_s = 0.6 in^2 — ϕ = 0.798 — ABDS 5.5.4.2

$a = \beta_1 c$ = 0.8824 in — Max Bar Spacing = 12 in — 1.2591 — ABDS 5.7.2.2

$\phi M_n = \phi(A_sf_y(d-a/2))$ = 46579 in-lb = 3.8816 ft-k > $M_u(-)$ — **OK** — ABDS 5.7.3.2.3

Use # 7 bars at 12 in spacing

	Project:	PRESSENTIN PARK BRIDGE 2	By:	ENL
BIG R BRIDGE	Job No.:	BR19-00321/2	Date:	12/24/2019
	Subject:	INFLUENCE LINES, 3 SPAN	Page:	9 of 45

P

A 1.1 1.2 1.3 1.4 1.5 1.6 1.7 1.8 1.9 B 2.1 2.2 2.3 2.4 2.5 2.6 2.7 2.8 2.9 C 3.1 3.2 3.3 3.4 3.5 3.6 3.7 3.8 3.9 D

Span 1 Span 2 Span 3

Span 1 Length = 8.6667 Span 2 Length = 8.6667 Span 3 Length = 8.6667

Moments/P

	A	1.1	1.2	1.3	1.4	1.5	1.6	1.7	1.8	1.9	B	2.1	2.2	2.3	2.4	2.5	2.6	2.7	2.8	2.9	C	3.1	3.2	3.3	3.4	3.5	3.6	3.7	3.8	3.9	D	+ Area	- Area	Total Ar
A	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000			
1.1	0.0000	0.7571	0.6490	0.5436	0.4423	0.3467	0.2579	0.1775	0.1068	0.0471	0.0000	-0.0338	-0.0555	-0.0667	-0.0693	-0.0650	-0.0555	-0.0425	-0.0277	-0.0130	0.0000	0.0099	0.0166	0.0206	0.0222	0.0217	0.0194	0.0158	0.0111	0.0057	0.0000			
1.2	0.0000	0.6476	1.2979	1.0871	0.8847	0.6933	0.5158	0.3550	0.2135	0.0943	0.0000	-0.0676	-0.1109	-0.1335	-0.1387	-0.1300	-0.1109	-0.0849	-0.0555	-0.0260	0.0000	0.0198	0.0333	0.0413	0.0444	0.0433	0.0388	0.0315	0.0222	0.0114	0.0000			
1.3	0.0000	0.5380	1.0802	1.6307	1.3270	1.0400	0.7738	0.5325	0.3203	0.1414	0.0000	-0.1014	-0.1664	-0.2002	-0.2080	-0.1950	-0.1664	-0.1274	-0.0832	-0.0390	0.0000	0.0296	0.0499	0.0619	0.0666	0.0650	0.0582	0.0473	0.0333	0.0172	0.0000			
1.4	0.0000	0.4285	0.8625	1.3076	1.7694	1.3867	1.0317	0.7100	0.4271	0.1886	0.0000	-0.1352	-0.2219	-0.2669	-0.2773	-0.2600	-0.2219	-0.1699	-0.1109	-0.0520	0.0000	0.0395	0.0666	0.0825	0.0887	0.0867	0.0777	0.0631	0.0444	0.0229	0.0000			
1.5	0.0000	0.3189	0.6448	0.9845	1.3451	1.7333	1.2896	0.8875	0.5339	0.2357	0.0000	-0.1690	-0.2773	-0.3337	-0.3467	-0.3250	-0.2773	-0.2123	-0.1387	-0.0650	0.0000	0.0494	0.0832	0.1031	0.1109	0.1083	0.0971	0.0789	0.0555	0.0286	0.0000			
1.6	0.0000	0.2094	0.4271	0.6614	0.9207	1.2133	1.5475	1.0650	0.6406	0.2829	0.0000	-0.2028	-0.3328	-0.4004	-0.4160	-0.3900	-0.3328	-0.2548	-0.1664	-0.0780	0.0000	0.0593	0.0998	0.1238	0.1331	0.1300	0.1165	0.0946	0.0666	0.0343	0.0000			
1.7	0.0000	0.0998	0.2094	0.3383	0.4964	0.6933	0.9388	1.2425	0.7474	0.3300	0.0000	-0.2366	-0.3883	-0.4671	-0.4853	-0.4550	-0.3883	-0.2973	-0.1941	-0.0910	0.0000	0.0692	0.1165	0.1444	0.1553	0.1517	0.1359	0.1104	0.0777	0.0400	0.0000			
1.8	0.0000	-0.0097	-0.0083	0.0153	0.0721	0.1733	0.3300	0.5533	0.8542	0.3772	0.0000	-0.2704	-0.4437	-0.5339	-0.5547	-0.5200	-0.4437	-0.3397	-0.2219	-0.1040	0.0000	0.0790	0.1331	0.1650	0.1775	0.1733	0.1553	0.1262	0.0887	0.0458	0.0000			
1.9	0.0000	-0.1193	-0.2260	-0.3078	-0.3522	-0.3467	-0.2787	-0.1359	0.0943	0.4243	0.0000	-0.3042	-0.4992	-0.6006	-0.6240	-0.5850	-0.4992	-0.3822	-0.2496	-0.1170	0.0000	0.0889	0.1498	0.1856	0.1997	0.1950	0.1747	0.1420	0.0998	0.0515	0.0000			
B	0.0000	-0.2288	-0.4437	-0.6309	-0.7765	-0.8667	-0.8875	-0.8251	-0.6656	-0.3952	0.0000	-0.3380	-0.5547	-0.6673	-0.6933	-0.6500	-0.5547	-0.4247	-0.2773	-0.1300	0.0000	0.0988	0.1664	0.2063	0.2219	0.2167	0.1941	0.1577	0.1109	0.0572	0.0000	1.2519	-8.7630	-7.5111
2.1	0.0000	-0.2002	-0.3883	-0.5521	-0.6795	-0.7583	-0.7765	-0.7219	-0.5824	-0.3458	0.0000	0.4628	0.1664	-0.0364	-0.1595	-0.2167	-0.2219	-0.1889	-0.1317	-0.0641	0.0000	0.0494	0.0832	0.1031	0.1109	0.1083	0.0971	0.0789	0.0555	0.0286	0.0000			
2.2	0.0000	-0.1716	-0.3328	-0.4732	-0.5824	-0.6500	-0.6656	-0.6188	-0.4992	-0.2964	0.0000	0.3969	0.8875	0.5945	0.3744	0.2167	0.1109	0.0468	0.0139	0.0017	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000			
2.3	0.0000	-0.1430	-0.2773	-0.3943	-0.4853	-0.5417	-0.5547	-0.5157	-0.4160	-0.2470	0.0000	0.3311	0.7419	1.2255	0.9083	0.6500	0.4437	0.2825	0.1595	0.0676	0.0000	-0.0494	-0.0832	-0.1031	-0.1109	-0.1083	-0.0971	-0.0789	-0.0555	-0.0286	0.0000			
2.4	0.0000	-0.1144	-0.2219	-0.3155	-0.3883	-0.4333	-0.4437	-0.4125	-0.3328	-0.1976	0.0000	0.2652	0.5963	0.9897	1.4421	1.0833	0.7765	0.5183	0.3051	0.1335	0.0000	-0.0988	-0.1664	-0.2063	-0.2219	-0.2167	-0.1941	-0.1577	-0.1109	-0.0572	0.0000			
2.5	0.0000	-0.0858	-0.1664	-0.2366	-0.2912	-0.3250	-0.3328	-0.3094	-0.2496	-0.1482	0.0000	0.1993	0.4507	0.7540	1.1093	1.5167	1.1093	0.7540	0.4507	0.1993	0.0000	-0.1482	-0.2496	-0.3094	-0.3328	-0.3250	-0.2912	-0.2366	-0.1664	-0.0858	0.0000			
2.6	0.0000	-0.0572	-0.1109	-0.1577	-0.1941	-0.2167	-0.2219	-0.2063	-0.1664	-0.0988	0.0000	0.1335	0.3051	0.5183	0.7765	1.0833	1.4421	0.9897	0.5963	0.2652	0.0000	-0.1976	-0.3328	-0.4125	-0.4437	-0.4333	-0.3883	-0.3155	-0.2219	-0.1144	0.0000			
2.7	0.0000	-0.0286	-0.0555	-0.0789	-0.0971	-0.1083	-0.1109	-0.1031	-0.0832	-0.0494	0.0000	0.0676	0.1595	0.2825	0.4437	0.6500	0.9083	1.2255	0.7419	0.3311	0.0000	-0.2470	-0.4160	-0.5157	-0.5547	-0.5417	-0.4853	-0.3943	-0.2773	-0.1430	0.0000			
2.8	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0017	0.0139	0.0468	0.1109	0.2167	0.3744	0.5945	0.8875	0.3969	0.0000	-0.2964	-0.4992	-0.6188	-0.6656	-0.6500	-0.5824	-0.4732	-0.3328	-0.1716	0.0000			
2.9	0.0000	0.0286	0.0555	0.0789	0.0971	0.1083	0.1109	0.1031	0.0832	0.0494	0.0000	-0.0641	-0.1317	-0.1889	-0.2219	-0.2167	-0.1595	-0.0364	0.1664	0.4628	0.0000	-0.3458	-0.5824	-0.7219	-0.7765	-0.7583	-0.6795	-0.5521	-0.3883	-0.2002	0.0000			
C	0.0000	0.0572	0.1109	0.1577	0.1941	0.2167	0.2219	0.2063	0.1664	0.0988	0.0000	-0.1300	-0.2773	-0.4247	-0.5547	-0.6500	-0.6933	-0.6673	-0.5547	-0.3380	0.0000	-0.3952	-0.6656	-0.8251	-0.8875	-0.8667	-0.7765	-0.6309	-0.4437	-0.2288	0.0000	1.2519	-8.7630	-7.5111
3.1	0.0000	0.0515	0.0998	0.1420	0.1747	0.1950	0.1997	0.1856	0.1498	0.0889	0.0000	-0.1170	-0.2496	-0.3822	-0.4992	-0.5850	-0.6240	-0.6006	-0.4992	-0.3042	0.0000	0.4243	0.0943	-0.1359	-0.2787	-0.3467	-0.3522	-0.3078	-0.2260	-0.1193	0.0000			
3.2	0.0000	0.0458	0.0887	0.1262	0.1553	0.1733	0.1775	0.1650	0.1331	0.0790	0.0000	-0.1040	-0.2219	-0.3397	-0.4437	-0.5200	-0.5547	-0.5339	-0.4437	-0.2704	0.0000	0.3772	0.8542	0.5533	0.3300	0.1733	0.0721	0.0153	-0.0083	-0.0097	0.0000			
3.3	0.0000	0.0400	0.0777	0.1104	0.1359	0.1517	0.1553	0.1444	0.1165	0.0692	0.0000	-0.0910	-0.1941	-0.2973	-0.3883	-0.4550	-0.4853	-0.4671	-0.3883	-0.2366	0.0000	0.3300	0.7474	1.2425	0.9388	0.6933	0.4964	0.3383	0.2094	0.0998	0.0000			
3.4	0.0000	0.0343	0.0666	0.0946	0.1165	0.1300	0.1331	0.1238	0.0998	0.0593	0.0000	-0.0780	-0.1664	-0.2548	-0.3328	-0.3900	-0.4160	-0.4004	-0.3328	-0.2028	0.0000	0.2829	0.6406	1.0650	1.5475	1.2133	0.9207	0.6614	0.4271	0.2094	0.0000			
3.5	0.0000	0.0286	0.0555	0.0789	0.0971	0.1083	0.1109	0.1031	0.0832	0.0494	0.0000	-0.0650	-0.1387	-0.2123	-0.2773	-0.3250	-0.3467	-0.3337	-0.2773	-0.1690	0.0000	0.2357	0.5339	0.8875	1.2896	1.7333	1.3451	0.9845	0.6448	0.3189	0.0000			
3.6	0.0000	0.0229	0.0444	0.0631	0.0777	0.0867	0.0887	0.0825	0.0666	0.0395	0.0000	-0.0520	-0.1109	-0.1699	-0.2219	-0.2600	-0.2773	-0.2669	-0.2219	-0.1352	0.0000	0.1886	0.4271	0.7100	1.0317	1.3867	1.7694	1.3076	0.8625	0.4285	0.0000			
3.7	0.0000	0.0172	0.0333	0.0473	0.0582	0.0650	0.0666	0.0619	0.0499	0.0296	0.0000	-0.0390	-0.0832	-0.1274	-0.1664	-0.1950	-0.2080	-0.2002	-0.1664	-0.1014	0.0000	0.1414	0.3203	0.5325	0.7738	1.0400	1.3270	1.6307	1.0802	0.5380	0.0000			
3.8	0.0000	0.0114	0.0222	0.0315	0.0388	0.0433	0.0444	0.0413	0.0333	0.0198	0.0000	-0.0260	-0.0555	-0.0849	-0.1109	-0.1300	-0.1387	-0.1335	-0.1109	-0.0676	0.0000	0.0943	0.2135	0.3550	0.5158	0.6933	0.8847	1.0871	1.2979	0.6476	0.0000			
3.9	0.0000	0.0057	0.0111	0.0158	0.0194	0.0217	0.0222	0.0206	0.0166	0.0099	0.0000	-0.0130	-0.0277	-0.0425	-0.0555	-0.0650	-0.0693	-0.0667	-0.0555	-0.0338	0.0000	0.0471	0.1068	0.1775	0.2579	0.3467	0.4423	0.5436	0.6490	0.7571	0.0000			
D	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000			

Reactions/P, Shears/P

	A	1.1	1.2	1.3	1.4	1.5	1.6	1.7	1.8	1.9	B	2.1	2.2	2.3	2.4	2.5	2.6	2.7	2.8	2.9	C	3.1	3.2	3.3	3.4	3.5	3.6	3.7	3.8	3.9	D	+ Area	- Area	Total Ar
R_A	0.0000	0.8736	0.7488	0.6272	0.5104	0.4000	0.2976	0.2048	0.1232	0.0544	0.0000	-0.0390	-0.0640	-0.0770	-0.0800	-0.0750	-0.0640	-0.0490	-0.0320	-0.0150	0.0000	0.0114	0.0192	0.0238	0.0256	0.0250	0.0224	0.0182	0.0128	0.0066	0.0000	3.9000	-0.4333	3.4667
R_B	0.0000	0.1594	0.3152	0.4638	0.6016	0.7250	0.8304	0.9142	0.9728	1.0026	1.0000	0.9630	0.8960	0.8050	0.6960	0.5750	0.4480	0.3210	0.2000	0.0910	0.0000	-0.0684	-0.1152	-0.1428	-0.1536	-0.1500	-0.1344	-0.1092	-0.0768	-0.0396	0.0000	10.4000	-0.8667	9.5333
R_C	0.0000	-0.0396	-0.0768	-0.1092	-0.1344	-0.1500	-0.1536	-0.1428	-0.1152	-0.0684	0.0000	0.0910	0.2000	0.3210	0.4480	0.5750	0.6960	0.8050	0.8960	0.9630	1.0000	1.0026	0.9728	0.9142	0.8304	0.7250	0.6016	0.4638	0.3152	0.1594	0.0000	10.4000	-0.8667	9.5333
R_D	0.0000	0.0066	0.0128	0.0182	0.0224	0.0250	0.0256	0.0238	0.0192	0.0114	0.0000	-0.0150	-0.0320	-0.0490	-0.0640	-0.0750	-0.0800	-0.0770	-0.0640	-0.0390	0.0000	0.0544	0.1232	0.2048	0.2976	0.4000	0.5104	0.6272	0.7488	0.8736	1.0000	3.9000	-0.4333	3.4667
V_{AB}	0.0000	0.8736	0.7488	0.6272	0.5104	0.4000	0.2976	0.2048	0.1232	0.0544	0.0000	-0.0390	-0.0640	-0.0770	-0.0800	-0.0750	-0.0640	-0.0490	-0.0320	-0.0150	0.0000	0.0114	0.0192	0.0238	0.0256	0.0250	0.0224	0.0182	0.0128	0.0066	0.0000	3.9000	-0.4333	3.4667
V_{BA}	0.0000	-0.1264	-0.2512	-0.3728	-0.4896	-0.6000	-0.7024	-0.7952	-0.8768	-0.9456	-1/0	-0.0390	-0.0640	-0.0770	-0.0800	-0.0750	-0.0640	-0.0490	-0.0320	-0.0150	0.0000	0.0114	0.0192	0.0238	0.0256	0.0250	0.0224	0.0182	0.0128	0.0066	0.0000	0.1444	-5.3444	-5.2000
V_{BC}	0.0000	0.0330	0.0640	0.0910	0.1120	0.1250	0.1280	0.1190	0.0960	0.0570	0/1	0.9240	0.8320	0.7280	0.6160	0.5000	0.3840	0.2720	0.1680	0.0760	0.0000	-0.0570	-0.0960	-0.1190	-0.1280	-0.1250	-0.1120	-0.0910	-0.0640	-0.0330	0.0000	5.0556	-0.7222	4.3333
V_{CB}	0.0000	0.0330	0.0640	0.0910	0.1120	0.1250	0.1280	0.1190	0.0960	0.0570	0.0000	-0.0760	-0.1680	-0.2720	-0.3840	-0.5000	-0.6160	-0.7280	-0.8320	-0.9240	-1/0	-0.0570	-0.0960	-0.1190	-0.1280	-0.1250	-0.1120	-0.0910	-0.0640	-0.0330	0.0000	0.7222	-5.0556	-4.3333
V_{CD}	0.0000	-0.0066	-0.0128	-0.0182	-0.0224	-0.0250	-0.0256	-0.0238	-0.0192	-0.0114	0.0000	0.0150	0.0320	0.0490	0.0640	0.0750	0.0800	0.0770	0.0640	0.0390	0/1	0.9456	0.8768	0.7952	0.7024	0.6000	0.4896	0.3728	0.2512	0.1264	0.0000	5.3444	-0.1444	5.2000
V_{DC}	0.0000	-0.0066	-0.0128	-0.0182	-0.0224	-0.0250	-0.0256	-0.0238	-0.0192	-0.0114	0.0000	0.0150	0.0320	0.0490	0.0640	0.0750	0.0800	0.0770	0.0640	0.0390	0.0000	-0.0544	-0.1232	-0.2048	-0.2976	-0.4000	-0.5104	-0.6272	-0.7488	-0.8736	-1.0000	0.4333	-3.9000	-3.4667

Reference

Lateral Loads:

				Reference
Half-Through Truss:	End Frame:	$P_{LAT} = 0.01P_{EV}$	$M_{LAT} = P_{LAT}h$	AGS 7.1.1
	Int Frame:	$P_{LAT} = P_{TC}/(100K)$	$M_{LAT} = P_{LAT}h$	AGS 7.1.1
Full-Through (Box) Truss:	End Frame:	$P_{LAT} = WS_{Pin}$	$M_{Lat} = P_{LAT}M_{MD}$	
	Int Frame:	$P_{LAT} = P_{TC}/(100)$	$M_{Lat} = P_{LAT}M_{MD}$	

		1st Int Frame		Int Frame	
$P_{(EV\ LC\ 1)}$ =	***60.8*** k	$P_{(TC\ LC\ 1)}$ =	***197.7*** k	$P_{(TC\ LC\ 1)}$ =	***197.7*** k
$P_{(EV\ LC\ 2)}$ =	***42*** k	$P_{(TC\ LC\ 2)}$ =	***127*** k	$P_{(TC\ LC\ 2)}$ =	***127*** k
$P_{(EV\ LC\ 3)}$ =	***28.1*** k	$P_{(TC\ LC\ 3)}$ =	***89.3*** k	$P_{(TC\ LC\ 3)}$ =	***89.3*** k
$P_{(EV\ LC\ 4)}$ =	***0*** k	$P_{(TC\ LC\ 4)}$ =	***0*** k	$P_{(TC\ LC\ 4)}$ =	***0*** k
$P_{(EV\ LC\ 5)}$ =	***0*** k	$P_{(TC\ LC\ 5)}$ =	***0*** k	$P_{(TC\ LC\ 5)}$ =	***0*** k
		K =	1.3808	K =	1.3808

h = 5.175 ft

WS_{Pin} = 2.8125 k (1/2 Force at top of End Portal assuming all int portals are pinned)

End Frame/Portal

	P_{LAT}	M_{LAT} Floor Beam	M_{LAT} Vertical	M_{LAT} Portal Strut
LC 1:	0.608 k	3.1464 ft-k	3.1464 ft-k	N/A ft-k
LC 2:	0.42 k	2.1735 ft-k	2.1735 ft-k	N/A ft-k
LC 3:	0.281 k	1.4542 ft-k	1.4542 ft-k	N/A ft-k
LC 4:	0 k	0 ft-k	0 ft-k	N/A ft-k
LC 5:	0 k	0 ft-k	0 ft-k	N/A ft-k

1st Int Frame/Portal

	P_{LAT}	M_{LAT} Floor Beam	M_{LAT} Vertical	M_{LAT} Portal Strut
LC 1:	1.4318 k	7.4094 ft-k	7.4094 ft-k	N/A ft-k
LC 2:	0.9198 k	4.7597 ft-k	4.7597 ft-k	N/A ft-k
LC 3:	0.6467 k	3.3468 ft-k	3.3468 ft-k	N/A ft-k
LC 4:	0 k	0 ft-k	0 ft-k	N/A ft-k
LC 5:	0 k	0 ft-k	0 ft-k	N/A ft-k

Int Frame/Portal

	P_{LAT}	M_{LAT} Floor Beam	M_{LAT} Vertical	M_{LAT} Portal Strut
LC 1:	1.4318 k	7.4094 ft-k	7.4094 ft-k	N/A ft-k
LC 2:	0.9198 k	4.7597 ft-k	4.7597 ft-k	N/A ft-k
LC 3:	0.6467 k	3.3468 ft-k	3.3468 ft-k	N/A ft-k
LC 4:	0 k	0 ft-k	0 ft-k	N/A ft-k
LC 5:	0 k	0 ft-k	0 ft-k	N/A ft-k

Reference

w_{DC} =	323.36 lb/ft	V_{DC} =	1.9402 k	M_{DC} =	5.82 ft-k
w_{DW} =	0 lb/ft	V_{DW} =	0 k	M_{DW} =	0.00 ft-k
w_{PL} =	407.81 lb/ft	V_{PL} =	2.4469 k	M_{PL} =	7.34 ft-k
P_{LL} =	4500 lb	V_{LL} =	5.625 k	M_{LL} =	15.188 ft-k

Span = L_b = 12 ft

Moment and Shear

	V_{SS}	M_{SS}	M_{LAT}	$M_{SS}+M_{LAT}$
LC 1:	6.7072 k	20.122 ft-k	3.1464 ft-k	23.268 ft-k
LC 2:	12.269 k	33.854 ft-k	2.1735 ft-k	36.027 ft-k
LC 3:	2.4252 k	7.2756 ft-k	1.4542 ft-k	8.7298 ft-k
LC 4:	2.5519 k	7.6556 ft-k	0 ft-k	7.6556 ft-k
LC 5:	2.4252 k	7.2756 ft-k	0 ft-k	7.2756 ft-k
V_r =	12.30 k		M_r =	36.03 ft-k

Beam Data

Beam Size =	W10x22	F_y =	***50*** ksi
Z_x =	26 in^3	E =	***29000*** ksi
S_x =	23.2 in^3	$D = d-2t_f$ =	9.48 in
b_f =	5.75 in	$D_c = D_{cp} = D/2$ =	4.74 in
t_f =	0.36 in	$h = d-t_f$ =	9.84 in
d =	10.2 in		
t_w =	0.24 in	$M_p = F_yZ_x$ =	1300 k-in
I_x =	118 in^4	$M_y = F_yS_x$ =	1160 k-in
		$F_{yr} = 0.7F_{yc}$ =	35 ksi

Vertical Data

	Orientation	Height (in)	Width (in)	Thickness (in)
Vertical: HSS6x6x3/8	X	H = 6	B = 6	t = 0.349
		F_y = 50000 psi		
		F_u = 70000 psi		

Resistance Factors — ABDS 6.5.4.2

ϕ_f = 1 ϕ_v = 1 ϕ_{e2} = 0.8

Check Flexure Capacity (Use the Provisions of Appendix A6):

F_y		<=	***70*** ksi		OK	ABDS A6.1
$2D_c/t_w$ =	39.5	<	$5.7(E/F_{yc})^{1/2}$ =	137.27	OK	ABDS (A6.1-1)
I_{yc}/I_{yt} =	***1***	>=	0.3		OK	ABDS (A6.1-2)

Reference

Compression Flange

$M_u+(1/3)f_l S_{xc}$ = 55.36 ft-k <= $\phi_f M_{nc}$ = 72.997 ft-k OK — ABDS (A6.1.1-1)

Tension Flange

$M_u+(1/3)f_l S_{xt}$ = 55.361 ft-k <= $\phi_f M_{nt}$ = 108.33 ft-k OK — ABDS (A6.1.2-1)

Web Plastification Factors

$2D_{cp}/t_w$ = 39.5 <= $\lambda_{pw(Dcp)}$ = 90.742 — ABDS (A6.2.1-1)

$\lambda_w = 2D_c/t_w$ = 39.5 < λ_{rw} = 137.27 — ABDS (A6.2.2-1)

Section is Compact

$\lambda_{pw(Dcp)} = (E/F_{yc})^{1/2}/(0.54(M_p/(R_h M_y))-.09)^2$ = 90.742 <= $\lambda_{rw}(D_{cp}/D_c)$ Use $\lambda_{pw(Dcp)}$ = 90.742 — ABDS (A6.2.1-2)

$\lambda_{pw(Dc)} = \lambda_{pw(Dcp)}(D_c/D_{cp})$ = 90.742 <= λ_{rw} Use $\lambda_{pw(Dc)}$ = 90.742 — ABDS (A6.2.2-6)

R_h = ***1*** — ABDS 6.10.1.10.1

$\lambda_{rw} = 5.7(E/F_{yc})^{1/2}$ = 137.27 — ABDS (A6.2.1-3 & A6.2.2-3)

$R_{pc} = R_{pt} = M_p/M_y$ = 1.1207 — ABDS (A6.2.1-4 & A6.2.1-5)

Local Buckling Resistance

λ_f <= λ_{pf} — $M_{nc} = R_{pc}M_{yc}$ = 1300 k-in — ABDS(A6.3.2-1)

$M_{nc}= [1-(1-(F_{yr}S_x)/(R_{pc}M_{yc}))((\lambda_f-\lambda_{pf})/(\lambda_{rf}-\lambda_{pf}))]R_{pc}M_{yc}$ = N/A k-in — ABDS(A6.3.2-2)

$\lambda_f = b_{fc}/(2t_{fc})$ = 7.9861 — ABDS (A6.3.2-3)

$\lambda_{pf} = 0.38(E/F_{yc})^{1/2}$ = 9.1516 — ABDS (A6.3.2-4)

$\lambda_{rf} = 0.95(Ek_c/F_y)^{0.5}$ = 19.945 — ABDS (A6.3.2-5)

k_c = ***0.76*** — ABDS (A6.3.2)

Lateral Torsional Buckling Resistance

Use M_{nc} = 875.97 k-in — ABDS (A6.3.3-2)

L_b > L_p — $M_{nc} = R_{pc}M_{yc}$ = N/A k-in — ABDS (A6.3.3-1)

L_b <= L_r — $M_{nc} = C_b[1-(1-F_{yr}S_{xc}/(R_{pc}M_{yc}))((L_b-L_p)/(L_r-L_p))]R_{pc}M_{yc}$ = 875.97 k-in — ABDS (A6.3.3-2)

$M_{nc} = F_{cr}S_x$ = N/A k-in — ABDS (A6.3.3-3)

L_b = 144 in

L_p = 1.0 $r_t(E/F_y)^{1/2}$ = 36.751 in — ABDS (A6.3.3-4)

$L_r = 1.95r_t(E/F_{yr})(J/(S_{xc}h))^{.5}(1+(1+6.76(F_{yr}S_{xc}h/(EJ))^2)^{.5})^{.5}$ = 160.18 in — ABDS (A6.3.3-5)

$r_t = b_{fc}/(12(1+D_c t_w/(3b_{fc}t_{fc})))^{1/2}$ = 1.526 in — ABDS (A6.3.3-10)

$J = Dt_w^3/3+b_{fc}t_{fc}^3(1-0.63t_{fc}/b_{fc})/3+b_{ft}t_{ft}^3(1-0.63t_{ft}/b_{ft})/3$ = 0.2155 in^4 — ABDS (A6.3.3-9)

$F_{cr} = (C_b\pi^2E/(L_b/r_t)^2)(1+0.078J(L_b/r_t)^2/(S_xh))^{0.5}$ = 41.357 ksi — ABDS (A6.3.3-8)

C_b = ***1***

Reference

Flexural Resistance on Tension Flange Yielding

$M_{nt} = R_{pt}M_{yt} =$ 1300 k-in — ABDS (A6.4-1)

Flange Lateral Bending Stress

Use $f_l =$ *30* ksi

Check Shear (Unstiffened Webs)

$\phi_v V_n =$ 0.58C $\phi_v F_y A_w =$ 65.981 k > $V_u =$ 12.30 k **OK** — ABDS 6.10.9.2

$A_w = Dt_w =$ 2.2752 in^2

$\lambda_{w1} = 1.12(Ek/F_{yw})^{1/2} =$ 60.314 $\lambda_{w2} = 1.4(Ek/F_{yw})^{1/2} =$ 75.392

If $\lambda_w <= \lambda_{w1}$	C =	1	ABDS (6.10.9.3.2-4)
If $\lambda_w > \lambda_{w1}$ and $<= \lambda_{w2}$,	$C = \lambda_{w1}/\lambda_w =$	1.5269	ABDS (6.10.9.3.2-5)
If $\lambda_w > \lambda_{w2}$,	$C = 1.51(Ek/F_{yw})/\lambda_w^2 =$	2.8066	ABDS (6.10.9.3.2-6)

λ_{w1} >= λ_w >= λ_{w2}, Use C = 1

k = ***5***

Check Floor Beam to Vertical Connection (Use the provisions of AISC K1)

V =	***12.3***	k	Load Case = **3**
$M_{Joint\ Fixity}$ =	***6.1***	ft-k	Member = **FB001**
$M_{U-Frame}$ =	1.4542	ft-k	
M_{Total} =	7.5542	ft-k	Flange Force = $P = M_{Total}/(d-t_f)$ = 9.2124 k

Check Applicability: — AISC Tbl K1.2A

Strength:	F_y <= 52 ksi		**OK**
Ductility:	F_y/F_u =	0.7 <= 0.8	**OK**
Width Ratio:	B_p/B =	0.9583 >= 0.25	**OK**
	B_p/B =	0.9583 <= 1	**OK**
$B_p = b_f$ = 5.75 in <= B,	use B_p =	5.75 in	
Wall Slenderness:	B/t =	14.2 <= 35	**OK**

Check Local Yielding of Plate

$R_n = (10F_y t/(B/t))B_p =$ 70.66 k <= $F_{yp}t_pB_p =$ 103.5 k, use 70.66 k — SSSB (K1-7)

$\phi R_n =$ 67.127 k >= P **OK**

$\phi =$ ***0.95***

Reference

Check Shear Yielding (Punching)

$B-2t =$ 5.302 < B_p	Limit State is Not Applicable			
$0.85B =$ 4.8 <= B_p	Check Limit State			
$R_n = (0.6F_yt(2t_p+2B_{ep}) =$	92.331 k			SSSB (K1-8)
$B_{ep} = 10B_p/(B/t) =$	4.0493 in <=	B_p, use	4.0493 in	SSSB (K1-18)
$\phi R_n =$ N/A				
$\phi =$	***0.95***			

Check Sidewall Local Yielding

$B_p/B =$ 0.9583 <>1	Limit State is Not Applicable	
$R_n = 2F_yt(5k+t_p) =$	103.91 k	SSSB (K1-9)
$k = 1.5t$	0.5235 in	
$\phi R_n =$ N/A		
$\phi =$	***1***	

Check Sidewall Local Crippling

$B_p/B =$ 0.9583 <>1	Limit State is Not Applicable		
$R_n = 1.6t^2(1+3t_p/(H-3t))(EF_y)^{1/2}Q_f =$	285.84 k		SSSB (K1-10)
$Q_f = 1.3-0.4U/\beta =$	1.1584 > 1	Use $Q_f =$ 1	
$U =$	0.3392		
$\phi R_n =$ N/A			
$\phi =$	***0.75***		

Check Weld Connection

Weld Material Strength: $F_{EXX} =$ ***70*** ksi

Flange Weld Capacity (Moment) = $R_n = R_rA_w =$ **42.788 k >= P** **OK**

Effective Weld Length = $L_e = 2(10/(B/t))(F_yt/(F_{yp}t_p))B_p+2t_p =$	7.2048 in	SSSB (K4-4)
Fillet Weld Size = t =	***0.25*** in	
$t_e = 0.707t =$	0.1768 in	
$A_w = L_et_e =$	1.2734 in^2	
$R_r = \alpha\phi_{e2}F_{EXX} =$	33.6 ksi	ABDS 6.13.3.2.4
$\alpha =$	0.6	

Web Weld Capacity (Shear) = $R_n = R_rA_w =$ **112.6 k >= V** **OK**

Effective Weld Length = $l_w = 2(d-2t_f) =$	18.96 in	
Fillet Weld Size = t =	***0.25*** in	
$t_e = 0.707t =$	0.1768 in	
$A_w = L_wt_e =$	3.3512 in^2	
$R_r = \alpha\phi_{e2}F_{EXX} =$	33.6 ksi	ABDS 6.13.3.2.4
$\alpha =$	0.6	

Reference

w_{DC} =	598.39 lb/ft	V_{DC} =	3.6153 k	M_{DC} =	10.92 ft-k
w_{DW} =	0 lb/ft	V_{DW} =	0 k	M_{DW} =	0.00 ft-k
w_{PL} =	780 lb/ft	V_{PL} =	4.7125 k	M_{PL} =	14.24 ft-k
P_{LL} =	4500 lb	V_{LL} =	5.6483 k	M_{LL} =	15.362 ft-k

Span = l = 12.083 ft

Moment and Shear

	V_{SS}	M_{SS}	M_{LAT}	M_{SS}+M_{LAT}
LC 1:	12.766 k	38.564 ft-k	7.4094 ft-k	45.973 ft-k
LC 2:	14.404 k	40.535 ft-k	4.7597 ft-k	45.295 ft-k
LC 3:	4.5191 k	13.652 ft-k	3.3468 ft-k	16.998 ft-k
LC 4:	4.7934 k	14.48 ft-k	0 ft-k	14.48 ft-k
LC 5:	4.5191 k	13.652 ft-k	0 ft-k	13.652 ft-k
V_r =	14.404 k		M_r =	45.97 ft-k

Beam Data

Beam Size =	W10x22	F_y =	***50*** ksi
Z_x =	26 in^3	E =	***29000*** ksi
S_x =	23.2 in^3	$D = d-2t_f$ =	9.48 in
b_f =	5.75 in	$D_c = D_{cp} = D/2$ =	4.74 in
t_f =	0.36 in	$h = d-t_f$ =	9.84 in
d =	10.2 in		
t_w =	0.24 in	$M_p = F_yZ_x$ =	1300 k-in
I_x =	118 in^4	$M_y = F_yS_x$ =	1160 k-in
		$F_{yr} = 0.7F_{yc}$ =	35 ksi

Vertical Data

	Orientation	Height (in)	Width (in)	Thickness (in)
Vertical: HSS5x5x1/4	X	H = 5	B = 5	t = 0.233
		F_y = 50000 psi		
		F_u = 70000 psi		

Resistance Factors — ABDS 6.5.4.2

ϕ_f = 1 ϕ_v = 1 ϕ_{e2} = 0.8

Check Flexure Capacity (Use the Provisions of Appendix A6):

F_y		<=	***70*** ksi		OK	ABDS A6.1
$2D_c/t_w$ =	39.5	<	$5.7(E/F_{yc})^{1/2}$ =	137.27	OK	ABDS (A6.1-1)
I_{yc}/I_{yt} =	***1***	>=	0.3		OK	ABDS (A6.1-2)

Reference

Compression Flange

M_u+(1/3)$f_l S_{xc}$ = 65.31 ft-k <= $\phi_f M_{nc}$ = 72.668 ft-k OK — ABDS (A6.1.1-1)

Tension Flange

M_u+(1/3)$f_l S_{xt}$ = 65.307 ft-k <= $\phi_f M_{nt}$ = 108.33 ft-k OK — ABDS (A6.1.2-1)

Web Plastification Factors

$2D_{cp}/t_w$ = 39.5 <= $\lambda_{pw(Dcp)}$ = 90.742 — ABDS (A6.2.1-1)

$\lambda_w = 2D_c/t_w$ = 39.5 < λ_{rw} = 137.27 — ABDS (A6.2.2-1)

Section is Compact

$\lambda_{pw(Dcp)} = (E/F_{yc})^{1/2}/(0.54(M_p/(R_hM_y))-.09)^2$ = 90.742 <= $\lambda_{rw}(D_{cp}/D_c)$ Use $\lambda_{pw(Dcp)}$ = 90.742 — ABDS (A6.2.1-2)

$\lambda_{pw(Dc)} = \lambda_{pw(Dcp)}(D_c/D_{cp})$ = 90.742 <= λ_{rw} Use $\lambda_{pw(Dc)}$ = 90.742 — ABDS (A6.2.2-6)

R_h = ***1*** — ABDS 6.10.1.10.1

$\lambda_{rw} = 5.7(E/F_{yc})^{1/2}$ = 137.27 — ABDS (A6.2.1-3 & A6.2.2-3)

$R_{pc} = R_{pt} = M_p/M_y$ = 1.1207 — ABDS (A6.2.1-4 & A6.2.1-5)

Local Buckling Resistance

λ_f <= λ_{pf} $M_{nc} = R_{pc}M_{yc}$ = 1300 k-in — ABDS(A6.3.2-1)

M_{nc}= $[1-(1-(F_{yr}S_x)/(R_{pc}M_{yc}))((\lambda_f-\lambda_{pf})/(\lambda_{rf}-\lambda_{pf}))]R_{pc}M_{yc}$ = N/A k-in — ABDS(A6.3.2-2)

$\lambda_f = b_{fc}/(2t_{fc})$ = 7.9861 — ABDS (A6.3.2-3)

$\lambda_{pf} = 0.38(E/F_{yc})^{1/2}$ = 9.1516 — ABDS (A6.3.2-4)

$\lambda_{rf} = 0.95(Ek_c/F_y)^{0.5}$ = 19.945 — ABDS (A6.3.2-5)

k_c = ***0.76*** — ABDS (A6.3.2)

Lateral Torsional Buckling Resistance

Use M_{nc} = 872.02 k-in — ABDS (A6.3.3-2)

L_b > L_p $M_{nc} = R_{pc}M_{yc}$ = N/A k-in — ABDS (A6.3.3-1)

L_b <= L_r $M_{nc} = C_b[1-(1-F_{yr}S_{xc}/(R_{pc}M_{yc}))((L_b-L_p)/(L_r-L_p))]R_{pc}M_{yc}$ = 872.02 k-in — ABDS (A6.3.3-2)

$M_{nc} = F_{cr}S_x$ = N/A k-in — ABDS (A6.3.3-3)

L_b = 145 in

L_p = 1.0 $r_t(E/F_y)^{1/2}$ = 36.751 in — ABDS (A6.3.3-4)

$L_r = 1.95r_t(E/F_{yr})(J/(S_{xc}h))^{.5}(1+(1+6.76(F_{yr}S_{xc}h/(EJ))^2)^{.5})^{.5}$ = 160.18 in — ABDS (A6.3.3-5)

$r_t = b_{fc}/(12(1+D_ct_w/(3b_{fc}t_{fc})))^{1/2}$ = 1.526 in — ABDS (A6.3.3-10)

$J = Dt_w^3/3+b_{fc}t_{fc}^3(1-0.63t_{fc}/b_{fc})/3+b_{ft}t_{ft}^3(1-0.63t_{ft}/b_{ft})/3$ = 0.2155 in^4 — ABDS (A6.3.3-9)

$F_{cr} = (C_b\pi^2E/(L_b/r_t)^2)(1+0.078J(L_b/r_t)^2/(S_xh))^{0.5}$ = 40.901 ksi — ABDS (A6.3.3-8)

C_b = ***1***

Reference

Flexural Resistance on Tension Flange Yielding

$M_{nt} = R_{pt}M_{yt} =$ 1300 k-in — ABDS (A6.4-1)

Flange Lateral Bending Stress

Use $f_l =$ ***30*** ksi

Check Shear (Unstiffened Webs)

$\phi_v V_n =$ 0.58C $\phi_v F_y A_w =$ 65.981 k > $V_u =$ 14.40 k — **OK** — ABDS 6.10.9.2

$A_w = Dt_w =$ 2.2752 in^2

$\lambda_{w1} = 1.12(Ek/F_{yw})^{1/2} =$ 60.314 $\lambda_{w2} = 1.4(Ek/F_{yw})^{1/2} =$ 75.392

			Reference
If $\lambda_w <= \lambda_{w1}$	C =	1	ABDS (6.10.9.3.2-4)
If $\lambda_w > \lambda_{w1}$ and $<= \lambda_{w2}$,	$C = \lambda_{w1}/\lambda_w =$	1.5269	ABDS (6.10.9.3.2-5)
If $\lambda_w > \lambda_{w2}$,	$C = 1.51(Ek/F_{yw})/\lambda_w^2 =$	2.8066	ABDS (6.10.9.3.2-6)

λ_{w1} >= λ_w >= λ_{w2}, Use C = 1

k = ***5***

Check Floor Beam to Vertical Connection (Use the provisions of AISC K1)

V = ***12.8*** k — Load Case = **3**

$M_{Joint\ Fixity} =$ ***9.9*** ft-k — Member = ***FB004***

$M_{U\text{-}Frame} =$ 3.3468 ft-k

$M_{Total} =$ 13.247 ft-k — Flange Force = $P = M_{Total}/(d-t_f) =$ 16.155 k

Check Applicability: — AISC Tbl K1.2A

Strength:	F_y	<= 52 ksi	**OK**
Ductility:	$F_y/F_u =$	0.7 <= 0.8	**OK**
Width Ratio:	$B_p/B =$	1 >= 0.25	**OK**
	$B_p/B =$	1 <= 1	**OK**
$B_p = b_f =$ 5.75 in > B,	use $B_p =$	5 in	
Wall Slenderness:	B/t =	18.5 <= 35	**OK**

Check Local Yielding of Plate

$R_n = (10F_y t/(B/t))B_p =$ 31.486 k <= $F_{yp}t_pB_p =$ 90 k, use 31.486 k — SSSB (K1-7)

$\phi R_n =$ 29.912 k >= P — **OK**

$\phi =$ ***0.95***

Reference

Check Shear Yielding (Punching)

$B-2t =$ 4.534 < B_p Limit State is Not Applicable

$0.85B =$ 4.25 <= B_p Check Limit State

$R_n = (0.6F_y t(2t_p+2B_{ep}) =$ 42.817 k — SSSB (K1-8)

$B_{ep} = 10B_p/(B/t) =$ 2.7027 in <= B_p, use 2.7027 in — SSSB (K1-18)

$\phi R_n =$ N/A

$\phi =$ ***0.95***

Check Sidewall Local Yielding

$B_p/B =$ 1 = 1 Check Limit State

$R_n = 2F_y t(5k+t_p) =$ 49.105 k — SSSB (K1-9)

$k = 1.5t$ 0.3495 in

$\phi R_n =$ 49.105 k >= P **OK**

$\phi =$ ***1***

Check Sidewall Local Crippling

$B_p/B =$ 1 = 1 Check Limit State

$R_n = 1.6t^2(1+3t_p/(H-3t))(EF_y)^{1/2}Q_f =$ 123.41 k — SSSB (K1-10)

$Q_f = 1.3-0.4U/\beta =$ 0.9431 < 1 Use $Q_f =$ 0.9431

$U =$ 0.8923

$\phi R_n =$ 92.561 k >= P **OK**

$\phi =$ ***0.75***

Check Weld Connection

Weld Material Strength: $F_{EXX} =$ ***70*** ksi

Flange Weld Capacity (Moment) = $R_n = R_r A_w =$ **22.188 k >= P** **OK**

Effective Weld Length = $L_e = 2(10/(B/t))(F_y t/(F_{yp} t_p))B_p+2t_p =$ 3.7361 in — SSSB (K4-4)

Fillet Weld Size = $t =$ ***0.25*** in

$t_e = 0.707t =$ 0.1768 in

$A_w = L_e t_e =$ 0.6603 in^2

$R_r = \alpha\phi_{e2}F_{EXX} =$ 33.6 ksi — ABDS 6.13.3.2.4

$\alpha =$ 0.6

Web Weld Capacity (Shear) = $R_n = R_r A_w =$ **112.6 k >= V** **OK**

Effective Weld Length = $l_w = 2(d-2t_f) =$ 18.96 in

Fillet Weld Size = $t =$ ***0.25*** in

$t_e = 0.707t =$ 0.1768 in

$A_w = L_w t_e =$ 3.3512 in^2

$R_r = \alpha\phi_{e2}F_{EXX} =$ 33.6 ksi — ABDS 6.13.3.2.4

$\alpha =$ 0.6

Reference

F_y = 50000 psi   Top Chord = HSS6x6x3/8   A = 7.58 in^2

E = 29000 ksi   Orientation = X t_c = 0.349 in

Plating: N

Thickness	Width	Sides	Configuration
N/A	N/A	N/A	N/A

In-Plane						Out-of-Plane					
b_i	b/t_i	I_i	Z_i	S_i	r_i	b_o	b/t_o	I_o	Z_o	S_o	r_o
6	14.2	39.5	15.8	13.2	2.28	6	14.2	39.5	15.8	13.2	2.28

Load Case = ***1***   Member: ***TC005***

P_u = ***197.8*** k

M_{ui} = ***3.1*** ft-k K_i = ***1*** KL/r_i = 45.614 <= 120 **OK**   ABDS 6.9.3

M_{uo} = ***0.9*** ft-k K_o = 1.3808 KL/r_o = 62.984 <= 120 **OK**   ABDS 6.9.3

V_u = ***0.4*** k   L = 104 in

Resistance Factors ϕ_f = 1 ϕ_c = 0.9 ϕ_v = 1   ABDS 6.5.4.2

Check Axial Compression Capacity

P_e/P_o = 1.443 $P_n = (0.658^{(Po/Pe)})P_oA_g$ = 283.58 k   ABDS 6.9.4.1-1

$P_e = \pi^2E/(KL/r)^2$ = 72.15 ksi $P_n = 0.877P_eA_g$ = N/A k   ABDS 6.9.4.1-2

$P_o = QF_y$ = 50 ksi $P_r = \phi_cP_n$ = 255.22 k

Q = ***1***   ABDS 6.9.4.2

Check Moment Capacity   ABDS 6.12.2.2.2

$M_{ni} = M_p = F_yZ_i$ = 65.833 ft-k λ_{pf} >= $\lambda_{f\text{-}In}$ =< λ_{rf}

$M_{ni} = M_p-(M_p-F_yS_i)(3.57\lambda_{f\text{-}In}(F_y/E)^{1/2}-4.0)$ = N/A ft-k ϕ_fM_{ni} = 65.833 ft-k

$M_{no} = M_p = F_yZ_o$ = 65.833 ft-k λ_{pf} >= $\lambda_{f\text{-}Out}$ =< λ_{rf}

$M_{no} = M_p-(M_p-F_yS_o)(3.57\lambda_{f\text{-}Out}(F_y/E)^{1/2}-4.0)$ = N/A ft-k ϕ_fM_{no} = 65.833 ft-k

Check Shear Capacity

$V_r = \phi_vV_n$ = $\phi 0.58\ F_yA_vC_v$ = 114.39 k   ABDS 6.10.9.2

$A_v = 2(b_i-t_c)t_c$ = 3.9444 in^2

C_v = 1   ABDS 6.10.9.3.2

$1.12(kE\ /F_y)^{1/2}$ = 59.237 >= h/t

k_v = ***5***

Combined Axial Compression & Flexure P_u/P_r = 0.775 >= 0.2   ABDS 6.9.2.2

$P_u/2.0P_r + M_{ui}/M_{ri} + M_{uo}/M_{ro}$ = N/A

$P_u/P_r + (8/9)(M_{ui}/M_{ri} + M_{uo}/M_{ro})$ = 0.829 <= 1   **OK**

Combined Shear, Flexure & Axial Force

$(P_u/P_r+M_{ui}/M_{ri}+M_{uo}/M_{ro})+(V_u/V_r)^2$ = 0.8358 <= 1   **OK**   SSSB H3.2

Find the Utilization Ratio   SSSB (K1-6)

$U = P_r/(A_gF_y)+M_i/(S_iF_c)+M_o/(S_oF_c)$ = 0.5946

Reference

F_y = 50000 psi   Bottom Chord = HSS6x4x3/8   A = 6.18 in^2

F_u = 70000 psi   Orientation = Y t_c = 0.349 in

E = 29000 ksi   Plating: N

Thickness	Width	Sides	Configuration
N/A	N/A	N/A	N/A

In-Plane						Out-of-Plane					
b_i	b/t_i	I_i	Z_i	S_i	r_i	b_o	b/t_o	I_o	Z_o	S_o	r_o
4	8.46	14.9	8.94	7.47	1.55	6	14.2	28.3	11.9	9.43	2.14

Load Case = ***1***

P_u = ***198*** k   Member: ***BC005***

M_{ui} = ***2.1*** ft-k

M_{uo} = ***0.4*** ft-k   L = 104 in

V_u = ***0.3*** k

Resistance Factors ϕ_f = 1 ϕ_y = 0.95 ϕ_u = 0.8 ϕ_v = 1   ABDS 6.5.4.2

Check Axial Tension Capacity

$P_r = \phi_y P_{ny} = \phi_y F_y A$ = 293.55 k $A_n = A$ = 6.18 in^2 ABDS 6.8.2.1-1

$P_r = \phi_u P_{nu} = \phi_u F_u A_n R_p U$ = 346.08 k R_p = ***1***   ABDS 6.8.2.1-2

Use P_r = 293.55 k   U = ***1***

Check Moment Capacity   ABDS 6.12.2.2.2

$M_{ni} = M_p = F_y Z_i$ = 37.25 ft-k λ_{pf} >= $\lambda_{f\text{-}In}$ =< λ_{rf}

$M_{ni} = M_p-(M_p-F_yS_i)(3.57\lambda_{f\text{-}In}(F_y/E)^{1/2}-4.0)$ = N/A ft-k $\phi_f M_{ni}$ = 37.25 ft-k

$M_{no} = M_p = F_y Z_o$ = 49.583 ft-k λ_{pf} >= $\lambda_{f\text{-}Out}$ =< λ_{rf}

$M_{no} = M_p-(M_p-F_yS_o)(3.57\lambda_{f\text{-}Out}(F_y/E)^{1/2}-4.0)$ = N/A ft-k $\phi_f M_{no}$ = 49.583 ft-k

Check Shear Capacity

$V_r = \phi_v V_n = \phi 0.58 F_y A_v C_v$ = 73.904 k   ABDS 6.10.9.2

$A_v = 2(b_i-t_c)t_c$ = 2.5484 in^2

C_v = 1   ABDS 6.10.9.3.2

$1.12(k_vE/F_y)^{1/2}$ = 60.314 >= h/t

k_v = ***5***

Combined Axial Tension & Flexure P_u/P_r = 0.6745 >= 0.2   ABDS 6.9.2.2

$P_u/2.0P_r + M_{ui}/M_{ri} + M_{uo}/M_{ro}$ = N/A

$P_u/P_r + (8/9)(M_{ui}/M_{ri} + M_{uo}/M_{ro})$ = 0.7318 <= 1   **OK**

Combined Shear, Flexure & Axial Force

$(P_u/P_r+M_{ui}/M_{ri}+M_{uo}/M_{ro})+(V_u/V_r)^2$ = 0.739 <= 1   **OK**   SSSB H3.2

Reference

F_y = 50000 psi   Vertical = HSS6x6x3/8   A = 7.58 in^2

E = 29000 ksi   Orientation = X t_c = 0.349 in

In-Plane						Out-of-Plane					
b_i	b/t_i	I_i	Z_i	S_i	r_i	b_o	b/t_o	I_o	Z_o	S_o	r_o
6	14.2	39.5	15.8	13.2	2.28	6	14.2	39.5	15.8	13.2	2.28

Load Case = ***1***

P = ***60.7*** k   Member: ***EV1***

M_i = ***5.2*** ft-k

M_{oa} = ***1.5*** ft-k $M_o = M_{oa} + M_{Lat}$ = 4.6464 ft-k M_{Lat} = 3.1464 ft-k

V_u = ***1.5*** k

K_i = ***1*** L_i = 71 in KL_i/r_i = 31.14 <= 120   **OK**   ABDS 6.9.3

K_o = ***2*** L_o = 62.1 in KL_o/r_o = 54.474 <= 120   **OK**   ABDS 6.9.3

Resistance Factors ϕ_f = 1 ϕ_c = 0.9 ϕ_v = 1 ϕ_{e1} = 0.85   ABDS 6.5.4.2

Check Axial Compression Capacity

P_e/P_o = 1.9291 $P_n = (0.658^{(Po/Pe)})P_oA_g$ = 305.08 k   ABDS 6.9.4.1-1

$P_e = \pi^2E/(KL/r)^2$ = 96.455 ksi $P_n = 0.877P_eA_g$ = N/A k   ABDS 6.9.4.1-2

$P_o = QF_y$ = 50 ksi $P_r = \phi_cP_n$ = 274.57 k

Q = ***1***   ABDS 6.9.4.2

Check Moment Capacity   ABDS 6.12.2.2.2

$M_{ni} = M_p = F_yZ_i$ = 65.833 ft-k λ_{pf} >= $\lambda_{f\text{-}In}$ =< λ_{rf}

$M_{ni} = M_p-(M_p-F_yS_i)(3.57\lambda_{f\text{-}In}(F_y/E)^{1/2}-4.0)$ = N/A ft-k ϕ_fM_{ni} = 65.833 ft-k

$M_{no} = M_p = F_yZ_o$ = 65.833 ft-k λ_{pf} >= $\lambda_{f\text{-}Out}$ =< λ_{rf}

$M_{no} = M_p-(M_p-F_yS_o)(3.57\lambda_{f\text{-}Out}(F_y/E)^{1/2}-4.0)$ = N/A ft-k ϕ_fM_{no} = 65.833 ft-k

Check Shear Capacity

$V_r = \phi_vV_n$ = $\phi 0.58\ F_yA_vC_v$ = 114.39 k   ABDS 6.10.9.2

$A_v = 2(b_i-t_c)t_c$ = 3.9444 in^2

C_v = 1   ABDS 6.10.9.3.2

$1.12(kE/F_y)^{1/2}$ = 59.237 >= h/t

k_v = ***5***

Combined Axial Compression & Flexure P_u/P_r = 0.2211 >= 0.2   ABDS 6.9.2.2

$P_u/2.0P_r + M_{ui}/M_{ri} + M_{uo}/M_{ro}$ = N/A

$P_u/P_r + (8/9)(M_{ui}/M_{ri} + M_{uo}/M_{ro})$ = 0.354 <= 1   **OK**

Combined Shear, Flexure & Axial Force

$(P_u/P_r+M_{ui}/M_{ri}+M_{uo}/M_{ro})+(V_u/V_r)^2$ = 0.3708 <= 1   **OK**   SSSB H3.2

Find the Utilization Ratio   SSSB (K1-6)

$U = P_r/(A_gF_y)+M_i/(S_iF_c)+M_o/(S_oF_c)$ = 0.3392

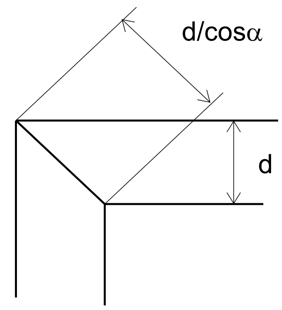
Reference

Check Chord Connection

P_u = 30.35 k Use only 1/2 P due to double mitered diagonal

M_i = 5.2 k-ft α = 40

M_o = 1.5 k-ft



Overlapped Diagonal = Y

d = 6 in

w = 6 in

Weld Length = $l_w = 2d/\cos\alpha$ = 15.665 in

$S_{iw} = (d/\cos\alpha)^2/3$ = 20.449 in^2

$S_{ow} = (d/\cos\alpha)w$ = 46.995 in^2

$f_w = (P_u/l_w+M_i/S_{iw})/t_e$ = 14.295 ksi

$f_w = (P_u/l_w+M_o/S_{ow})/t_e$ = 6.6489 ksi

$t_e = t_c$ = 0.349 in

$R_r = \alpha\phi_{e1}F_{EXX}$ = 35.7 ksi <= F_y, Use 35.7 ksi > f_w **OK** ABDS 6.13.3.2.2

F_{EXX} = ***70*** ksi

α = 0.6

Reference

F_y = 50000 psi   Vertical = HSS5x5x1/4   A = 4.3 in^2

E = 29000 ksi   Orientation = X t_c = 0.233 in

In-Plane						Out-of-Plane					
b_i	b/t_i	I_i	Z_i	S_i	r_i	b_o	b/t_o	I_o	Z_o	S_o	r_o
5	18.5	16	7.61	6.41	1.93	5	18.5	16	7.61	6.41	1.93

Load Case = ***1***

P = ***53.3*** k   Member: ***V002***

M_i = ***7.5*** ft-k

M_o = ***2.3*** ft-k $M_o = M_{oa} + M_{Lat}$ = 9.7094 ft-k M_{Lat} = 7.4094 ft-k

V_u = ***2.2*** k

K_i = ***1*** L_i = 71 in KL_i/r_i = 36.788 <= 120 **OK** ABDS 6.9.3

K_o = ***2*** L_o = 62.1 in KL_o/r_o = 64.352 <= 120 **OK** ABDS 6.9.3

Resistance Factors ϕ_f = 1 ϕ_c = 0.9 ϕ_v = 1 ϕ_{e2} = 0.8   ABDS 6.5.4.2

Check Axial Compression Capacity

P_e/P_o = 1.3823 $P_n = (0.658^{(Po/Pe)})P_oA_g$ = 158.83 k   ABDS 6.9.4.1-1

$P_e = \pi^2E/(KL/r)^2$ = 69.114 ksi $P_n = 0.877P_eA_g$ = N/A k   ABDS 6.9.4.1-2

$P_o = QF_y$ = 50 ksi $P_r = \phi_cP_n$ = 142.95 k

Q = ***1***   ABDS 6.9.4.2

Check Moment Capacity   ABDS 6.12.2.2.2

$M_{ni} = M_p = F_yZ_i$ = 31.708 ft-k λ_{pf} >= $\lambda_{f\text{-}In}$ =< λ_{rf}

$M_{ni} = M_p-(M_p-F_yS_i)(3.57\lambda_{f\text{-}In}(F_y/E)^{1/2}-4.0)$ = N/A ft-k ϕ_fM_{ni} = 31.708 ft-k

$M_{no} = M_p = F_yZ_o$ = 31.708 ft-k λ_{pf} >= $\lambda_{f\text{-}Out}$ =< λ_{rf}

$M_{no} = M_p-(M_p-F_yS_o)(3.57\lambda_{f\text{-}Out}(F_y/E)^{1/2}-4.0)$ = N/A ft-k ϕ_fM_{no} = 31.708 ft-k

Check Shear Capacity

$V_r = \phi_vV_n$ = $\phi 0.58\ F_yA_vC_v$ = 64.421 k   ABDS 6.10.9.2

$A_v = 2(b_i-t_c)t_c$ = 2.2214 in^2

C_v = 1   ABDS 6.10.9.3.2

$1.12(kE/F_y)^{1/2}$ = 59.237 >= h/t

k_v = ***5***

Combined Axial Compression & Flexure P_u/P_r = 0.3729 >= 0.2   ABDS 6.9.2.2

$P_u/2.0P_r + M_{ui}/M_{ri} + M_{uo}/M_{ro}$ = N/A

$P_u/P_r + (8/9)(M_{ui}/M_{ri} + M_{uo}/M_{ro})$ = 0.8553 <= 1   **OK**

Combined Shear, Flexure & Axial Force

$(P_u/P_r+M_{ui}/M_{ri}+M_{uo}/M_{ro})+(V_u/V_r)^2$ = 0.9168 <= 1   **OK**   SSSB H3.2

Find the Utilization Ratio   SSSB (K1-6)

$U = P_r/(A_gF_y)+M_i/(S_iF_c)+M_o/(S_oF_c)$ = 0.8923

Reference

Check Chord Connection

P_u = 53.3 k

M_i = 7.5 k-ft

M_o = 2.3 k-ft

Overlapped Diagonal = ***N***

$\beta = B_b/B$ = 0.8333

d = 5 in

θ = 90 °

b = 5 in

$b_{eoi} = [10/(B/t)][F_y t/(F_y t_p)]B_p]$ = 4.3563 in

Use b_{eoi} = 4.3563 in

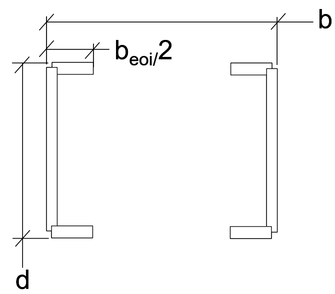
when $\beta > 0.85$ or $\theta > 50^o$, $b_{eoi}/2$ shall not exceed 2t = 0.698 in

Side Weld Size = t_w = ***0.25*** in

t_{ed} = .707t_w or t = 0.1768 in

Face Fillet Weld Size = t_w = ***0.25*** in

t_{eb} = .707t_w = 0.1768 in



Weld Area = $I_w = 2dt_{ed}+2b_{eoi}t_{eb}$ = 3.3074 in^2 — SSSB Tbl K4.1

$S_{iw} = t_{ed}d^2/3+t_{eb}b_{eoi}d$ = 5.3228 in^3 — SSSB Tbl K4.1

$S_{ow} = t_{ed}db+t_{eb}(b^2/3-(b-b_{eoi})^3/(3b))$ = 5.8885 in^3 — SSSB Tbl K4.1

(tension) $f_w = (M_i/S_{iw}+Mo/S_{ow})$ = 21.596 ksi

(compression) $f_w = (P_u/I_w+M_i/S_{iw}+M_o/S_{ow})$ = 37.711 ksi

$R_r = \alpha\phi_{e2}F_{EXX}$ = 33.6 ksi <= F_y, Use 33.6 ksi > f_w **OK** — ABDS 6.13.3.2.4

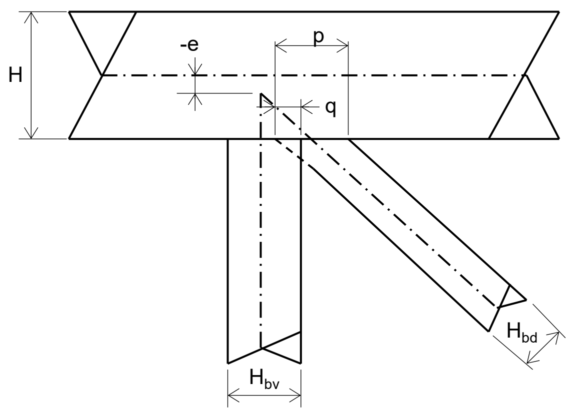
F_{EXX} = ***70*** ksi

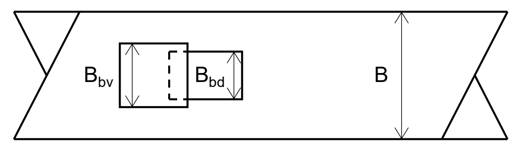
α = 0.6

(compression) $R_r = \phi_c F_y$ = 45 ksi > f_w **OK**

Reference

		Orientation	Thickness (in)		Height (in)		Width (in)	
Top Chord :	HSS6x6x3/8	X	$t =$	0.349	$H =$	6	$B =$	6
Vertical:	HSS6x6x3/8	X	$t_{bv} =$	0.349	$H_{bv} =$	6	$B_{bv} =$	6
Diagonal:	HSS5x3x1/4	Y	$t_{bd} =$	0.233	$H_{bd} =$	3	$B_{bd} =$	5





$\theta =$ 34.163 deg

$F_y = F_{ybv} = F_{ybd} =$ 50 ksi

$F_u =$ 70 ksi

$E =$ 29000 ksi

Area of Diagonal = $A_g =$ 3.37 in^2

Load Case = ***1*** Member: ***D001***

Load Applied to Diagonal = P = ***93*** k *T* (T = Tension, C = Compression)

$q =$ 2.6712 in $O_v = q/p =$ 50.00%

$p = H_{bd}/\sin\theta =$ 5.3423 in $e =$ -0.964

Check Applicability: SSSB Tbl K2.2A

Joint Eccentricity:	-.55H =	-3.3	<= e	**OK**
	0.25H =	1.5	>= e	**OK**
Branch Angle:		θ >= 30°		**OK**
Chord Wall Slenderness:	B/t=	14.2	<= 30	**OK**
	H/t=	14.2	<= 35	**OK**
Tension Branch Wall Slenderness:	B_{bd}/t_{bd} =	18.5	<= 35	**OK**
Comp Branch Wall Slenderness:	B_{bd}/t_{bd} =	18.5	N/A	**N/A**
	$1.1(E/F_y)^{0.5}$ = 26.492	>=	B_{bd}/t_{bd}	**N/A**
Width Ratio:	B_{bd}/B & H_{bd}/B =	0.5	>= 0.25	**OK**
Aspect Ratio:	H/B & H_{bd}/B_{bd} =	0.6	>= 0.5	**OK**
	H/B & H_{bd}/B_{bd} =	1	<= 2.0	**OK**
Overlap:	O_v =	50.00%	>=25%	**OK**
	O_v =	50.00%	<=100%	**OK**
Branch Width Ratio:	B_{bd}/B_{bv} =	0.8333	>= 0.75	**OK**
Branch Thickness Ratio:	t_{bd}/t_{bv} =	0.6676	<=1	**OK**
Strength:		F_y <= 52 ksi		**OK**
Ductility:	F_y/F_u =	0.71	<= 0.8	**OK**

Reference

Check Connection for Local Yielding due to Uneven Load Distribution: — SSSB Tbl K2.2

$b_{eoi} = (10/(B/t))((F_y t)/(F_y t_{bd}))B_{bd} =$ 5.2741 in > B_{bd} use 5 in — SSSB (K2-20)

$b_{eov} = (10/(B_{bv}/t_{bv}))((F_y t_{bv})/(F_y t_{bd}))B_{bd} =$ 5.2741 in > B_{bd} use 5 in — SSSB (K2-21)

25% <= O_v < 50%

$P_n = \phi F_y t_{bd}((O_v/50)(2H_{bd}-4t_{bd})+b_{eoi}+b_{eov}) =$ N/A N/A **N/A** — SSSB (K2-17)

50% <= O_v < 80%

$P_n = \phi F_y t_{bd}(2H_{bd}-4t_{bd}+b_{eoi}+b_{eov}) =$ 166.77 k >=P **OK** — SSSB (K2-18)

80% <= O_v <= 100%

$P_n = \phi F_y t_{bd}(2H_{bd}-4t_{bd}+B_{bd}+b_{eov}) =$ N/A N/A **N/A** — SSSB (K2-19)

$\phi =$ ***0.95***

Resistance Factors — ABDS 6.5.4.2

$\phi_y =$ 0.95 $\phi_u =$ 0.8 $\phi_{e2} =$ 0.8

Check Axial Tension Capacity

$P_r = \phi_y P_{ny} = \phi_y F_y A =$ 160.08 k — ABDS 6.8.2.1-1

$P_r = \phi_u P_{nu} = \phi_u F_u A_n R_p U =$ 188.72 k Use $P_r =$ 160.08 k >=P **OK** — ABDS 6.8.2.1-2

$A_n = A_g =$ 3.37 in^2

$R_p =$ ***1***

$U =$ ***1***

Check Connection

$l_w = 2O_v/50[(1-O_v/100)(H_{bd}/\sin\theta)+O_v/100(H_{bd}/\sin(\theta+\beta))]+b_{eoi}+b_{eov} =$ N/A in

$l_w = 2[(1-O_v/100)(H_{bd}/\sin\theta)+O_v/100(H_{bd}/\sin(\theta+\beta))]+b_{eoi}+b_{eov} =$ 18.968 in

$l_w = 2[(1-O_v/100)(H_{bd}/\sin\theta)+O_v/100(H_{bd}/\sin(\theta+\beta))]+B_b+b_{eov} =$ N/A in

Use $l_w =$ 18.968 in — SSSB Tbl K4.1

when B_{bd}/B > 0.85, $b_{eoi}/2$ shall not exceed 2t = 0.698 in Use $b_{eoi} =$ 5 in

and when B_{bd}/B_{bv} > 0.85, $b_{eov}/2$ shall not exceed $2t_{bv}$ = 0.698 in Use $b_{eov} =$ 5 in

Fillet Weld Size = t = ***0.25*** in

$t_e = 0.707t =$ 0.1768 in

$f_w = (P/l_w)/t_e =$ 27.74 ksi

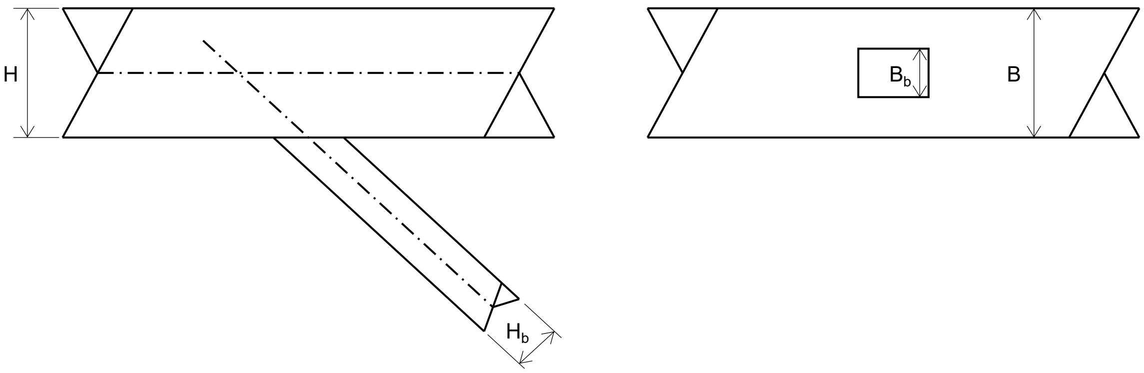
$R_r = \alpha\phi_{e2}F_{EXX} =$ 33.6 ksi <= F_y, Use 33.6 ksi > f_w **OK** — ABDS 6.13.3.2.4

$F_{EXX} =$ ***70*** ksi

$\alpha =$ 0.6

Reference

		Orientation	A	t_c	In-Plane b	In-Plane S	Out-of-Plane b	Out-of-Plane S
Chord:	HSS6x6x3/8	X	7.58	0.349	6	13.2	6	13.2
Branch:	HSS3x3x1/4	X	2.44	0.233	3	2.01	3	2.01



B = 6　　H = 6　　t = 0.349　　θ = 35.984

B_b = 3　　H_b = 3　　t_b = 0.233

$\beta = B_b/B$ = 0.5　　$F_y = F_{yb}$ = 50 ksi　　F_u = 70 ksi

$\gamma = B/2t$ = 8.596　　E = 29000 ksi

$\eta = H_b/B\sin\theta$ = 0.851

Load Case = ***1***　　Member: ***D002***

Load Applied to Diagonal = P = ***68.8*** k　　*T*　　(T = Tension, C = Compression)

Chord-Stress Interaction Parameter:

Q_f = 0.8243 (Q_f = 1 if Chord is in Tension, $Q_f = 1.3\text{-}0.4U/\beta$ if Chord is in Compression) — SSSB K1-5a

U = 0.5946

Check Applicability: — SSSB Tbl K2.2

Branch Angle:		θ >= 30°			**OK**
Chord Wall Slenderness:	B/t & H/t=	14.2	<= 35		**OK**
Tension Branch Wall Slenderness:	B_b/t_b =	9.88	<= 35		**OK**
Comp Branch Wall Slenderness:	B_b/t_b =	9.88	N/A		**N/A**
	$1.25(E/F_y)^{0.5}$ =	30.104	>=	B_b/t_b	**N/A**
Width Ratio:	B_{bd}/B & H_{bd}/B =	0.5	>= 0.25		**OK**
Aspect Ratio:	H/B & H_{bd}/B_{bd} =	1	>= 0.5		**OK**
	H/B & H_{bd}/B_{bd} =	1	<= 2.0		**OK**
Strength:		F_y <= 52 ksi			**OK**
Ductility:	F_y/F_u =	0.71	<= 0.8		**OK**

Reference

Check Chord Wall Plastification: SSSB Tbl K2.2

β <= 0.85, Check Limit State

$P_n = \phi(F_y t^2(2\eta/(1-\beta)+4/(1-\beta)^{0.5})Q_f/\sin\theta) =$ 77.413 k >=P **OK** SSSB (K2-7)

$\phi =$ ***1***

Check Shear Yielding (Punching):

$(1-1/\gamma) =$ 0.8837 >= β Check Limit State

β < 0.85 & B/t >= 10 Limit State is Not Applicable

$P_n = \phi(0.6F_y tB(2\eta+2\beta_{eop})/\sin\theta) =$ N/A **N/A** SSSB (K2-8)

$\phi =$ ***0.95***

$\beta_{eop} = 5\beta/\gamma =$ 0.2908 <= β, use $\beta_{oep} =$ 0.2908

Check Sidewall Strength:

β <> 1, Limit State is Not Applicable

(i) Local Yielding:

$P_n = \phi(2F_y t(5k+l_b)/\sin\theta) =$ N/A **N/A** SSSB (K2-9)

$\phi =$ ***1***

$k = 1.5t =$ 0.5235 in

$l_b = H_b/\sin\theta =$ 5.1059 in

(ii) Sidewall Local Crippling

$P_n = \phi(1.6t^2(1+3l_b/(H-3t))(EF_y)^{0.5}Q_f/\sin\theta) =$ N/A **N/A** SSSB (K2-10)

$\phi =$ ***0.75***

Check Local Yielding due to Uneven Load Distribution:

β < 0.85, Limit State is Not Applicable

$P_n = \phi(F_{yb}t_b(2H_b+2b_{eoi}-4t_b)) =$ N/A **N/A** SSSB (K2-12)

$\phi =$ ***0.95***

$b_{eoi} = (10/(B/t))(F_y t/(F_{yb} tb))B_b <= B_b =$ 2.6138 in SSSB (K2-13)

Resistance Factors ABDS 6.5.4.2

$\phi_y =$ 0.95 $\phi_u =$ 0.8 $\phi_{e2} =$ 0.8

Check Axial Tension Capacity

$P_r = \phi_y P_{ny} = \phi_y F_y A =$ 115.9 k ABDS 6.8.2.1-1

$P_r = \phi_u P_{nu} = \phi_u F_u A_n R_p U =$ 97.496 k Use $P_r =$ 97.496 k >=P **OK** ABDS 6.8.2.1-2

$A_n = Ag - t_b B_b =$ 1.741 in^2 (Assume only 3 sides are welded)

$R_p =$ ***1***

$U =$ ***1***

Reference

Check Connection

Weld Length = $l_w = 2H_{bd}/\sin\theta + b_{eoi}$ = 12.825 in (Assume only 3 sides are welded) — SSSB Tbl K4.1

when $\beta > 0.85$ or $\theta > 50^o$, $b_{eoi}/2$ shall not exceed 2t = 0.698 in Use b_{eoi} = 2.6138 in

Fillet Weld Size = t = ***0.25*** in

$t_e = 0.707t$ = 0.1768 in

$f_w = (P/l_w)/t_e$ = 30.35 ksi

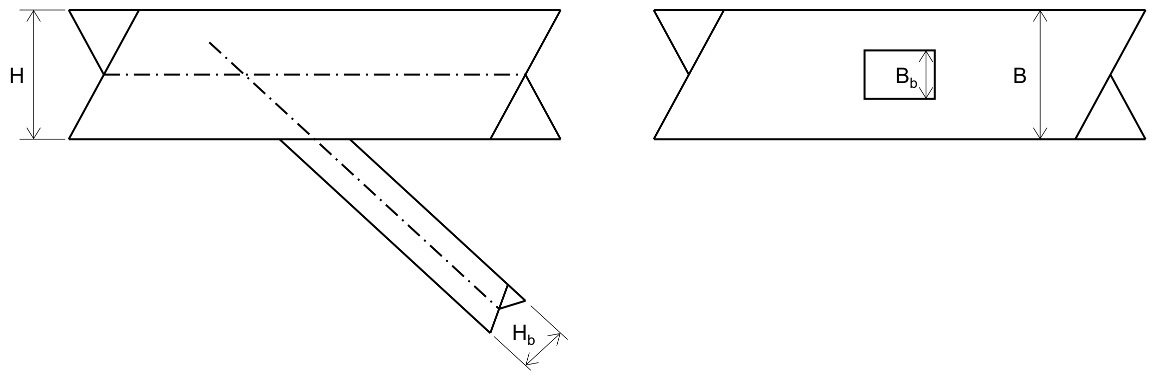
$R_r = \alpha\phi_{e2}F_{EXX}$ = 33.6 ksi <= F_y, Use 33.6 ksi > f_w **OK** — ABDS 6.13.3.2.4

F_{EXX} = ***70*** ksi

α = 0.6

Reference

	Orientation	A	t_c	In-Plane b	In-Plane S	Out-of-Plane b	Out-of-Plane S
Chord : HSS6x4x3/8	X	6.18	0.349	6	9.43	4	7.47
Branch: HSS4x3x1/4	X	2.91	0.233	3	2.61	4	3.07



B = 4 H = 6 t = 0.349 θ = 55.265

B_b = 4 H_b = 3 t_b = 0.233

$\beta = B_b/B$ = 1 $F_y = F_{yb}$ = 50 ksi F_u = 70 ksi

$\gamma = B/2t$ = 5.7307 E = 29000 ksi

$\eta = H_b/B\sin\theta$ = 0.9126

Load Case = ***3***

P = ***17.5*** k Member: ***BD001***

Chord-Stress Interaction Parameter:

Q_f = ***1*** (Q_f = 1 if Chord is in Tension, $Q_f = 1.3\text{-}0.4U/\beta$ if Chord is in Compression) SSSB Tbl K2.2

Check Applicability: SSSB Tbl K2.2

Branch Angle:		θ >= 30°	**OK**
Chord Wall Slenderness:	B/t & H/t=	14.2 <= 35	**OK**
Tension Branch Wall Slenderness:	B_b/t_b =	14.2 <= 35	**OK**
Comp Branch Wall Slenderness:	B_b/t_b =	14.2 <= 35	**OK**
	$1.25(E/F_y)^{0.5}$ = 30.104	>= B_b/t_b	**OK**
Width Ratio:	B_{bd}/B & H_{bd}/B =	0.75 >= 0.25	**OK**
Aspect Ratio:	H/B & H_{bd}/B_{bd} =	1.5 >= 0.5	**OK**
	H/B & H_{bd}/B_{bd} =	1.5 <= 2.0	**OK**
Strength:		F_y <= 52 ksi	**OK**
Ductility:	F_y/F_u =	0.71 <= 0.8	**OK**

Reference

Check Chord Wall Plastification: SSSB Tbl K2.2

β > 0.85, Limit State is Not Applicable

$P_n = \phi(F_y t^2(2\eta/(1-\beta)+4/(1-\beta)^{0.5})Q_f/\sin\theta) =$ N/A **N/A** SSSB (K2-7)

$\phi =$ ***1***

Check Shear Yielding (Punching):

$(1-1/\gamma) =$ 0.8255 < β Limit State is Not Applicable

β >= 0.85 or B/t < 10 Check Limit State

$P_n = \phi(0.6F_y tB(2\eta+2\beta_{eop})/\sin\theta) =$ N/A **N/A** SSSB (K2-8)

$\phi =$ ***0.95***

$\beta_{eop} = 5\beta/\gamma =$ 0.8725 <= β, use $\beta_{oep} =$ 0.8725

Check Sidewall Strength:

β = 1, Check Limit State

(i) Local Yielding:

$P_n = \phi(2F_y t(5k+l_b)/\sin\theta) =$ 266.19 k >=P **OK** SSSB (K2-9)

$\phi =$ ***1***

k = 1.5t = 0.5235 in

$l_b = H_b/\sin\theta =$ 3.6505 in

(ii) Sidewall Local Crippling

$P_n = \phi(1.6t^2(1+3l_b/(H-3t))(EF_y)^{0.5}Q_f/\sin\theta) =$ 687.71 k >=P **OK** SSSB (K2-10)

$\phi =$ ***0.75***

Check Local Yielding due to Uneven Load Distribution:

β >= 0.85, Check Limit State

$P_n = \phi(F_{yb}t_b(2H_b+2b_{eoi}-4t_b)) =$ 144.63 k >=P **OK** SSSB (K2-12)

$\phi =$ ***0.95***

$b_{eoi} = (10/(B/t))(F_y t/(F_{yb}tb))B_b <= B_b =$ 4 in SSSB (K2-13)

Resistance Factors ABDS 6.5.4.2

$\phi_y =$ 0.95 $\phi_u =$ 0.8 $\phi_c =$ 0.9 $\phi_{e2} =$ 0.8

Check Axial Tension Capacity

$P_r = \phi_y P_{ny} = \phi_y F_y A =$ 138.23 k ABDS 6.8.2.1-1

$P_r = \phi_u P_{nu} = \phi_u F_u A_n R_p U =$ 123.82 k Use $P_r =$ 123.82 k >=P **OK** ABDS 6.8.2.1-2

$A_n = Ag-t_b B_b =$ 2.211 in^2 (Assume only 3 sides are welded)

$R_p =$ ***1***

U = ***1***

Reference

Check Axial Compression Capacity

K = ***1***

L = 176.73 in   KL/r = 121.88 <= 140   **OK**   ABDS 6.9.3

r = 1.45 in^3

$P_e/P_o =$ 0.3853 $P_n = (0.658^{(Po/Pe)})P_oA_g =$ N/A k   ABDS 6.9.4.1-1

$P_e = \pi^2E/(KL/r)^2 =$ 19.267 ksi $P_n = 0.877P_eA_g =$ 49.171 k   ABDS 6.9.4.1-2

$P_o = QF_y =$ 50 ksi $P_r = \phi_cP_n =$ 44.254 k   **OK**

Q = ***1***   ABDS 6.9.4.2

Check Connection

Weld Length = $l_w = 2H_{bd}/\sin\theta+b_{eoi} =$ 7.9991 in   (Assume only 3 sides are welded)   SSSB Tbl K4.1

when β > 0.85 or θ > 50°, $b_{eoi}/2$ shall not exceed 2t = 0.698 in   Use b_{eoi} = 0.698 in

Fillet Weld Size = t = ***0.25*** in

$t_e = 0.707t =$ 0.1768 in

$f_w = (P/l_w)/t_e =$ 12.378 ksi

$R_r = \alpha\phi_{e2}F_{EXX} =$ 33.6 ksi <= F_y, Use 33.6 ksi > f_w **OK**   ABDS 6.13.3.2.4

$F_{EXX} =$ ***70*** ksi

$\alpha =$ 0.6

Check Connection for Fatigue   ABDS 6.6.1.2.5-1

P = ***2.7*** k   Load Case = ***Fatigue***

Member = ***BD001***

Constant-Amplitude Fatique Threshold = $(\Delta F)_{TH}$ = 4.5 ksi   ABDS Table 6.6.1.2.5-3

Detail Category = ***E***

$f_w = (P/l_w)/t_e =$ 1.9097 **ksi < F**   **OK for Infinite Life**

Reference

Structure Information:

Expansion Coefficient = α = ***0.0000065*** /°F

Expansion Length = L = 78.292 ft

Skew = 0 °

Temperature Information:

Mean High = T_H = ***120*** °F

Mean Low = T_L = ***-30*** °F

Max Base = T_{BMax} = ***55*** °F   Min Base = T_{BMin} = ***35*** °F

Total Movements:

$\Delta_{Rise} = \alpha(T_H - T_{BMin})Lm$ = 0.5191 in

$\Delta_{Fall} = \alpha(T_{BMax} - T_L)Lm$ = 0.5191 in

Perpendicular Movements:

$\Delta_{P\ Rise} = \Delta_{Rise}Cos(Skew)$ = 0.5191 in

$\Delta_{P\ Fall} = \Delta_{Fall}Cos(Skew)$ = 0.5191 in

1.0381 in

Racking Movements:

$\Delta_{R\ Rise} = \Delta_{Rise}Sin(Skew)$ = 0 in

$\Delta_{R\ Fall} = \Delta_{Fall}Sin(Skew)$ = 0 in

0 in

Gaps:

Gap at $T_B = G_B$ = 1.25 in

Minimum Installation Gap = G_M = ***0.125*** in

Minimum Gap = $G_B - \Delta_{P\ Rise}$ = 0.7309 in > ***0.125*** in **OK**

Maximum Gap = $G_B + \Delta_{P\ Fall}$ = 1.7691 in > ***1.5*** in **N.G.**

Cover Plate or Expansion Joint Requires

Maximum Temperature for Installation Gap:

$T_{Max} = T_B + (G_B - 1/4 - G_M)/(\alpha LmCos(Skew))$ = 198.28 °F

Gap Variance per 10°F:

$G_V = \alpha LmCos(Skew)10$ = 0.0611 in

Bearing Force:

R_{LL} = 21.2 k (Unfactored w/o IM)

R_{DL} = 20.1 k (Unfactored)

R = 41.3 k (Unfactored)

Check Bearing Force on PTFE Pad:

Length = L = ***7*** in

Width = W = ***7*** in

Area = A = 49 in^2

q = R/A = 842.86 psi < 1500 psi **OK**

Anchor Bolt Checks

Reference

Horizontal Loads:

WS_H = 5.75 k	R_u (LC 3) = $(\gamma_{WS}WS_H^2+\gamma_{TU}TU_L^2)^{1/2}$ =	8.868 k		ABDS Tbl 3.4.1-1
WA = 0 k	R_u (LC 4) = $\gamma_{EQ}(0.3EQ_H^2+EQ_L^2)^{1/2}$ =	47.93 k		ABDS 3.8.10
EQ_H/R = 23.7 k	R_u (LC 5) = $\gamma_{WA}WA$ =	0 k		ABDS Tbl 3.4.1-1
EQ_L/R = 47.4 k				
TU_L = 3.1 k	R_u = 47.93 k			

Uplift Load:

DC = -20.1 k	Pu (LC 3) = $\gamma_{DC}DC+\gamma_{DW}DW+\gamma_{WS}WS_H$ =	-4.09 k
DW = 0 k	P_u (LC 5) = $\gamma_{WA}WA$ =	0 k
WS_H = 10 k		
WA = 0 k	P_u = 0 k	

Load Factors

γ_{DC}	γ_{DW}	γ_{WS}	γ_{EQ}	γ_{WA}	γ_{TU}
0.9	***0.65***	*1.4*	*1*	*1*	***1.2***

Bearing Plate Thickness = t = 0.75 in

Bearing Plate Clear Distance = L_c = 1.25 in

Bearing Plate Tensile Strength = F_u = ***70*** ksi

Number of Bolts = n = 2

Anchor Bolt Diameter = d = 1.25 in

Area of Bolt = A_b = 1.2272 in^2

F_{ub} = 75 ksi (F1554 Grade 55 Bolts) — ABDS 6.4.3

Resistance Factors — ABDS 6.5.4.2

ϕ_f	ϕ_v	ϕ_{bb}	ϕ_t	ϕ_s	ϕ_{e2}
1	***1***	***0.8***	***0.8***	***0.75***	*0.8*

Bolt Capacity in Shear

$\phi_s R_n$ = (0.8)0.48 $\phi_s A_b F_{ub} N_s n$ = 53.014 k >= R_u **OK** ABDS 6.13.2.12

N_s = ***1***

Bolt Capacity in Tension

$\phi_t T_n$ = 0.76 $\phi_t A_b F_{ub} n$ = 111.92 k >= P_u **OK** ABDS 6.13.2.10

Bearing Resistance at Bolt Holes

$\phi_{bb}R_{nb} = \phi_{bb}L_c t F_u n$ = 105 k >= R_u **OK** ABDS 6.13.2.9

$\phi_{bb}R_{nb} = \phi_{bb}2.0dtF_u n$ = 210 k >= R_u **OK** ABDS 6.13.2.9

Capacity of Weld

$R_r = (0.6\phi_{e2}F_{EXX})(0.707t)l_w$ = 106.9 k >= γR_u **OK** ABDS 6.13.3.2.4

Weld Length = l_w = 18 in

Weld Size = t = ***0.25*** in

F_{EXX} = ***70*** ksi

BR19-00321-2

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Company: BIG R BRIDGE, LLC   Engineer: Eva Leong

VisualAnalysis 12.00.0020 Report

Model Summary

Structure Type: Space Frame

68 Nodes, and 569 Degrees of Freedom

90 Member Elements

The model is linear.

The model will have 401 unique mode shapes.

The size of the model is:

77.79 ft, in the X direction

5.917 ft, in the Y direction

12 ft, in the Z direction

Nodes

Node	X	Y	Z	Fix DX	Fix DY	Fix DZ	Fix RX	Fix RY	Fix RZ
	ft	ft	ft						
N001	0	0	0	No	Yes	No	No	No	No
N001-0	0	0	-12	Yes	Yes	Yes	No	No	No
N002	8.563	0	0	No	No	No	No	No	No
N002-0	8.563	0	-12	No	No	No	No	No	No
N003	17.229	0	0	No	No	No	No	No	No
N003-0	17.229	0	-12	No	No	No	No	No	No
N004	25.896	0	0	No	No	No	No	No	No
N004-0	25.896	0	-12	No	No	No	No	No	No
N005	34.563	0	0	No	No	No	No	No	No
N005-0	34.563	0	-12	No	No	No	No	No	No
N006	43.229	0	0	No	No	No	No	No	No
N006-0	43.229	0	-12	No	No	No	No	No	No
N007	51.896	0	0	No	No	No	No	No	No
N007-0	51.896	0	-12	No	No	No	No	No	No
N008	60.563	0	0	No	No	No	No	No	No
N008-0	60.563	0	-12	No	No	No	No	No	No
N009	69.229	0	0	No	No	No	No	No	No
N009-0	69.229	0	-12	No	No	No	No	No	No
N010	77.792	0	0	No	Yes	No	No	No	No
N010-0	77.792	0	-12	No	Yes	Yes	No	No	No
N101	0	5.917	0	No	No	No	No	No	No
N101-0	0	5.917	-12	No	No	No	No	No	No
N102	8.563	5.917	0	No	No	No	No	No	No
N102-0	8.563	5.917	-12	No	No	No	No	No	No

N103	17.229	5.917	0	No	No	No	No	No	No
N103-0	17.229	5.917	-12	No	No	No	No	No	No
N104	25.896	5.917	0	No	No	No	No	No	No
N104-0	25.896	5.917	-12	No	No	No	No	No	No
N105	34.563	5.917	0	No	No	No	No	No	No
N105-0	34.563	5.917	-12	No	No	No	No	No	No
N106	43.229	5.917	0	No	No	No	No	No	No
N106-0	43.229	5.917	-12	No	No	No	No	No	No
N107	51.896	5.917	0	No	No	No	No	No	No
N107-0	51.896	5.917	-12	No	No	No	No	No	No
N108	60.563	5.917	0	No	No	No	No	No	No
N108-0	60.563	5.917	-12	No	No	No	No	No	No
N109	69.229	5.917	0	No	No	No	No	No	No
N109-0	69.229	5.917	-12	No	No	No	No	No	No
N110	77.792	5.917	0	No	No	No	No	No	No
N110-0	77.792	5.917	-12	No	No	No	No	No	No
NB001	0	0.742	0	No	No	No	No	No	No
NB001-0	0	0.742	-12	No	No	No	No	No	No
NB002	8.563	0.742	0	No	No	No	No	No	No
NB002-0	8.563	0.742	-12	No	No	No	No	No	No
NB003	17.229	0.742	0	No	No	No	No	No	No
NB003-0	17.229	0.742	-12	No	No	No	No	No	No
NB004	25.896	0.742	0	No	No	No	No	No	No
NB004-0	25.896	0.742	-12	No	No	No	No	No	No
NB005	34.563	0.742	0	No	No	No	No	No	No
NB005-0	34.563	0.742	-12	No	No	No	No	No	No
NB006	43.229	0.742	0	No	No	No	No	No	No
NB006-0	43.229	0.742	-12	No	No	No	No	No	No
NB007	51.896	0.742	0	No	No	No	No	No	No
NB007-0	51.896	0.742	-12	No	No	No	No	No	No
NB008	60.563	0.742	0	No	No	No	No	No	No
NB008-0	60.563	0.742	-12	No	No	No	No	No	No
NB009	69.229	0.742	0	No	No	No	No	No	No
NB009-0	69.229	0.742	-12	No	No	No	No	No	No
NB010	77.792	0.742	0	No	No	No	No	No	No
NB010-0	77.792	0.742	-12	No	No	No	No	No	No
NB011	8.771	5.917	0	No	No	No	No	No	No
NB012	17.438	5.917	0	No	No	No	No	No	No
NB013	26.104	5.917	0	No	No	No	No	No	No
NB014	34.771	5.917	0	No	No	No	No	No	No
NB015	16.896	0	0	No	No	No	No	No	No
NB016	25.563	0	0	No	No	No	No	No	No
NB017	34.229	0	0	No	No	No	No	No	No
NB018	42.896	0	0	No	No	No	No	No	No

Member Elements

Member	Section	Material	(1)Node	(2)Node	Rz1	Ry1	Rx1	Rz2	Ry2	Rx2
BC001	HSS6x4x3/8	ASTM A8	N001	N002	Rigid	Rigid	Rigid	Rigid	Rigid	Rigid
BC001-0	HSS6x4x3/8	ASTM A8	N001-0	N002-0	Rigid	Rigid	Rigid	Rigid	Rigid	Rigid
BC002	HSS6x4x3/8	ASTM A8	N002	N003	Rigid	Rigid	Rigid	Rigid	Rigid	Rigid
BC002-0	HSS6x4x3/8	ASTM A8	N002-0	N003-0	Rigid	Rigid	Rigid	Rigid	Rigid	Rigid
BC003	HSS6x4x3/8	ASTM A8	N003	N004	Rigid	Rigid	Rigid	Rigid	Rigid	Rigid
BC003-0	HSS6x4x3/8	ASTM A8	N003-0	N004-0	Rigid	Rigid	Rigid	Rigid	Rigid	Rigid
BC004	HSS6x4x3/8	ASTM A8	N004	N005	Rigid	Rigid	Rigid	Rigid	Rigid	Rigid
BC004-0	HSS6x4x3/8	ASTM A8	N004-0	N005-0	Rigid	Rigid	Rigid	Rigid	Rigid	Rigid
BC005	HSS6x4x3/8	ASTM A8	N005	N006	Rigid	Rigid	Rigid	Rigid	Rigid	Rigid
BC005-0	HSS6x4x3/8	ASTM A8	N005-0	N006-0	Rigid	Rigid	Rigid	Rigid	Rigid	Rigid
BC006	HSS6x4x3/8	ASTM A8	N006	N007	Rigid	Rigid	Rigid	Rigid	Rigid	Rigid
BC006-0	HSS6x4x3/8	ASTM A8	N006-0	N007-0	Rigid	Rigid	Rigid	Rigid	Rigid	Rigid
BC007	HSS6x4x3/8	ASTM A8	N007	N008	Rigid	Rigid	Rigid	Rigid	Rigid	Rigid
BC007-0	HSS6x4x3/8	ASTM A8	N007-0	N008-0	Rigid	Rigid	Rigid	Rigid	Rigid	Rigid
BC008	HSS6x4x3/8	ASTM A8	N008	N009	Rigid	Rigid	Rigid	Rigid	Rigid	Rigid
BC008-0	HSS6x4x3/8	ASTM A8	N008-0	N009-0	Rigid	Rigid	Rigid	Rigid	Rigid	Rigid
BC009	HSS6x4x3/8	ASTM A8	N009	N010	Rigid	Rigid	Rigid	Rigid	Rigid	Rigid
BC009-0	HSS6x4x3/8	ASTM A8	N009-0	N010-0	Rigid	Rigid	Rigid	Rigid	Rigid	Rigid
BD001	HSS4x3x1/4	ASTM A8	N001-0	N002	Free	Free	Free	Free	Free	Rigid
BD002	HSS4x3x1/4	ASTM A8	N002	N003-0	Free	Free	Free	Free	Free	Rigid
BD003	HSS4x3x1/4	ASTM A8	N003-0	N004	Free	Free	Free	Free	Free	Rigid
BD007	HSS4x3x1/4	ASTM A8	N007	N008-0	Free	Free	Free	Free	Free	Rigid
BD008	HSS4x3x1/4	ASTM A8	N008-0	N009	Free	Free	Free	Free	Free	Rigid
BD009	HSS4x3x1/4	ASTM A8	N009	N010-0	Free	Free	Free	Free	Free	Rigid
D001	HSS5x3x1/4	ASTM A8	N101	N002	Free	Free	Free	Free	Free	Rigid
D001-0	HSS5x3x1/4	ASTM A8	N101-0	N002-0	Free	Free	Free	Free	Free	Rigid
D002	HSS3x3x1/4	ASTM A8	NB011	NB015	Free	Free	Free	Free	Free	Rigid
D002-0	HSS3x3x1/4	ASTM A8	N102-0	N003-0	Free	Free	Free	Free	Free	Rigid
D003	HSS3x3x1/4	ASTM A8	NB012	NB016	Free	Free	Free	Free	Free	Rigid
D003-0	HSS3x3x1/4	ASTM A8	N103-0	N004-0	Free	Free	Free	Free	Free	Rigid
D004	HSS3x3x1/4	ASTM A8	NB013	NB017	Free	Free	Free	Free	Free	Rigid
D004-0	HSS3x3x1/4	ASTM A8	N104-0	N005-0	Free	Free	Free	Free	Free	Rigid
D005	HSS3x3x1/4	ASTM A8	NB014	NB018	Free	Free	Free	Free	Free	Rigid
D005-0	HSS3x3x1/4	ASTM A8	N105-0	N006-0	Free	Free	Free	Free	Free	Rigid
D006	HSS3x3x1/4	ASTM A8	N006	N107	Free	Free	Free	Free	Free	Rigid
D006-0	HSS3x3x1/4	ASTM A8	N006-0	N107-0	Free	Free	Free	Free	Free	Rigid
D007	HSS3x3x1/4	ASTM A8	N007	N108	Free	Free	Free	Free	Free	Rigid
D007-0	HSS3x3x1/4	ASTM A8	N007-0	N108-0	Free	Free	Free	Free	Free	Rigid
D008	HSS3x3x1/4	ASTM A8	N008	N109	Free	Free	Free	Free	Free	Rigid
D008-0	HSS3x3x1/4	ASTM A8	N008-0	N109-0	Free	Free	Free	Free	Free	Rigid
D009	HSS5x3x1/4	ASTM A8	N009	N110	Free	Free	Free	Free	Free	Rigid

D009-0	HSS5x3x1/4	ASTM A8	N009-0	N110-0	Free	Free	Free	Free	Free	Rigid
EV1	HSS6x6x3/8	ASTM A8	N001	N101	Rigid	Rigid	Rigid	Rigid	Rigid	Rigid
EV1-0	HSS6x6x3/8	ASTM A8	N001-0	N101-0	Rigid	Rigid	Rigid	Rigid	Rigid	Rigid
EV2	HSS6x6x3/8	ASTM A8	N010	N110	Rigid	Rigid	Rigid	Rigid	Rigid	Rigid
EV2-0	HSS6x6x3/8	ASTM A8	N010-0	N110-0	Rigid	Rigid	Rigid	Rigid	Rigid	Rigid
FB001	W10x22	ASTM A8	NB001	NB001-0	Rigid	Rigid	Rigid	Rigid	Rigid	Rigid
FB002	W10x22	ASTM A8	NB002	NB002-0	Rigid	Rigid	Rigid	Rigid	Rigid	Rigid
FB003	W10x22	ASTM A8	NB003	NB003-0	Rigid	Rigid	Rigid	Rigid	Rigid	Rigid
FB004	W10x22	ASTM A8	NB004	NB004-0	Rigid	Rigid	Rigid	Rigid	Rigid	Rigid
FB005	W10x22	ASTM A8	NB005	NB005-0	Rigid	Rigid	Rigid	Rigid	Rigid	Rigid
FB006	W10x22	ASTM A8	NB006	NB006-0	Rigid	Rigid	Rigid	Rigid	Rigid	Rigid
FB007	W10x22	ASTM A8	NB007	NB007-0	Rigid	Rigid	Rigid	Rigid	Rigid	Rigid
FB008	W10x22	ASTM A8	NB008	NB008-0	Rigid	Rigid	Rigid	Rigid	Rigid	Rigid
FB009	W10x22	ASTM A8	NB009	NB009-0	Rigid	Rigid	Rigid	Rigid	Rigid	Rigid
FB010	W10x22	ASTM A8	NB010	NB010-0	Rigid	Rigid	Rigid	Rigid	Rigid	Rigid
TC001	HSS6x6x3/8	ASTM A8	N101	N102	Rigid	Rigid	Rigid	Rigid	Rigid	Rigid
TC001-0	HSS6x6x3/8	ASTM A8	N101-0	N102-0	Rigid	Rigid	Rigid	Rigid	Rigid	Rigid
TC002	HSS6x6x3/8	ASTM A8	N102	N103	Rigid	Rigid	Rigid	Rigid	Rigid	Rigid
TC002-0	HSS6x6x3/8	ASTM A8	N102-0	N103-0	Rigid	Rigid	Rigid	Rigid	Rigid	Rigid
TC003	HSS6x6x3/8	ASTM A8	N103	N104	Rigid	Rigid	Rigid	Rigid	Rigid	Rigid
TC003-0	HSS6x6x3/8	ASTM A8	N103-0	N104-0	Rigid	Rigid	Rigid	Rigid	Rigid	Rigid
TC004	HSS6x6x3/8	ASTM A8	N104	N105	Rigid	Rigid	Rigid	Rigid	Rigid	Rigid
TC004-0	HSS6x6x3/8	ASTM A8	N104-0	N105-0	Rigid	Rigid	Rigid	Rigid	Rigid	Rigid
TC005	HSS6x6x3/8	ASTM A8	N105	N106	Rigid	Rigid	Rigid	Rigid	Rigid	Rigid
TC005-0	HSS6x6x3/8	ASTM A8	N105-0	N106-0	Rigid	Rigid	Rigid	Rigid	Rigid	Rigid
TC006	HSS6x6x3/8	ASTM A8	N106	N107	Rigid	Rigid	Rigid	Rigid	Rigid	Rigid
TC006-0	HSS6x6x3/8	ASTM A8	N106-0	N107-0	Rigid	Rigid	Rigid	Rigid	Rigid	Rigid
TC007	HSS6x6x3/8	ASTM A8	N107	N108	Rigid	Free	Free	Rigid	Rigid	Rigid
TC007-0	HSS6x6x3/8	ASTM A8	N107-0	N108-0	Rigid	Rigid	Rigid	Rigid	Rigid	Rigid
TC008	HSS6x6x3/8	ASTM A8	N108	N109	Rigid	Rigid	Rigid	Rigid	Rigid	Rigid
TC008-0	HSS6x6x3/8	ASTM A8	N108-0	N109-0	Rigid	Rigid	Rigid	Rigid	Rigid	Rigid
TC009	HSS6x6x3/8	ASTM A8	N109	N110	Rigid	Rigid	Rigid	Rigid	Rigid	Rigid
TC009-0	HSS6x6x3/8	ASTM A8	N109-0	N110-0	Rigid	Rigid	Rigid	Rigid	Rigid	Rigid
V002	HSS5x5x1/4	ASTM A8	N002	N102	Rigid	Rigid	Rigid	Rigid	Rigid	Rigid
V002-0	HSS5x5x1/4	ASTM A8	N002-0	N102-0	Rigid	Rigid	Rigid	Rigid	Rigid	Rigid
V003	HSS5x5x1/4	ASTM A8	N003	N103	Rigid	Rigid	Rigid	Rigid	Rigid	Rigid
V003-0	HSS5x5x1/4	ASTM A8	N003-0	N103-0	Rigid	Rigid	Rigid	Rigid	Rigid	Rigid
V004	HSS5x5x1/4	ASTM A8	N004	N104	Rigid	Rigid	Rigid	Rigid	Rigid	Rigid
V004-0	HSS5x5x1/4	ASTM A8	N004-0	N104-0	Rigid	Rigid	Rigid	Rigid	Rigid	Rigid
V005	HSS5x5x1/4	ASTM A8	N005	N105	Rigid	Rigid	Rigid	Rigid	Rigid	Rigid
V005-0	HSS5x5x1/4	ASTM A8	N005-0	N105-0	Rigid	Rigid	Rigid	Rigid	Rigid	Rigid
V006	HSS5x5x1/4	ASTM A8	N006	N106	Rigid	Rigid	Rigid	Rigid	Rigid	Rigid
V006-0	HSS5x5x1/4	ASTM A8	N006-0	N106-0	Rigid	Rigid	Rigid	Rigid	Rigid	Rigid
V007	HSS5x5x1/4	ASTM A8	N007	N107	Rigid	Rigid	Rigid	Rigid	Rigid	Rigid

V007-0	HSS5x5x1/4	ASTM A8	N007-0	N107-0	Rigid	Rigid	Rigid	Rigid	Rigid	Rigid
V008	HSS5x5x1/4	ASTM A8	N008	N108	Rigid	Rigid	Rigid	Rigid	Rigid	Rigid
V008-0	HSS5x5x1/4	ASTM A8	N008-0	N108-0	Rigid	Rigid	Rigid	Rigid	Rigid	Rigid
V009	HSS5x5x1/4	ASTM A8	N009	N109	Rigid	Rigid	Rigid	Rigid	Rigid	Rigid
V009-0	HSS5x5x1/4	ASTM A8	N009-0	N109-0	Rigid	Rigid	Rigid	Rigid	Rigid	Rigid

Load Combination Summary

Factored Combination: Fatigue

Factor : Service Case

0.22 x WS

Factored Combination: LC 1) Strength I (PL)

Factor : Service Case

1.25 x DC

1.75 x PL

Factored Combination: LC 2) Strength I (LL)

Factor : Service Case

1.25 x DC

1.75 x LL

Factored Combination: LC 3) Strength III

Factor : Service Case

1.25 x DC

1.40 x WS

Member Uniform Loads

Load Cas	Member	Direction	Offset	ıd Offset	Force
			ft	ft	K/ft
DC	FB001	Force Y	0	12	-0.301
DC	FB002	Force Y	0	12	-0.576
DC	FB003	Force Y	0	12	-0.576
DC	FB004	Force Y	0	12	-0.576
DC	FB005	Force Y	0	12	-0.576
DC	FB006	Force Y	0	12	-0.576
DC	FB007	Force Y	0	12	-0.576
DC	FB008	Force Y	0	12	-0.576
DC	FB009	Force Y	0	12	-0.576
DC	FB010	Force Y	0	12	-0.301
PL	FB001	Force Y	0	12	-0.408
PL	FB002	Force Y	0	12	-0.78
PL	FB003	Force Y	0	12	-0.78
PL	FB004	Force Y	0	12	-0.78

PL	FB005	Force Y	0	12	-0.78
PL	FB006	Force Y	0	12	-0.78
PL	FB007	Force Y	0	12	-0.78
PL	FB008	Force Y	0	12	-0.78
PL	FB009	Force Y	0	12	-0.78
PL	FB010	Force Y	0	12	-0.408
WS	BC001	Force Z	0	8.563	0.072
WS	BC001-0	Force Z	0	8.563	0.072
WS	BC002	Force Z	0	8.667	0.072
WS	BC002-0	Force Z	0	8.667	0.072
WS	BC003	Force Z	0	8.667	0.072
WS	BC003-0	Force Z	0	8.667	0.072
WS	BC004	Force Z	0	8.667	0.072
WS	BC004-0	Force Z	0	8.667	0.072
WS	BC005	Force Z	0	8.667	0.072
WS	BC005-0	Force Z	0	8.667	0.072
WS	BC006	Force Z	0	8.667	0.072
WS	BC006-0	Force Z	0	8.667	0.072
WS	BC007	Force Z	0	8.667	0.072
WS	BC007-0	Force Z	0	8.667	0.072
WS	BC008	Force Z	0	8.667	0.072
WS	BC008-0	Force Z	0	8.667	0.072
WS	BC009	Force Z	0	8.563	0.072
WS	BC009-0	Force Z	0	8.563	0.072
WS	TC001	Force Z	0	8.563	0.072
WS	TC001-0	Force Z	0	8.563	0.072
WS	TC002	Force Z	0	8.667	0.072
WS	TC002-0	Force Z	0	8.667	0.072
WS	TC003	Force Z	0	8.667	0.072
WS	TC003-0	Force Z	0	8.667	0.072
WS	TC004	Force Z	0	8.667	0.072
WS	TC004-0	Force Z	0	8.667	0.072
WS	TC005	Force Z	0	8.667	0.072
WS	TC005-0	Force Z	0	8.667	0.072
WS	TC006	Force Z	0	8.667	0.072
WS	TC006-0	Force Z	0	8.667	0.072
WS	TC007	Force Z	0	8.667	0.072
WS	TC007-0	Force Z	0	8.667	0.072
WS	TC008	Force Z	0	8.667	0.072
WS	TC008-0	Force Z	0	8.667	0.072
WS	TC009	Force Z	0	8.563	0.072
WS	TC009-0	Force Z	0	8.563	0.072

Load Cas	Member	Direction	Offset	Force
			ft	K
LL	FB001	Force Y	1.5	-4.5
LL	FB001	Force Y	7.5	-4.5
LL	FB005	Force Y	1.5	-3
LL	FB005	Force Y	7.5	-3
LL	FB006	Force Y	1.5	-4.5
LL	FB006	Force Y	7.5	-4.5

Nodal Loads

Load Cas	Node	Direction	Force
			K
DC	N101	DY	-0.064
DC	N101-0	DY	-0.064
DC	N102	DY	-0.123
DC	N102-0	DY	-0.123
DC	N103	DY	-0.123
DC	N103-0	DY	-0.123
DC	N104	DY	-0.123
DC	N104-0	DY	-0.123
DC	N105	DY	-0.123
DC	N105-0	DY	-0.123
DC	N106	DY	-0.123
DC	N106-0	DY	-0.123
DC	N107	DY	-0.123
DC	N107-0	DY	-0.123
DC	N108	DY	-0.123
DC	N108-0	DY	-0.123
DC	N109	DY	-0.123
DC	N109-0	DY	-0.123
DC	N110	DY	-0.064
DC	N110-0	DY	-0.064

BR19-00321-2

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Company: BIG R BRIDGE, LLC   Engineer: Eva Leong

VisualAnalysis 12.00.0020 Report

Nodal Displacements

Node	Result Case Nam	DX	DY	DZ
		in	in	in
N006	DC	0.11	-1.029	-0.03
N006	LL	0.027	-0.407	0.034
N006	PL	**0.118**	**-1.11**	-0.035
N006	WS	-0.037	-0.228	0.507

Member End Reactions

Member	Result Case Nam	Offset	Fx	Vy	Vz	Mx	My	Mz
		ft	K	K	K	K-ft	K-ft	K-ft
FB001	LC 1) Strength I (PL	0	-0.649	6.648	-0.152	**0**	0.949	1.673
FB001	LC 1) Strength I (PL	12	-0.649	-6.768	-0.152	0	-0.881	0.949
FB001	LC 2) Strength I (LL	0	-0.302	12.327	-0.09	-0.001	0.51	-2.619
FB001	LC 2) Strength I (LL	12	-0.302	-8.275	-0.09	-0.001	-0.571	-1.935
FB001	LC 3) Strength III	0	**0.698**	3.296	0.117	**-0.003**	-0.684	-4.402
FB001	LC 3) Strength III	12	0.698	-1.556	0.117	-0.003	0.723	**6.042**
FB004	LC 1) Strength I (PL	0	-0.993	**12.776**	**-0.186**	-0.001	1.113	-1.395
FB004	LC 1) Strength I (PL	12	-0.993	**-12.582**	-0.186	-0.001	-1.12	-0.234
FB004	LC 2) Strength I (LL	0	-0.507	4.492	-0.077	-0.001	0.459	1.131
FB004	LC 2) Strength I (LL	12	-0.507	-4.486	-0.077	-0.001	-0.459	1.168
FB004	LC 3) Strength III	0	**-4.546**	5.726	**0.224**	-0.002	**-1.34**	**-9.886**
FB004	LC 3) Strength III	12	-4.546	-3.251	0.224	-0.002	**1.346**	4.963

Member Internal Forces

Member	Result Case Nam	Offset	Fx	Vy	Vz	Mx	My	Mz
		ft	K	K	K	K-ft	K-ft	K-ft
BC005	LC 1) Strength I (PL	0	197.763	0	0.079	0	-2.102	0.334
BC005	LC 1) Strength I (PL	2.167	197.763	0	0.135	0	-1.871	0.333
BC005	LC 1) Strength I (PL	4.333	197.763	0	0.192	0	-1.518	0.332
BC005	LC 1) Strength I (PL	6.5	197.763	0	0.25	0	-1.036	0.332
BC005	LC 1) Strength I (PL	8.667	**198.077**	0	0.13	0	-0.492	0.331
BC005	LC 2) Strength I (LL	0	124.902	-0.043	0.061	-0.216	-1.635	0.157
BC005	LC 2) Strength I (LL	2.167	124.902	-0.043	0.118	-0.216	-1.442	0.065
BC005	LC 2) Strength I (LL	4.333	124.902	-0.043	0.175	-0.216	-1.126	-0.028
BC005	LC 2) Strength I (LL	6.5	124.902	-0.043	0.232	-0.216	-0.683	-0.122
BC005	LC 2) Strength I (LL	8.667	127.083	-0.043	-1.247	-0.216	-0.63	-0.215
BC005	LC 3) Strength III	0	113.304	-0.443	-0.003	-0.027	-0.97	-2.474

BC005	LC 3) Strength III	2.167	113.304	-0.226	0.054	-0.027	-0.915	-3.197
BC005	LC 3) Strength III	4.333	113.304	-0.009	0.111	-0.027	-0.738	-3.451
BC005	LC 3) Strength III	6.5	113.304	0.21	0.168	-0.027	-0.434	-3.231
BC005	LC 3) Strength III	8.667	113.581	0.428	0.076	-0.027	-0.057	-2.539
BD001	Fatigue	0	2.659	0	0	0	0	0
BD001	Fatigue	3.685	2.659	0	0	0	0	0
BD001	Fatigue	7.371	2.659	0	0	0	0	0
BD001	Fatigue	11.056	2.659	0	0	0	0	0
BD001	Fatigue	14.742	2.659	0	0	0	0	0
BD001	LC 1) Strength I (PL	0	1.498	0.091	0	0	0	0
BD001	LC 1) Strength I (PL	3.685	1.498	0.046	0	0	0	0.253
BD001	LC 1) Strength I (PL	7.371	1.498	0	0	0	0	0.337
BD001	LC 1) Strength I (PL	11.056	1.498	-0.046	0	0	0	0.253
BD001	LC 1) Strength I (PL	14.742	1.498	-0.091	0	0	0	0
BD001	LC 2) Strength I (LL	0	0.861	0.091	0	0	0	0
BD001	LC 2) Strength I (LL	3.685	0.861	0.046	0	0	0	0.253
BD001	LC 2) Strength I (LL	7.371	0.861	0	0	0	0	0.337
BD001	LC 2) Strength I (LL	11.056	0.861	-0.046	0	0	0	0.253
BD001	LC 2) Strength I (LL	14.742	0.861	-0.091	0	0	0	0
BD001	LC 3) Strength III	0	17.461	0.091	0	0	0	0
BD001	LC 3) Strength III	3.685	17.461	0.046	0	0	0	0.253
BD001	LC 3) Strength III	7.371	17.461	0	0	0	0	0.337
BD001	LC 3) Strength III	11.056	17.461	-0.046	0	0	0	0.253
BD001	LC 3) Strength III	14.742	17.461	-0.091	0	0	0	0
D001	LC 1) Strength I (PL	0	93.016	0	-0.061	0	0	0
D001	LC 1) Strength I (PL	2.602	92.994	0	-0.031	0	-0.12	0
D001	LC 1) Strength I (PL	5.204	92.973	0	0	0	-0.16	0
D001	LC 1) Strength I (PL	7.806	92.952	0	0.031	0	-0.12	0
D001	LC 1) Strength I (PL	10.408	92.931	0	0.061	0	0	0
D001	LC 2) Strength I (LL	0	50.736	0	-0.061	0	0	0
D001	LC 2) Strength I (LL	2.602	50.715	0	-0.031	0	-0.12	0
D001	LC 2) Strength I (LL	5.204	50.693	0	0	0	-0.16	0
D001	LC 2) Strength I (LL	7.806	50.672	0	0.031	0	-0.12	0
D001	LC 2) Strength I (LL	10.408	50.651	0	0.061	0	0	0
D001	LC 3) Strength III	0	42.158	0	-0.061	0	0	0
D001	LC 3) Strength III	2.602	42.137	0	-0.031	0	-0.12	0
D001	LC 3) Strength III	5.204	42.115	0	0	0	-0.16	0
D001	LC 3) Strength III	7.806	42.094	0	0.031	0	-0.12	0
D001	LC 3) Strength III	10.408	42.073	0	0.061	0	0	0
D002	LC 1) Strength I (PL	0	68.783	0.042	0	0	0	0
D002	LC 1) Strength I (PL	2.513	68.768	0.021	0	0	0	0.08
D002	LC 1) Strength I (PL	5.025	68.752	0	0	0	0	0.106
D002	LC 1) Strength I (PL	7.538	68.737	-0.021	0	0	0	0.08
D002	LC 1) Strength I (PL	10.051	68.722	-0.042	0	0	0	0

D002	LC 2) Strength I (LL	0	40.764	0.042	0	0	0	0
D002	LC 2) Strength I (LL	2.513	40.749	0.021	0	0	0	0.08
D002	LC 2) Strength I (LL	5.025	40.734	0	0	0	0	0.106
D002	LC 2) Strength I (LL	7.538	40.718	-0.021	0	0	0	0.08
D002	LC 2) Strength I (LL	10.051	40.703	-0.042	0	0	0	0
D002	LC 3) Strength III	0	31.358	0.042	0	0	0	0
D002	LC 3) Strength III	2.513	31.343	0.021	0	0	0	0.08
D002	LC 3) Strength III	5.025	31.327	0	0	0	0	0.106
D002	LC 3) Strength III	7.538	31.312	-0.021	0	0	0	0.08
D002	LC 3) Strength III	10.051	31.297	-0.042	0	0	0	0
EV1	LC 1) Strength I (PL	0	-60.767	-1.437	-0.382	-0.593	0.451	4.099
EV1	LC 1) Strength I (PL	1.479	-54.073	-1.59	0.267	0.355	-1.317	1.913
EV1	LC 1) Strength I (PL	2.958	-54.025	-1.59	0.267	0.355	-0.923	-0.437
EV1	LC 1) Strength I (PL	4.438	-53.976	-1.59	0.267	0.355	-0.518	-2.843
EV1	LC 1) Strength I (PL	5.917	-53.928	-1.59	0.267	0.355	-0.123	-5.194
EV1	LC 2) Strength I (LL	0	-42.019	-0.79	-0.424	-1.409	-0.836	2.294
EV1	LC 2) Strength I (LL	1.479	-29.645	-0.88	-0.122	-0.899	1.382	1.088
EV1	LC 2) Strength I (LL	2.958	-29.598	-0.88	-0.122	-0.899	1.202	-0.213
EV1	LC 2) Strength I (LL	4.438	-29.549	-0.88	-0.122	-0.899	1.017	-1.544
EV1	LC 2) Strength I (LL	5.917	-29.501	-0.88	-0.122	-0.899	0.837	-2.845
EV1	LC 3) Strength III	0	-28.085	-0.849	0.163	-0.397	-0.433	1.979
EV1	LC 3) Strength III	1.479	-24.742	-0.732	-0.534	-1.08	3.714	0.831
EV1	LC 3) Strength III	2.958	-24.694	-0.732	-0.534	-1.08	2.924	-0.251
EV1	LC 3) Strength III	4.438	-24.645	-0.732	-0.534	-1.08	2.115	-1.359
EV1	LC 3) Strength III	5.917	-24.598	-0.732	-0.534	-1.08	1.324	-2.441
TC005	LC 1) Strength I (PL	0	-197.575	0.39	0	0	0.853	2.855
TC005	LC 1) Strength I (PL	2.167	**-197.89**	0.039	0	0	0.854	3.073
TC005	LC 1) Strength I (PL	4.333	-197.89	-0.031	0	0	0.854	3.081
TC005	LC 1) Strength I (PL	6.5	-197.89	-0.101	0	0	0.855	2.937
TC005	LC 1) Strength I (PL	8.667	-197.89	-0.171	0	0	0.856	2.642
TC005	LC 2) Strength I (LL	0	-124.853	**1.831**	0.086	0.029	0.662	1.376
TC005	LC 2) Strength I (LL	2.167	-127.034	0.121	0.086	0.029	0.847	2.055
TC005	LC 2) Strength I (LL	4.333	-127.034	0.052	0.086	0.029	1.033	2.242
TC005	LC 2) Strength I (LL	6.5	-127.034	-0.019	0.086	0.029	1.221	2.277
TC005	LC 2) Strength I (LL	8.667	-127.034	-0.089	0.086	0.029	1.407	2.161
TC005	LC 3) Strength III	0	-89.07	0.322	-0.428	-0.013	-2.354	1.508
TC005	LC 3) Strength III	2.167	-89.347	-0.002	-0.212	-0.013	-3.043	1.632
TC005	LC 3) Strength III	4.333	-89.347	-0.072	0.006	-0.013	-3.266	1.552
TC005	LC 3) Strength III	6.5	-89.347	-0.142	0.226	-0.013	-3.013	1.319
TC005	LC 3) Strength III	8.667	-89.347	-0.212	0.443	-0.013	-2.289	0.935
V002	LC 1) Strength I (PL	0	-53.272	**-2.137**	-2.438	**0.646**	-0.249	4.902
V002	LC 1) Strength I (PL	1.479	-40.296	-2.08	-0.646	0.296	1.879	1.854
V002	LC 1) Strength I (PL	2.958	-40.269	-2.08	-0.646	0.296	0.924	-1.221
V002	LC 1) Strength I (PL	4.438	-40.241	-2.08	-0.646	0.296	-0.055	-4.369

V002	LC 1) Strength I (PL	5.917	-40.214	-2.08	-0.646	0.296	-1.011	**-7.444**
V002	LC 2) Strength I (LL	0	-28.816	-1.2	-1.078	-0.228	0.621	2.763
V002	LC 2) Strength I (LL	1.479	-24.161	-1.181	-0.067	-0.327	-0.353	1.041
V002	LC 2) Strength I (LL	2.958	-24.134	-1.181	-0.067	-0.327	-0.452	-0.706
V002	LC 2) Strength I (LL	4.438	-24.106	-1.181	-0.067	-0.327	-0.553	-2.495
V002	LC 2) Strength I (LL	5.917	-24.079	-1.181	-0.067	-0.327	-0.652	-4.242
V002	LC 3) Strength III	0	-23.891	-1.016	**-3.268**	0.272	0.149	2.165
V002	LC 3) Strength III	1.479	-18.638	-0.901	-0.861	-0.424	3.347	0.775
V002	LC 3) Strength III	2.958	-18.611	-0.901	-0.861	-0.424	2.074	-0.557
V002	LC 3) Strength III	4.438	-18.583	-0.901	-0.861	-0.424	0.771	-1.921
V002	LC 3) Strength III	5.917	-18.556	-0.901	-0.861	-0.424	-0.502	-3.252

BRIDGE DESIGN CALCULATIONS

FOR

PRESSENTIN PARK BRIDGE 3

SKAGIT COUNTY PUBLIC WORKS

58.333' X 6' HALF-THROUGH H-SECTION

WEATHERING STEEL BRIDGE

MARBLEMOUNT, WA

BIG R BRIDGE JOB NO. BR19-00321/3

Design Specifications: LRFD GUIDE SPECIFICATIONS FOR DESIGN OF PEDESTRIAN BRIDGES BY AASHTO, DECEMBER 2009 (AGS)

Other Specifications: AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS, 7TH EDITION, 2014 (ABDS)

AASHTO STANDARD SPECIFICATIONS FOR STRUCTURAL SUPPORTS FOR HIGHWAY SIGNS, LUMINAIRES, AND TRAFFIC SIGNALS, 6TH EDITION, 2013 (ASHS)

STEEL CONSTRUCTION MANUAL BY AISC, 14TH EDITION (AISC)

SPECIFICATION FOR STRUCTURAL STEEL BUILDINGS, 2010 (SSSB)

Structural Steel Material:

TUBING: A847
SHAPES: A588
PLATES: A588

December 24, 2019

BIG R BRIDGE	Project: PRESSENTIN PARK BRIDGE 3	By:	ENL
	Job No.: BR19-00321/3	Date:	12/24/2019
	Subject: TRUSS LAYOUT	Page:	2 of 44

Truss Layout

CL Bridge Length =	58.33333	ft
Low End Deck Cantilever =	0	ft
High End Deck Cantilever =	0	ft
Bridge Width = W =	6	ft
Bridge Height = H =	54	in
Roof Height =	0	in
Rail Height =	54	in
Total Bridge Width =	6.666667	ft
Total Truss Height =	6.166667	ft
Number of Bays =	7	ea

	Length	End Bay 1	End Bay 2
Front Truss (ft) :	58.33333	8.166667	8.166667
Rear Truss (ft) :	58.33333	8.166667	8.166667

Mid Bay Spacing =	8.333333	ft
CL to CL Chord Width = b =	76	in
CL TC to CL FB Max = h =	61.07	in
CL TC to CL FB Ave = h =	61.07	in
x =	2.86	in
Rise in Bearing Elevations =	0	in
Total Camber =	8 1/4	in
DL Camber =	3/8	in

Bridge Skew 1 =	0	°	End FB 1 Skew =	0	°
Bridge Skew 2 =	0	°	End FB 2 Skew =	0	°
			Int FB Skew =	0	°

Members

Member	Section	In-Plane Orientation	Number of Bays	Plated
End Top Chord =	HSS4x4x1/4	X	0	N
Top Chord =	HSS4x4x1/4	X		N
End Bottom Chord =	HSS4x4x1/4	X	0	N
Bottom Chord =	HSS4x4x1/4	X		N
End Verticals =	HSS4x4x1/4	X		
1st Verticals =	HSS4x3x1/4	X	0	
Verticals =	HSS4x3x1/4	X		
End Diagonals =	HSS3x2x1/4	Y	1	
Overlapped Diagonals =	HSS2x2x1/4	X	0	
Gapped Diagonals =	HSS2x2x1/4	X		
End Brace Diags. =	HSS3x3x1/4	X	1	
Brace Diagonals =	HSS3x3x1/4	X	1	
Stacked End Floor Beam =	N/A	N/A		
End Floor Beams =	W8x18	X		
1st Floor Beams =	W8x18	X	0	
Floor Beams =	W8x18	X		
End Top Brace Diagonals =	N/A			
Top Brace Diagonals =	N/A			
End Portal Struts =	N/A			
Portal Struts =	N/A			
Stringers =	N/A			
Shipping Struts =	N/A			
TC Plating =	N/A			
BC Plating =	N/A			

Interior Bay Gap = 1.25 in Starting at bay 2

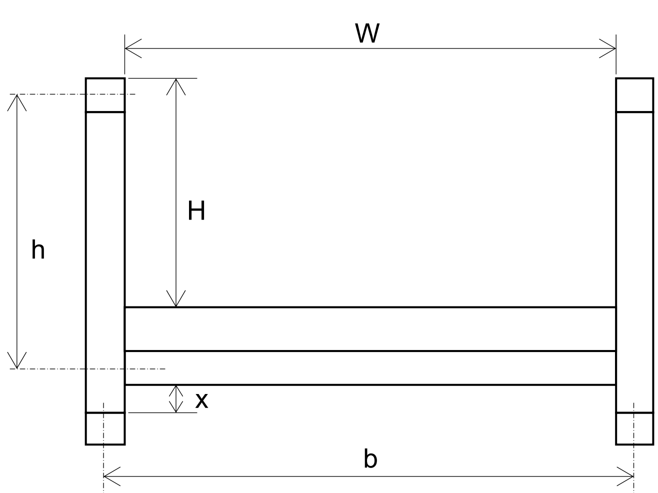
	Front Truss	Rear Truss
End Diagonal Angle =	34.93094 °	34.93094 °
End Diagonal Angle =	34.93094 °	34.93094 °
Overlapped Diagonal Angle =	34.63323 °	34.63323 °
Gapped Diagonal Angle =	36.2189 °	36.2189 °

End Brace Diagonal Gap From End FB = 0.75 in

Brace Diagonal Gap From CL = 0.75 in

Deck Layout:

Type =	Concrete				
Decking =	VULCRAFT 1.5C18				
Thickness of Deck at Edge =	5	in, at CL =	5	in
Concrete Top Cover at Edge =	1.5	in, at CL =	1.5	in
Top of Decking to Rebar =	0.875	in		
Rebar Size =	5			
Rebar Spacing =	12			
Stringer Spacing =	N/A	in		



Bridge Length = 58.333 ft	Bridge Inside Width = 6 ft	Total Deck Area = 350 sf
Bay Length = 8.3333 ft	Clear Deck Width = 6 ft	Usable Deck Area = 350 sf
	Bridge Roof Width = 6.6667 ft	Total Roof Area = 388.89 sf

Dead Loads (DC)

Rail + Curb Weight =	14.233	lb/ft
Roof Weight =	0	psf
Deck Weight =	61.329	psf
Truss Weight =	6011	lb
Deck Load to End Floor Beam 1 =	260.65	lb/ft
Deck Load to End Floor Beam 2 =	260.65	lb/ft
Deck Load to Floor Beam =	511.08	lb/ft
Rail Load to End Vertical =	60.49	lb
Rail Load to Vertical =	118.61	lb
Roof Load to End Portal Strut 1 =	0	lb/ft
Roof Load to End Portal Strut 2 =	0	lb/ft
Roof Load to Portal Strut =	0	lb/ft
Total DC =	29137	lb

Wind Loads (WSH) (ASHS 3.8 & 3.9)

$P_z = 0.00256K_zGV^2I_rC_d$ =	46.214	psf
Basic Wind Speed = V =	90	mph
Design Life =	50	yr
$I_r = I_F$ =	1.15	
K_z =	1	
Max Height above grade =	32.8	ft
G =	***1.14***	
C_d =	***1.7***	
Projected Area of Truss =	133.3	sf
Projected Area of Deck & Rail =	199.54	sf
Projected Area of Roof =	0	sf
Total Projected Area = A_P =	332.84	sf
Wind Load to Top Chord =	65.923	lb/ft
Wind Load to Bottom Chord =	65.923	lb/ft
Total WS = P_zA_P =	15382	lb

Wind Loads (WSV) (ABDS 3.8.2)

P_V = ***20*** psf uplift over deck area

Uplift on Leeward Truss =	88.421	plf
Uplift on windward Truss =	31.579	plf

Wearing Surface & Utilities (DW)

DW Load to Verticals =	0	lb/ft
DW Load to Deck =	0	psf
DW to End Floor Beam 1 =	0	lb/ft
DW to End Floor Beam 2 =	0	lb/ft
DW to Floor Beam =	0	lb/ft
DW Load to End Vertical =	0	lb
DW Load toVertical =	0	lb
Total DW =	0	lb

Pedestrian Live Load (PL) (AGS 3.1)

Pedestrian Live Load =	90	psf
PL Reduction = $(0.25+15/A_T^{1/2})$ =	N/A	
Reduced Pedestrian Live Load (PL) =	90	psf
PL to End Floor Beam 1 =	382.5	lb/ft
PL to End Floor Beam 2 =	382.5	lb/ft
PL to Floor Beam =	750	lb/ft
Total PL =	31500	lb

Vehicle Live Load (LL) (AGS 3.2)

Vehicle =	4000	
IM =	1	
Weight =	4000	lb
Front Axle Spacing = WB =	4	ft
Rear Axle Spacing = WB_R =	0	ft
Wheel Spacing = T =	2.6667	ft
Edge = C =	0.75	ft
P_F =	1000	lb
P_R =	1000	lb
P_{RR} =	0	lb

Snow Load (SL)

Snow Load (SL) =	50	psf
SL to End Floor Beam 1 =	212.5	lb/ft
SL to End Floor Beam 2 =	212.5	lb/ft
SL to Floor Beam =	416.67	lb/ft
Total SL =	17500	lb

Fatigue Live Load (FLL) (ASHS 11)

$P_{NW} = 5.2C_dI_F =$ 10.166 psf

Horiz Fatigue Load to Top Chord = 14.501 lb/ft
Horiz Fatigue Load to Btm Chord = 14.501 lb/ft
Total Horizontal Fatigue Load = 3383.7 lb

V_T (Truck Speed if Over Road) = 0 mph
$P_{TG} = 18.8C_d(V_T/65)^2I_F =$ 0 psf
Vertical Fatigue Load to Btm Chord = 0 lb/ft

Stream Load (WA) (ABDS 3.7.3)

Stream Velocity = V = 0 fps
at 0 ft above deck
$P_{max} = C_DV^2 =$ 0 psf
$C_D =$ 1.4

Stream Force to Bottom Chord = 0 lb/ft
Stream Force to Top Chord = 0 lb/ft
Total Stream Load = 0 lb

Seismic Loads (EQ)

Design to ABDS 3.10
* See Seismic Loading Page for Details

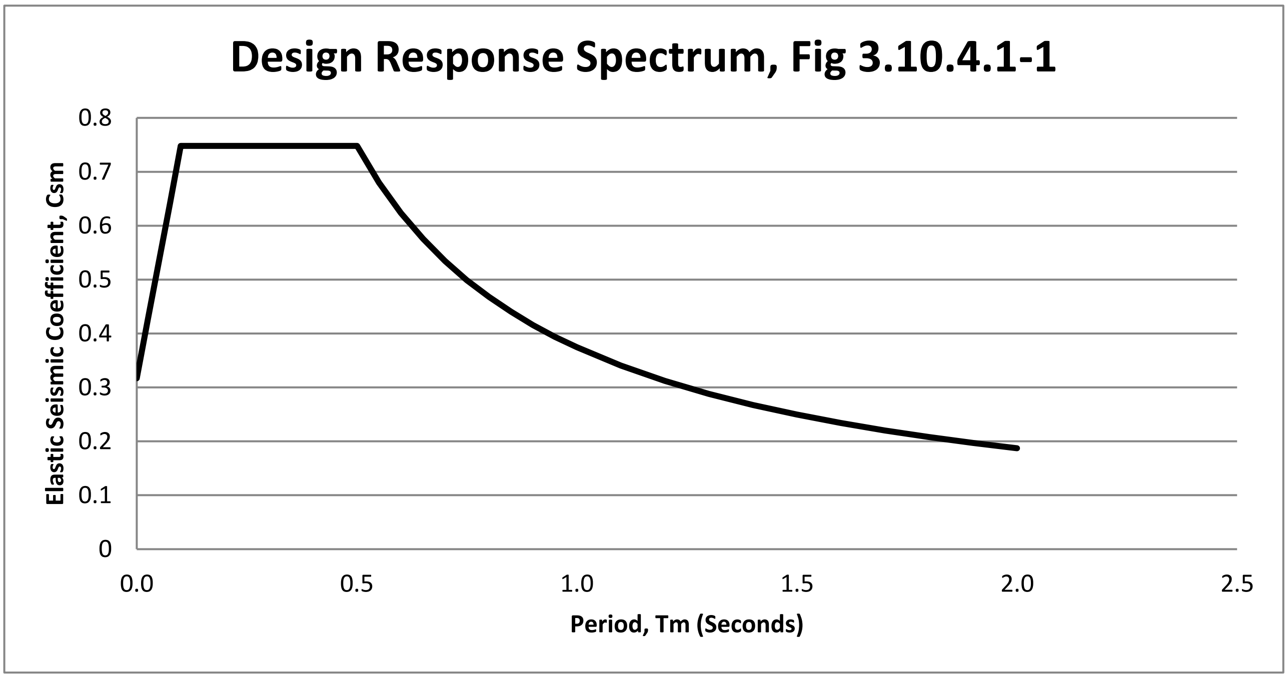
For Load Factors and Combinations, use ABDS Table 3.4.1-1

Basic Load Combination = $\gamma_{DC}DC+\gamma_{DW}DW+\gamma_{PL}PL+\gamma_{LL}LL+\gamma_{SL}SL+\gamma_{WS}WS+\gamma_{EQ}EQ+\gamma_{WA}WA$

Load Combination Number	Load Combination Name	Load Factors γ_{DC}	γ_{DW}	γ_{PL}	γ_{LL}	γ_{SL}	γ_{WS}	γ_{EQ}	γ_{WA}	Notes
1	Strength I (PL)	***1.25***	***1.50***	***1.75***	***0.00***	***0.00***	***0.00***	***0.00***	***0.00***	
2	Strength I (LL)	***1.25***	***1.50***	***0.00***	***1.75***	***0.00***	***0.00***	***0.00***	***0.00***	
3	Strength III	***1.25***	***1.50***	***0.00***	***0.00***	***0.00***	***1.40***	***0.00***	***0.00***	
4	Extreme Event I	***1.00***	***1.00***	***0.25***	***0.00***	***0.00***	***0.00***	***1.00***	***0.00***	See Note 1 & ABDS 6.5.5
5	Flood	***1.25***	***1.50***	***0.00***	***0.00***	***0.00***	***0.00***	***0.00***	***1.00***	
	Fatigue	***0.00***	***0.00***	***0.00***	***0.00***	***0.00***	***0.22***	***0.00***	***0.00***	
	Service	***1.00***	***1.00***	***1.30***	***0.00***	***0.00***	***0.00***	***0.00***	***0.00***	Used for Splice Slip only

Note 1: Per AASHTO, single span bridges need only the connection between bridge span and the abutment designed for seismic loads.
Do not apply LC 4 to the bridge unless the project specifications require it.

Reference



Site Class = ***D***

$A_s = F_{PGA}PGA =$	0.3168				(3.10.4.2-2)
$S_{DS} = F_aS_S =$	0.748				(3.10.4.2-3)
$S_{D1} = F_vS_1 =$	0.3744				(3.10.4.2-6)
$T_o = 0.2T_s =$	0.1001 sec				
$T_s = S_{D1}/S_{DS} =$	0.5005 sec		PGA =	0.24	Figure 3.10.2.1-1
			$S_S =$	0.55	Figure 3.10.2.1-2
Use C_{sm} = 0.748	at T = 0.152 sec		$S_1 =$	0.18	Figure 3.10.2.1-3
			$F_{PGA} =$	1.32	Table 3.10.3.2-1
			$F_a =$	1.36	Table 3.10.3.2-2
			$F_v =$	2.08	Table 3.10.3.2-3

Connection Between Superstructure and Abutment

Seismic Load = $C_{sm}W/R$ = 34606 lbs (for Abutment Connection)

Seismic Load = $C_{sm}W$ = 27685 lbs (for Bridge Reaction)

$W = P_{DC}+P_{DW}+\gamma_{PL}P_{PL}+\gamma_{SL}P_{SL} =$ 37012 lbs

Modification Factor, R = ***0.8*** — Table 3.10.7.1-2

g_{PL} = 0.25

g_{SL} = 0.00

Reference

Maximum Deflections

$\Delta_{DL} = \Delta_{DC} + \Delta_{DW} =$ ***0.35*** in vertical Node: ***N005*** L = 58.333 ft

$\Delta_{PL} =$ ***0.4*** in vertical Node: ***N005***

$\Delta_{WS} =$ ***1*** in horizontal Node: ***N005***

Allowable LL Deflection = L/X = 1.9444 in > Δ_{PL} **OK** X = ***360*** — AGS 5

Allowable WL Deflection = L/X = 1.9444 in > Δ_{WL} **OK** X = ***360***

Camber: Use a minimum of 150% Δ_{DL} or 1.10% L + Δ_{DL}

Minimum Camber = 8.05 in use ***8.25*** in

Vibrations (Vertical Direction)

$f \approx 0.18(g/\Delta_{DL})^{1/2} =$ 5.9808 Hz > 3Hz **OK** — AGS 6

g = ***32.2*** ft/sec^2

Vibrations (Lateral Direction)

$\Delta_{DL\ lat} = 5WL^3/(384EI) =$ 0.2262 in $f \approx 0.18(g/\Delta_{DL\ lat})^{1/2} =$ 7.439 Hz > 1.3 Hz **OK** — AGS 6

$I_{y\text{-truss}} =$ 19496 in^4

W = 29.137 k

U-Frame Calculations (Stability) — AGS 7.1.2

Int Frame:

b = 76 in $I_v =$ 3.91 E = 29000 ksi

h = 61.07 in $I_b =$ 61.9 L = 8.3333 ft (Bay Spacing)

Maximum Top Chord Compression

$P_{Max} =$ ***54.6*** $FS(P_{Max}) =$ 72.618 k FS = ***1.33***

$P_c =$ 72.618 k

$C_{furn} = E/(h^2((h/3I_v)+(b/2I_b))) =$ 1.336

$CL/P_c =$ 1.8398

1/K = 0.7278 — AGS Tbl 7.1.2-1

K = 1.374 >= 1.3 Use K = **1.374**

0.01/K = 0.0073 >= 0.003 Use 0.01/K = 0.0073 — AGS 7.1.1

Reference: AASHTO LRFD GUIDE SPECIFICATIONS FOR DESIGN OF PEDESTRIAN BRIDGES, Table 7.1.2-1

1/K	n = 4	n = 6	n = 8	n = 10	n = 12	n = 14	n = 16
1.000	3.686	3.616	3.660	3.714	3.754	3.785	3.809
0.980		3.284	2.944	2.806	2.787	2.771	2.774
0.960		3.000	2.665	2.542	2.456	2.454	2.479
0.950			2.595				
0.940		2.754		2.303	2.252	2.254	2.828
0.920		2.643		2.146	2.094	2.101	2.121
0.900	3.352	2.593	2.263	2.045	1.951	1.968	1.981
0.850		2.460	2.013	1.794	1.709	1.681	1.694
0.800	2.961	2.313	1.889	1.629	1.480	1.456	1.465
0.750		2.147	1.750	1.501	1.344	1.273	1.262
0.700	2.448	1.955	1.595	1.359	1.200	1.111	1.088
0.650		1.739	1.442	1.236	1.087	0.988	0.940
0.600	2.035	1.639	1.338	1.133	0.985	0.878	0.808
0.550		1.517	1.211	1.007	0.860	0.768	0.708
0.500	1.750	1.362	1.047	0.847	0.750	0.668	0.600
0.450		1.158	0.829	0.714	0.624	0.537	0.500
0.400	1.232	0.886	0.627	0.555	0.454	0.428	0.383
0.350		0.530	0.434	0.352	0.323	0.292	0.280
0.300	0.121	0.187	0.249	0.170	0.203	0.183	0.187
0.293	0						
0.259		0					
0.250			0.135	0.107	0.103	0.121	0.112
0.200			0.045	0.068	0.055	0.053	0.070
0.180			0				
0.150				0.017	0.031	0.029	0.025
0.139				0			
0.114					0		
0.100						0.003	0.010
0.097						0	
0.085							0

Int Frame: n = 7

CL/P_c = 1.8398

1/K = 0.7278

n = 6		n = 8	
1/K	CL/P_c	1/K	CL/P_c
0.65	1.739	0.75	1.75
0.7	1.955	0.8	1.889
1/K =	0.6733	1/K =	0.7823

BIG R BRIDGE	Project: PRESSENTIN PARK BRIDGE 3	By: ENL
	Job No.: BR19-00321/3	Date: 12/24/2019
	Subject: CONCRETE DECK	Page: 8 of 44

Deck Loading (assume 3 span continuous deck) — Reference

Average Deck Thickness = 5 in — Decking = VULCRAFT 1.5C18

Design Deck Thickness = t_d = 5 in — Decking Thickness = t_{dk} = 1.5 in

Concrete Unit Weight = γ_c = 150 pcf — Decking Weight = 2.7 psf

Span = s = 8.3333 ft

Deck Width = W_1 = 6 ft

Dead Load (DC) — Concrete = 0.0563 ksf

Decking Weight = 0.0027 ksf — $M_{DC}(-) = 0.1ws^2$ = 0.4094 ft-k

Total DL = 0.059 ksf — $M_{DC}(+) = 0.08ws^2$ = 0.3275 ft-k

Dead Load (DW) — DW = 0 ksf — $M_{DW}(-) = 0.121ws^2$ = 0 ft-k

$M_{DW}(+) = 0.101ws^2$ = 0 ft-k

Pedestrian Live Load (PL) — PL = 0.09 ksf — $M_{PL}(-) = 0.121ws^2$ = 0.7563 ft-k

$M_{PL}(+) = 0.101ws^2$ = 0.6313 ft-k

Vehicle Load (LL)

P_1 = 1 k — Use E = 2 ft — $E = w+5(L_1W_1)^{1/2}$ = 3.324 ft — ABDS 4.6.2.3

P_2 = 1 k — $L_1 = s-b_f/2$ = 8.1146 ft — E = 1/2 Deck Width = 3 ft

Wheel Width = 5 in — b_f = 5.25 in — E = 0.75 Wheel Spacing = 2 ft

Wheel Spacing = 2.6667 ft — E = 0.6S+Wheel Width = 5.2854 ft — Structural Engineers Handbook, 4th Ed.

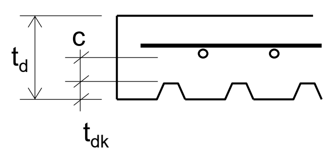
$M_{LL}(-) = (P_1f_1+P_2f_2)/E$ = 0.6633 ft-k — f_1 = -0.5333 — f_2 = -0.7933 — WB_R = N/A ft

$M_{LL}(+) = (P_1f_1+P_2f_2)/E$ = 0.9413 ft-k — f_1 = 1.7013 — f_2 = 0.1813 — WB_R = N/A ft

f_1 and f_2 are from Influence Lines

$M_{u(LC\ 1\ OR\ 2)}(-)$ = 1.8352 ft-k

$M_{u(LC\ 1\ OR\ 2)}(+)$ = 2.0567 ft-k



Reinforced Concrete Section Properties:

f'_c = ***4000*** psi — Try # ***5*** bars

f_y = ***60000*** psi — bar dia. = d_b = 0.625 in — Transverse bar # ***4*** bars

β_1 = 0.85 — bar area = 0.31 in^2 — bar dia. = d_{Tr} = 0.5 in

Effective Deck Thickness = $h = t_d - t_{dk}/2$ = 4.25 in — b = ***12*** in

c = ***0.875*** in — Cover = 1.5 in

$d(+) = t_d - t_{dk} - c - d_b/2$ = 2.3125 in — $d(-) = c+(t_{dk}+d_b)/2$ = 1.9375 in

Flexure Capacity (+)

$c = A_sf_y/(0.85f'_c\beta_1 b)$ = 0.5363 — ε_t = 0.0099 — c/d = 0.2319 — ABDS 5.7.2.1

A_s = 0.31 in^2 — ϕ = 0.9 — ABDS 5.5.4.2

$a = \beta_1 c$ = 0.4559 in — Max Bar Spacing = 12 in — 0.8513 — ABDS 5.7.2.2

$\phi M_n = \phi(A_sf_y(d-a/2))$ = 34896 in-lb = 2.908 ft-k > $M_u(+)$ — **OK** — ABDS 5.7.3.2.3

Flexure Capacity (-)

$c = A_sf_y/(0.85f'_c\beta_1 b)$ = 0.5363 — ε_t = 0.0078 — c/d = 0.2768

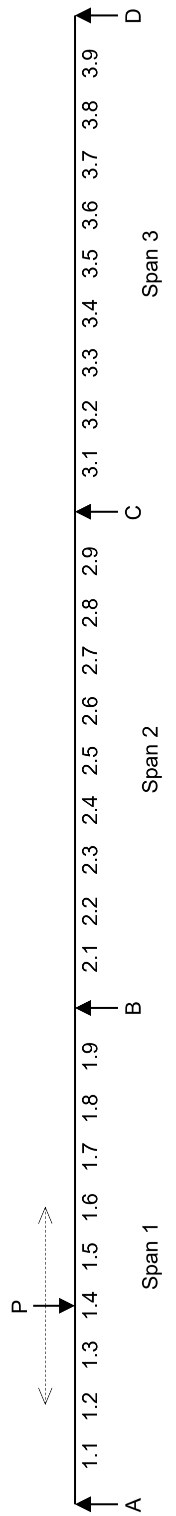
A_s = 0.31 in^2 — ϕ = 0.9 — ABDS 5.5.4.2

$a = \beta_1 c$ = 0.4559 in — Max Bar Spacing = 12 in — 0.5497 — ABDS 5.7.2.2

$\phi M_n = \phi(A_sf_y(d-a/2))$ = 28618 in-lb = 2.3848 ft-k > $M_u(-)$ — **OK** — ABDS 5.7.3.2.3

Use # 5 bars at 12 in spacing

BIG R BRIDGE	
Project:	PRESSENTIN PARK BRIDGE 3
Job No.:	BR19-00321/3
Subject:	INFLUENCE LINES, 3 SPAN
By:	ENL
Date:	12/24/2019
Page:	9 of 44



Span 1 Length = 8.3333 Span 2 Length = 8.3333 Span 3 Length = 8.3333

Reactions/P, Shears/P

		A	1.1	1.2	1.3	1.4	1.5	1.6	1.7	1.8	1.9	B	2.1	2.2	2.3	2.4	2.5	2.6	2.7	2.8	2.9	C	3.1	3.2	3.3	3.4	3.5	3.6	3.7	3.8	3.9	D	+ Area	- Area	Total Ar
Shears/P	V_{DC}	0.0000	-0.0066	-0.0128	-0.0182	-0.0224	-0.0250	-0.0256	-0.0238	-0.0192	-0.0114	0.0000	0.0150	0.0320	0.0490	0.0640	0.0750	0.0800	0.0770	0.0640	0.0390	0.0000	-0.0544	-0.1232	-0.2048	-0.2976	-0.4000	-0.5104	-0.6272	-0.7488	-0.8736	-1.0000	0.4167	-3.7500	-3.3333
	V_{CD}	0.0000	-0.0066	-0.0128	-0.0182	-0.0224	-0.0250	-0.0256	-0.0238	-0.0192	-0.0114	0.0000	0.0150	0.0320	0.0490	0.0640	0.0750	0.0800	0.0770	0.0640	0.0390	0 / 1	0.9456	0.8768	0.7952	0.7024	0.6000	0.4896	0.3728	0.2512	0.1264	0.0000	5.1389	-0.1389	5.0000
	V_{CB}	0.0000	0.0330	0.0640	0.0910	0.1120	0.1250	0.1280	0.1190	0.0960	0.0570	0.0000	-0.0760	-0.1680	-0.2720	-0.3840	-0.5000	-0.6160	-0.7280	-0.8320	-0.9240	-1 / 0	-0.0570	-0.0960	-0.1190	-0.1280	-0.1250	-0.1120	-0.0910	-0.0640	-0.0330	0.0000	0.6944	-4.8611	-4.1667
	V_{BC}	0.0000	0.0330	0.0640	0.0910	0.1120	0.1250	0.1280	0.1190	0.0960	0.0570	0 / 1	0.9240	0.8320	0.7280	0.6160	0.5000	0.3840	0.2720	0.1680	0.0760	0.0000	-0.0570	-0.0960	-0.1190	-0.1280	-0.1250	-0.1120	-0.0910	-0.0640	-0.0330	0.0000	4.8611	-0.6944	4.1667
	V_{BA}	0.0000	-0.1264	-0.2512	-0.3728	-0.4896	-0.6000	-0.7024	-0.7952	-0.8768	-0.9456	-1 / 0	-0.0390	-0.0640	-0.0770	-0.0800	-0.0750	-0.0640	-0.0490	-0.0320	-0.0150	0.0000	0.0114	0.0192	0.0238	0.0256	0.0250	0.0224	0.0182	0.0128	0.0066	0.0000	0.1389	-5.1389	-5.0000
	V_{AB}	0.0000	0.8736	0.7488	0.6272	0.5104	0.4000	0.2976	0.2048	0.1232	0.0544	0.0000	-0.0390	-0.0640	-0.0770	-0.0800	-0.0750	-0.0640	-0.0490	-0.0320	-0.0150	0.0000	0.0114	0.0192	0.0238	0.0256	0.0250	0.0224	0.0182	0.0128	0.0066	0.0000	3.7500	-0.4167	3.3333
Reactions/P	R_D	0.0000	0.0066	0.0128	0.0182	0.0224	0.0250	0.0256	0.0238	0.0192	0.0114	0.0000	-0.0150	-0.0320	-0.0490	-0.0640	-0.0750	-0.0800	-0.0770	-0.0640	-0.0390	0.0000	0.0544	0.1232	0.2048	0.2976	0.4000	0.5104	0.6272	0.7488	0.8736	1.0000	3.7500	-0.4167	3.3333
	R_C	0.0000	-0.0396	-0.0768	-0.1092	-0.1344	-0.1500	-0.1536	-0.1428	-0.1152	-0.0684	0.0000	0.0910	0.2000	0.3210	0.4480	0.5750	0.6960	0.8050	0.8960	0.9630	1.0000	1.0026	0.9728	0.9142	0.8304	0.7250	0.6016	0.4638	0.3152	0.1594	0.0000	10.0000	-0.8333	9.1667
	R_B	0.0000	0.1594	0.3152	0.4638	0.6016	0.7250	0.8304	0.9142	0.9728	1.0026	1.0000	0.9630	0.8960	0.8050	0.6960	0.5750	0.4480	0.3210	0.2000	0.0910	0.0000	-0.0684	-0.1152	-0.1428	-0.1536	-0.1500	-0.1344	-0.1092	-0.0768	-0.0396	0.0000	10.0000	-0.8333	9.1667
	R_A	0.0000	0.8736	0.7488	0.6272	0.5104	0.4000	0.2976	0.2048	0.1232	0.0544	0.0000	-0.0390	-0.0640	-0.0770	-0.0800	-0.0750	-0.0640	-0.0490	-0.0320	-0.0150	0.0000	0.0114	0.0192	0.0238	0.0256	0.0250	0.0224	0.0182	0.0128	0.0066	0.0000	3.7500	-0.4167	3.3333

Moments/P

	A	1.1	1.2	1.3	1.4	1.5	1.6	1.7	1.8	1.9	B	2.1	2.2	2.3	2.4	2.5	2.6	2.7	2.8	2.9	C	3.1	3.2	3.3	3.4	3.5	3.6	3.7	3.8	3.9	D	+ Area	- Area	Total Ar
D	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000			
3.9	0.0000	0.0055	0.0107	0.0152	0.0187	0.0208	0.0213	0.0198	0.0160	0.0095	0.0000	-0.0125	-0.0267	-0.0408	-0.0533	-0.0625	-0.0667	-0.0642	-0.0533	-0.0325	0.0000	0.0453	0.1027	0.1707	0.2480	0.3333	0.4253	0.5227	0.6240	0.7280	0.0000			
3.8	0.0000	0.0110	0.0213	0.0303	0.0373	0.0417	0.0427	0.0397	0.0320	0.0190	0.0000	-0.0250	-0.0533	-0.0817	-0.1067	-0.1250	-0.1333	-0.1283	-0.1067	-0.0650	0.0000	0.0907	0.2053	0.3413	0.4960	0.6667	0.8507	1.0453	1.2480	0.6227	0.0000			
3.7	0.0000	0.0165	0.0320	0.0455	0.0560	0.0625	0.0640	0.0595	0.0480	0.0285	0.0000	-0.0375	-0.0800	-0.1225	-0.1600	-0.1875	-0.2000	-0.1925	-0.1600	-0.0975	0.0000	0.1360	0.3080	0.5120	0.7440	1.0000	1.2760	1.5680	1.0387	0.5173	0.0000			
3.6	0.0000	0.0220	0.0427	0.0607	0.0747	0.0833	0.0853	0.0793	0.0640	0.0380	0.0000	-0.0500	-0.1067	-0.1633	-0.2133	-0.2500	-0.2667	-0.2567	-0.2133	-0.1300	0.0000	0.1813	0.4107	0.6827	0.9920	1.3333	1.7013	1.2573	0.8293	0.4120	0.0000			
3.5	0.0000	0.0275	0.0533	0.0758	0.0933	0.1042	0.1067	0.0992	0.0800	0.0475	0.0000	-0.0625	-0.1333	-0.2042	-0.2667	-0.3125	-0.3333	-0.3208	-0.2667	-0.1625	0.0000	0.2267	0.5133	0.8533	1.2400	1.6667	1.2933	0.9467	0.6200	0.3067	0.0000			
3.4	0.0000	0.0330	0.0640	0.0910	0.1120	0.1250	0.1280	0.1190	0.0960	0.0570	0.0000	-0.0750	-0.1600	-0.2450	-0.3200	-0.3750	-0.4000	-0.3850	-0.3200	-0.1950	0.0000	0.2720	0.6160	1.0240	1.4880	1.1667	0.8853	0.6360	0.4107	0.2013	0.0000			
3.3	0.0000	0.0385	0.0747	0.1062	0.1307	0.1458	0.1493	0.1388	0.1120	0.0665	0.0000	-0.0875	-0.1867	-0.2858	-0.3733	-0.4375	-0.4667	-0.4492	-0.3733	-0.2275	0.0000	0.3173	0.7187	1.1947	0.9027	0.6667	0.4773	0.3253	0.2013	0.0960	0.0000			
3.2	0.0000	0.0440	0.0853	0.1213	0.1493	0.1667	0.1707	0.1587	0.1280	0.0760	0.0000	-0.1000	-0.2133	-0.3267	-0.4267	-0.5000	-0.5333	-0.5133	-0.4267	-0.2600	0.0000	0.3627	0.8213	0.5320	0.3173	0.1667	0.0693	0.0147	-0.0080	-0.0093	0.0000			
3.1	0.0000	0.0495	0.0960	0.1365	0.1680	0.1875	0.1920	0.1785	0.1440	0.0855	0.0000	-0.1125	-0.2400	-0.3675	-0.4800	-0.5625	-0.6000	-0.5775	-0.4800	-0.2925	0.0000	0.4080	0.0907	-0.1307	-0.2680	-0.3333	-0.3387	-0.2960	-0.2173	-0.1147	0.0000			
C	0.0000	0.0550	0.1067	0.1517	0.1867	0.2083	0.2133	0.1983	0.1600	0.0950	0.0000	-0.1250	-0.2667	-0.4083	-0.5333	-0.6250	-0.6667	-0.6417	-0.5333	-0.3250	0.0000	-0.3800	-0.6400	-0.7933	-0.8533	-0.8333	-0.7467	-0.6067	-0.4267	-0.2200	0.0000	1.1574	-8.1019	-6.9444
2.9	0.0000	0.0275	0.0533	0.0758	0.0933	0.1042	0.1067	0.0992	0.0800	0.0475	0.0000	-0.0617	-0.1267	-0.1817	-0.2133	-0.2083	-0.1533	-0.0350	0.1600	0.4450	0.0000	-0.3325	-0.5600	-0.6942	-0.7467	-0.7292	-0.6533	-0.5308	-0.3733	-0.1925	0.0000			
2.8	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0017	0.0133	0.0450	0.1067	0.2083	0.3600	0.5717	0.8533	0.3817	0.0000	-0.2850	-0.4800	-0.5950	-0.6400	-0.6250	-0.5600	-0.4550	-0.3200	-0.1650	0.0000			
2.7	0.0000	-0.0275	-0.0533	-0.0758	-0.0933	-0.1042	-0.1067	-0.0992	-0.0800	-0.0475	0.0000	0.0650	0.1533	0.2717	0.4267	0.6250	0.8733	1.1783	0.7133	0.3183	0.0000	-0.2375	-0.4000	-0.4958	-0.5333	-0.5208	-0.4667	-0.3792	-0.2667	-0.1375	0.0000			
2.6	0.0000	-0.0550	-0.1067	-0.1517	-0.1867	-0.2083	-0.2133	-0.1983	-0.1600	-0.0950	0.0000	0.1283	0.2933	0.4983	0.7467	1.0417	1.3867	0.9517	0.5733	0.2550	0.0000	-0.1900	-0.3200	-0.3967	-0.4267	-0.4167	-0.3733	-0.3033	-0.2133	-0.1100	0.0000			
2.5	0.0000	-0.0825	-0.1600	-0.2275	-0.2800	-0.3125	-0.3200	-0.2975	-0.2400	-0.1425	0.0000	0.1917	0.4333	0.7250	1.0667	1.4583	1.0667	0.7250	0.4333	0.1917	0.0000	-0.1425	-0.2400	-0.2975	-0.3200	-0.3125	-0.2800	-0.2275	-0.1600	-0.0825	0.0000			
2.4	0.0000	-0.1100	-0.2133	-0.3033	-0.3733	-0.4167	-0.4267	-0.3967	-0.3200	-0.1900	0.0000	0.2550	0.5733	0.9517	1.3867	1.0417	0.7467	0.4983	0.2933	0.1283	0.0000	-0.0950	-0.1600	-0.1983	-0.2133	-0.2083	-0.1867	-0.1517	-0.1067	-0.0550	0.0000			
2.3	0.0000	-0.1375	-0.2667	-0.3792	-0.4667	-0.5208	-0.5333	-0.4958	-0.4000	-0.2375	0.0000	0.3183	0.7133	1.1783	0.8733	0.6250	0.4267	0.2717	0.1533	0.0650	0.0000	-0.0475	-0.0800	-0.0992	-0.1067	-0.1042	-0.0933	-0.0758	-0.0533	-0.0275	0.0000			
2.2	0.0000	-0.1650	-0.3200	-0.4550	-0.5600	-0.6250	-0.6400	-0.5950	-0.4800	-0.2850	0.0000	0.3817	0.8533	0.5717	0.3600	0.2083	0.1067	0.0450	0.0133	0.0017	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000			
2.1	0.0000	-0.1925	-0.3733	-0.5308	-0.6533	-0.7292	-0.7467	-0.6942	-0.5600	-0.3325	0.0000	0.4450	0.1600	-0.0350	-0.1533	-0.2083	-0.2133	-0.1817	-0.1267	-0.0617	0.0000	0.0475	0.0800	0.0992	0.1067	0.1042	0.0933	0.0758	0.0533	0.0275	0.0000			
B	0.0000	-0.2200	-0.4267	-0.6067	-0.7467	-0.8333	-0.8533	-0.7933	-0.6400	-0.3800	0.0000	-0.3250	-0.5333	-0.6417	-0.6667	-0.6250	-0.5333	-0.4083	-0.2667	-0.1250	0.0000	0.0950	0.1600	0.1983	0.2133	0.2083	0.1867	0.1517	0.1067	0.0550	0.0000	1.1574	-8.1019	-6.9444
1.9	0.0000	-0.1147	-0.2173	-0.2960	-0.3387	-0.3333	-0.2680	-0.1307	0.0907	0.4080	0.0000	-0.2925	-0.4800	-0.5775	-0.6000	-0.5625	-0.4800	-0.3675	-0.2400	-0.1125	0.0000	0.0855	0.1440	0.1785	0.1920	0.1875	0.1680	0.1365	0.0960	0.0495	0.0000			
1.8	0.0000	-0.0093	-0.0080	0.0147	0.0693	0.1667	0.3173	0.5320	0.8213	0.3627	0.0000	-0.2600	-0.4267	-0.5133	-0.5333	-0.5000	-0.4267	-0.3267	-0.2133	-0.1000	0.0000	0.0760	0.1280	0.1587	0.1707	0.1667	0.1493	0.1213	0.0853	0.0440	0.0000			
1.7	0.0000	0.0960	0.2013	0.3253	0.4773	0.6667	0.9027	1.1947	0.7187	0.3173	0.0000	-0.2275	-0.3733	-0.4492	-0.4667	-0.4375	-0.3733	-0.2858	-0.1867	-0.0875	0.0000	0.0665	0.1120	0.1388	0.1493	0.1458	0.1307	0.1062	0.0747	0.0385	0.0000			
1.6	0.0000	0.2013	0.4107	0.6360	0.8853	1.1667	1.4880	1.0240	0.6160	0.2720	0.0000	-0.1950	-0.3200	-0.3850	-0.4000	-0.3750	-0.3200	-0.2450	-0.1600	-0.0750	0.0000	0.0570	0.0960	0.1190	0.1280	0.1250	0.1120	0.0910	0.0640	0.0330	0.0000			
1.5	0.0000	0.3067	0.6200	0.9467	1.2933	1.6667	1.2400	0.8533	0.5133	0.2267	0.0000	-0.1625	-0.2667	-0.3208	-0.3333	-0.3125	-0.2667	-0.2042	-0.1333	-0.0625	0.0000	0.0475	0.0800	0.0992	0.1067	0.1042	0.0933	0.0758	0.0533	0.0275	0.0000			
1.4	0.0000	0.4120	0.8293	1.2573	1.7013	1.3333	0.9920	0.6827	0.4107	0.1813	0.0000	-0.1300	-0.2133	-0.2567	-0.2667	-0.2500	-0.2133	-0.1633	-0.1067	-0.0500	0.0000	0.0380	0.0640	0.0793	0.0853	0.0833	0.0747	0.0607	0.0427	0.0220	0.0000			
1.3	0.0000	0.5173	1.0387	1.5680	1.2760	1.0000	0.7440	0.5120	0.3080	0.1360	0.0000	-0.0975	-0.1600	-0.1925	-0.2000	-0.1875	-0.1600	-0.1225	-0.0800	-0.0375	0.0000	0.0285	0.0480	0.0595	0.0640	0.0625	0.0560	0.0455	0.0320	0.0165	0.0000			
1.2	0.0000	0.6227	1.2480	1.0453	0.8507	0.6667	0.4960	0.3413	0.2053	0.0907	0.0000	-0.0650	-0.1067	-0.1283	-0.1333	-0.1250	-0.1067	-0.0817	-0.0533	-0.0250	0.0000	0.0190	0.0320	0.0397	0.0427	0.0417	0.0373	0.0303	0.0213	0.0110	0.0000			
1.1	0.0000	0.7280	0.6240	0.5227	0.4253	0.3333	0.2480	0.1707	0.1027	0.0453	0.0000	-0.0325	-0.0533	-0.0642	-0.0667	-0.0625	-0.0533	-0.0408	-0.0267	-0.0125	0.0000	0.0095	0.0160	0.0198	0.0213	0.0208	0.0187	0.0152	0.0107	0.0055	0.0000			
A	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000			

Reference

Lateral Loads:

				Reference
Half-Through Truss:	End Frame:	$P_{LAT} = 0.01P_{EV}$	$M_{LAT} = P_{LAT}h$	AGS 7.1.1
	Int Frame:	$P_{LAT} = P_{TC}/(100K)$	$M_{LAT} = P_{LAT}h$	AGS 7.1.1
Full-Through (Box) Truss:	End Frame:	$P_{LAT} = WS_{Pin}$	$M_{Lat} = P_{LAT}M_{MD}$	
	Int Frame:	$P_{LAT} = P_{TC}/(100)$	$M_{Lat} = P_{LAT}M_{MD}$	

		1st Int Frame		Int Frame	
$P_{(EV\ LC\ 1)}$ =	***22.5*** k	$P_{(TC\ LC\ 1)}$ =	***54.6*** k	$P_{(TC\ LC\ 1)}$ =	***54.6*** k
$P_{(EV\ LC\ 2)}$ =	***14.4*** k	$P_{(TC\ LC\ 2)}$ =	***31.5*** k	$P_{(TC\ LC\ 2)}$ =	***31.5*** k
$P_{(EV\ LC\ 3)}$ =	***13.6*** k	$P_{(TC\ LC\ 3)}$ =	***30.6*** k	$P_{(TC\ LC\ 3)}$ =	***30.6*** k
$P_{(EV\ LC\ 4)}$ =	***0*** k	$P_{(TC\ LC\ 4)}$ =	***0*** k	$P_{(TC\ LC\ 4)}$ =	***0*** k
$P_{(EV\ LC\ 5)}$ =	***0*** k	$P_{(TC\ LC\ 5)}$ =	***0*** k	$P_{(TC\ LC\ 5)}$ =	***0*** k
		K =	1.374	K =	1.374

h = 5.0892 ft

WS_{Pin} = 1.9107 k (1/2 Force at top of End Portal assuming all int portals are pinned)

End Frame/Portal

	P_{LAT}	M_{LAT} Floor Beam	M_{LAT} Vertical	M_{LAT} Portal Strut
LC 1:	0.225 k	1.1451 ft-k	1.1451 ft-k	N/A ft-k
LC 2:	0.144 k	0.7328 ft-k	0.7328 ft-k	N/A ft-k
LC 3:	0.136 k	0.6921 ft-k	0.6921 ft-k	N/A ft-k
LC 4:	0 k	0 ft-k	0 ft-k	N/A ft-k
LC 5:	0 k	0 ft-k	0 ft-k	N/A ft-k

1st Int Frame/Portal

	P_{LAT}	M_{LAT} Floor Beam	M_{LAT} Vertical	M_{LAT} Portal Strut
LC 1:	0.3974 k	2.0223 ft-k	2.0223 ft-k	N/A ft-k
LC 2:	0.2293 k	1.1667 ft-k	1.1667 ft-k	N/A ft-k
LC 3:	0.2227 k	1.1334 ft-k	1.1334 ft-k	N/A ft-k
LC 4:	0 k	0 ft-k	0 ft-k	N/A ft-k
LC 5:	0 k	0 ft-k	0 ft-k	N/A ft-k

Int Frame/Portal

	P_{LAT}	M_{LAT} Floor Beam	M_{LAT} Vertical	M_{LAT} Portal Strut
LC 1:	0.3974 k	2.0223 ft-k	2.0223 ft-k	N/A ft-k
LC 2:	0.2293 k	1.1667 ft-k	1.1667 ft-k	N/A ft-k
LC 3:	0.2227 k	1.1334 ft-k	1.1334 ft-k	N/A ft-k
LC 4:	0 k	0 ft-k	0 ft-k	N/A ft-k
LC 5:	0 k	0 ft-k	0 ft-k	N/A ft-k

Reference

w_{DC} =	278.65	lb/ft	V_{DC} =	0.8359	k	M_{DC} =	1.25	ft-k
w_{DW} =	0	lb/ft	V_{DW} =	0	k	M_{DW} =	0.00	ft-k
w_{PL} =	382.5	lb/ft	V_{PL} =	1.1475	k	M_{PL} =	1.72	ft-k
P_{LL} =	1510.2	lb	V_{LL} =	1.9717	k	M_{LL} =	2.7093	ft-k

Span = L_b = 6 ft

Moment and Shear

	V_{SS}	M_{SS}	M_{LAT}	$M_{SS}+M_{LAT}$
LC 1:	3.0531 k	4.5796 ft-k	1.1451 ft-k	5.7247 ft-k
LC 2:	4.4953 k	6.3086 ft-k	0.7328 ft-k	7.0415 ft-k
LC 3:	1.0449 k	1.5674 ft-k	0.6921 ft-k	2.2595 ft-k
LC 4:	1.1228 k	1.6842 ft-k	0 ft-k	1.6842 ft-k
LC 5:	1.0449 k	1.5674 ft-k	0 ft-k	1.5674 ft-k
V_r =	4.60 k		M_r =	7.04 ft-k

Beam Data

Beam Size =	W8x18		F_y =	***50***	ksi
Z_x =	17	in^3	E =	***29000***	ksi
S_x =	15.2	in^3	$D = d-2t_f$ =	7.48	in
b_f =	5.25	in	$D_c = D_{cp} = D/2$ =	3.74	in
t_f =	0.33	in	$h = d-t_f$ =	7.81	in
d =	8.14	in			
t_w =	0.23	in	$M_p = F_yZ_x$ =	850	k-in
I_x =	61.9	in^4	$M_y = F_yS_x$ =	760	k-in
			$F_{yr} = 0.7F_{yc}$ =	35	ksi

Vertical Data

	Orientation	Height (in)		Width (in)		Thickness (in)	
Vertical: HSS4x4x1/4	X	H =	4	B =	4	t =	0.233
		F_y =	50000 psi				
		F_u =	70000 psi				

Resistance Factors — ABDS 6.5.4.2

ϕ_f = 1 ϕ_v = 1 ϕ_{e2} = 0.8

Check Flexure Capacity (Use the Provisions of Appendix A6):

	F_y	<=	***70*** ksi		**OK**	ABDS A6.1
$2D_c/t_w$ =	32.522	<	$5.7(E/F_{yc})^{1/2}$ =	137.27	**OK**	ABDS (A6.1-1)
I_{yc}/I_{yt} =	***1***	>=	0.3		**OK**	ABDS (A6.1-2)

Reference

Compression Flange

$M_u+(1/3)f_lS_{xc}$ = 19.71 ft-k <= ϕ_fM_{nc} = 62.47 ft-k OK — ABDS (A6.1.1-1)

Tension Flange

$M_u+(1/3)f_lS_{xt}$ = 19.708 ft-k <= ϕ_fM_{nt} = 70.833 ft-k OK — ABDS (A6.1.2-1)

Web Plastification Factors

$2D_{cp}/t_w$ = 32.522 <= $\lambda_{pw(Dcp)}$ = 91.175 — ABDS (A6.2.1-1)

$\lambda_w = 2D_c/t_w$ = 32.522 < λ_{rw} = 137.27 — ABDS (A6.2.2-1)

Section is Compact

$\lambda_{pw(Dcp)} = (E/F_{yc})^{1/2}/(0.54(M_p/(R_hM_y))-.09)^2$ = 91.175 <= $\lambda_{rw}(D_{cp}/D_c)$ Use $\lambda_{pw(Dcp)}$ = 91.175 — ABDS (A6.2.1-2)

$\lambda_{pw(Dc)} = \lambda_{pw(Dcp)}(D_c/D_{cp})$ = 91.175 <= λ_{rw} Use $\lambda_{pw(Dc)}$ = 91.175 — ABDS (A6.2.2-6)

R_h = ***1*** — ABDS 6.10.1.10.1

$\lambda_{rw} = 5.7(E/F_{yc})^{1/2}$ = 137.27 — ABDS (A6.2.1-3 & A6.2.2-3)

$R_{pc} = R_{pt} = M_p/M_y$ = 1.1184 — ABDS (A6.2.1-4 & A6.2.1-5)

Local Buckling Resistance

λ_f <= λ_{pf} $M_{nc} = R_{pc}M_{yc}$ = 850 k-in — ABDS(A6.3.2-1)

$M_{nc}= [1-(1-(F_{yr}S_x)/(R_{pc}M_{yc}))((\lambda_f-\lambda_{pf})/(\lambda_{rf}-\lambda_{pf}))]R_{pc}M_{yc}$ = N/A k-in — ABDS(A6.3.2-2)

$\lambda_f = b_{fc}/(2t_{fc})$ = 7.9545 — ABDS (A6.3.2-3)

$\lambda_{pf} = 0.38(E/F_{yc})^{1/2}$ = 9.1516 — ABDS (A6.3.2-4)

$\lambda_{rf} = 0.95(Ek_c/F_y)^{0.5}$ = 19.945 — ABDS (A6.3.2-5)

k_c = ***0.76*** — ABDS (A6.3.2)

Lateral Torsional Buckling Resistance

Use M_{nc} = 749.64 k-in — ABDS (A6.3.3-2)

L_b > L_p $M_{nc} = R_{pc}M_{yc}$ = N/A k-in — ABDS (A6.3.3-1)

L_b <= L_r $M_{nc} = C_b[1-(1-F_{yr}S_{xc}/(R_{pc}M_{yc}))((L_b-L_p)/(L_r-L_p))]R_{pc}M_{yc}$ = 749.64 k-in — ABDS (A6.3.3-2)

$M_{nc} = F_{cr}S_x$ = N/A k-in — ABDS (A6.3.3-3)

L_b = 72 in

L_p = 1.0 $r_t(E/F_y)^{1/2}$ = 33.809 in — ABDS (A6.3.3-4)

$L_r = 1.95r_t(E/F_{yr})(J/(S_{xc}h))^{.5}(1+(1+6.76(F_{yr}S_{xc}h/(EJ))^2)^{.5})^{.5}$ = 154.83 in — ABDS (A6.3.3-5)

$r_t = b_{fc}/(12(1+D_ct_w/(3b_{fc}t_{fc})))^{1/2}$ = 1.4038 in — ABDS (A6.3.3-10)

$J = Dt_w^3/3+b_{fc}t_{fc}^3(1-0.63t_{fc}/b_{fc})/3+b_{ft}t_{ft}^3(1-0.63t_{ft}/b_{ft})/3$ = 0.1511 in^4 — ABDS (A6.3.3-9)

$F_{cr} = (C_b\pi^2E/(L_b/r_t)^2)(1+0.078J(L_b/r_t)^2/(S_xh))^{0.5}$ = 122.19 ksi — ABDS (A6.3.3-8)

C_b = ***1***

Reference

Flexural Resistance on Tension Flange Yielding

$M_{nt} = R_{pt}M_{yt} =$ 850 k-in — ABDS (A6.4-1)

Flange Lateral Bending Stress

Use $f_l =$ *30* ksi

Check Shear (Unstiffened Webs)

$\phi_v V_n =$ 0.58C $\phi_v F_y A_w =$ 49.892 k > $V_u =$ 4.60 k — OK — ABDS 6.10.9.2

$A_w = Dt_w =$ 1.7204 in^2

$\lambda_{w1} = 1.12(Ek/\ F_{yw})^{1/2} =$ 60.314 $\lambda_{w2} = 1.4(Ek/F_{yw})^{1/2} =$ 75.392

If $\lambda_w <= \lambda_{w1}$ C = 1 — ABDS (6.10.9.3.2-4)

If $\lambda_w > \lambda_{w1}$ and $<= \lambda_{w2}$, $C = \lambda_{w1}/\lambda_w =$ 1.8546 — ABDS (6.10.9.3.2-5)

If $\lambda_w > \lambda_{w2}$, C = $1.51(Ek/F_{yw})/\lambda_w^2 =$ 4.1403 — ABDS (6.10.9.3.2-6)

λ_{w1} >= λ_w >= λ_{w2}, Use C = 1

k = ***5***

Check Floor Beam to Vertical Connection (Use the provisions of AISC K1)

V = ***4.6*** k Load Case = **3**

$M_{Joint\ Fixity} =$ ***4.6*** ft-k Member = **FB001**

$M_{U\text{-}Frame} =$ 0.6921 ft-k

$M_{Total} =$ 5.2921 ft-k Flange Force = P = $M_{Total}/(d-t_f) =$ 8.1313 k

Check Applicability: — AISC Tbl K1.2A

Strength:	F_y <= 52 ksi		**OK**
Ductility:	$F_y/F_u =$	0.7 <= 0.8	**OK**
Width Ratio:	$B_p/B =$	1 >= 0.25	**OK**
	$B_p/B =$	1 <= 1	**OK**
$B_p = b_f =$ 5.25 in > B,	use $B_p =$	4 in	
Wall Slenderness:	B/t =	14.2 <= 35	**OK**

Check Local Yielding of Plate

$R_n = (10F_yt/(B/t))B_p =$ 32.817 k <= $F_{yp}t_pB_p =$ 66 k, use 32.817 k — SSSB (K1-7)

$\phi R_n =$ 31.176 k >= P — OK

$\phi =$ ***0.95***

Reference

Check Shear Yielding (Punching)

$B-2t =$ 3.534 $<$ B_p Limit State is Not Applicable

$0.85B =$ 3.2 $<=$ B_p Check Limit State

$R_n = (0.6F_yt(2t_p+2B_{ep}) =$ 43.994 k — SSSB (K1-8)

$B_{ep} = 10B_p/(B/t) =$ 2.8169 in $<=$ B_p, use 2.8169 in — SSSB (K1-18)

$\phi R_n =$ N/A

$\phi =$ ***0.95***

Check Sidewall Local Yielding

$B_p/B =$ 1 = 1 Check Limit State

$R_n = 2F_yt(5k+t_p) =$ 48.406 k — SSSB (K1-9)

$k = 1.5t$ 0.3495 in

$\phi R_n =$ 48.406 k >= P **OK**

$\phi =$ ***1***

Check Sidewall Local Crippling

$B_p/B =$ 1 = 1 Check Limit State

$R_n = 1.6t^2(1+3t_p/(H-3t))(EF_y)^{1/2}Q_f =$ 135.97 k — SSSB (K1-10)

$Q_f = 1.3-0.4U/\beta =$ 1.1889 > 1 Use $Q_f =$ 1

$U =$ 0.2778

$\phi R_n =$ 101.97 k >= P **OK**

$\phi =$ ***0.75***

Check Weld Connection

Weld Material Strength: $F_{EXX} =$ ***70*** ksi

Flange Weld Capacity (Moment) = $R_n = R_rA_w =$ **23.46 k >= P** **OK**

Effective Weld Length = $L_e = 2(10/(B/t))(F_yt/(F_{yp}t_p))B_p+2t_p =$ 3.9502 in — SSSB (K4-4)

Fillet Weld Size = t = ***0.25*** in

$t_e = 0.707t =$ 0.1768 in

$A_w = L_et_e =$ 0.6982 in^2

$R_r = \alpha\phi_{e2}F_{EXX} =$ 33.6 ksi — ABDS 6.13.3.2.4

$\alpha =$ 0.6

Web Weld Capacity (Shear) = $R_n = R_rA_w =$ **88.844 k >= V** **OK**

Effective Weld Length = $l_w = 2(d-2t_f) =$ 14.96 in

Fillet Weld Size = t = ***0.25*** in

$t_e = 0.707t =$ 0.1768 in

$A_w = L_wt_e =$ 2.6442 in^2

$R_r = \alpha\phi_{e2}F_{EXX} =$ 33.6 ksi — ABDS 6.13.3.2.4

$\alpha =$ 0.6

Reference

w_{DC} =	529.08 lb/ft	V_{DC} =	1.6093 k	M_{DC} =	2.45 ft-k
w_{DW} =	0 lb/ft	V_{DW} =	0 k	M_{DW} =	0.00 ft-k
w_{PL} =	750 lb/ft	V_{PL} =	2.2813 k	M_{PL} =	3.47 ft-k
P_{LL} =	1520 lb	V_{LL} =	1.9989 k	M_{LL} =	2.7763 ft-k

Span = l = 6.0833 ft

Moment and Shear

	V_{SS}	M_{SS}	M_{LAT}	$M_{SS}+M_{LAT}$
LC 1:	6.0038 k	9.1307 ft-k	2.0223 ft-k	11.153 ft-k
LC 2:	5.5097 k	7.9177 ft-k	1.1667 ft-k	9.0845 ft-k
LC 3:	2.0116 k	3.0593 ft-k	1.1334 ft-k	4.1927 ft-k
LC 4:	2.1796 k	3.3148 ft-k	0 ft-k	3.3148 ft-k
LC 5:	2.0116 k	3.0593 ft-k	0 ft-k	3.0593 ft-k
V_r =	6.0038 k		M_r =	11.15 ft-k

Beam Data

Beam Size =	W8x18	F_y =	***50*** ksi
Z_x =	17 in^3	E =	***29000*** ksi
S_x =	15.2 in^3	$D = d-2t_f$ =	7.48 in
b_f =	5.25 in	$D_c = D_{cp} = D/2$ =	3.74 in
t_f =	0.33 in	$h = d-t_f$ =	7.81 in
d =	8.14 in		
t_w =	0.23 in	$M_p = F_yZ_x$ =	850 k-in
I_x =	61.9 in^4	$M_y = F_yS_x$ =	760 k-in
		$F_{yr} = 0.7F_{yc}$ =	35 ksi

Vertical Data

	Orientation	Height (in)	Width (in)	Thickness (in)
Vertical: HSS4x3x1/4	X	H = 3	B = 4	t = 0.233
		F_y = 50000 psi		
		F_u = 70000 psi		

Resistance Factors — ABDS 6.5.4.2

ϕ_f = 1 ϕ_v = 1 ϕ_{e2} = 0.8

Check Flexure Capacity (Use the Provisions of Appendix A6):

	F_y	<=	***70*** ksi		**OK**	ABDS A6.1
$2D_c/t_w$ =	32.522	<	$5.7(E/F_{yc})^{1/2}$ =	137.27	**OK**	ABDS (A6.1-1)
I_{yc}/I_{yt} =	***1***	>=	0.3		**OK**	ABDS (A6.1-2)

Reference

Compression Flange

$M_u+(1/3)f_\ell S_{xc}$ = 23.82 ft-k <= $\phi_f M_{nc}$ = 62.251 ft-k OK (ABDS (A6.1.1-1))

Tension Flange

$M_u+(1/3)f_\ell S_{xt}$ = 23.82 ft-k <= $\phi_f M_{nt}$ = 70.833 ft-k OK (ABDS (A6.1.2-1))

Web Plastification Factors

$2D_{cp}/t_w$ = 32.522 <= $\lambda_{pw(Dcp)}$ = 91.175 (ABDS (A6.2.1-1))

$\lambda_w = 2D_c/t_w$ = 32.522 < λ_{rw} = 137.27 (ABDS (A6.2.2-1))

Section is Compact

$\lambda_{pw(Dcp)} = (E/F_{yc})^{1/2}/(0.54(M_p/(R_hM_y))-.09)^2$ = 91.175 <= $\lambda_{rw}(D_{cp}/D_c)$ Use $\lambda_{pw(Dcp)}$ = 91.175 (ABDS (A6.2.1-2))

$\lambda_{pw(Dc)} = \lambda_{pw(Dcp)}(D_c/D_{cp})$ = 91.175 <= λ_{rw} Use $\lambda_{pw(Dc)}$ = 91.175 (ABDS (A6.2.2-6))

R_h = ***1*** (ABDS 6.10.1.10.1)

$\lambda_{rw} = 5.7(E/F_{yc})^{1/2}$ = 137.27 (ABDS (A6.2.1-3 & A6.2.2-3))

$R_{pc} = R_{pt} = M_p/M_y$ = 1.1184 (ABDS (A6.2.1-4 & A6.2.1-5))

Local Buckling Resistance

λ_f <= λ_{pf} — $M_{nc} = R_{pc}M_{yc}$ = 850 k-in (ABDS(A6.3.2-1))

$M_{nc}= [1-(1-(F_{yr}S_x)/(R_{pc}M_{yc}))((\lambda_f-\lambda_{pf})/(\lambda_{rf}-\lambda_{pf}))]R_{pc}M_{yc}$ = N/A k-in (ABDS(A6.3.2-2))

$\lambda_f = b_{fc}/(2t_{fc})$ = 7.9545 (ABDS (A6.3.2-3))

$\lambda_{pf} = 0.38(E/F_{yc})^{1/2}$ = 9.1516 (ABDS (A6.3.2-4))

$\lambda_{rf} = 0.95(Ek_c/F_y)^{0.5}$ = 19.945 (ABDS (A6.3.2-5))

k_c = ***0.76*** (ABDS (A6.3.2))

Lateral Torsional Buckling Resistance

Use M_{nc} = 747.02 k-in (ABDS (A6.3.3-2))

L_b > L_p — $M_{nc} = R_{pc}M_{yc}$ = N/A k-in (ABDS (A6.3.3-1))

L_b <= L_r — $M_{nc} =C_b[1-(1-F_{yr}S_{xc}/(R_{pc}M_{yc}))((L_b-L_p)/(L_r-L_p))]R_{pc}M_{yc}$ = 747.02 k-in (ABDS (A6.3.3-2))

$M_{nc} = F_{cr}S_x$ = N/A k-in (ABDS (A6.3.3-3))

L_b = 73 in

L_p = 1.0 $r_t(E/F_y)^{1/2}$ = 33.809 in (ABDS (A6.3.3-4))

$L_r = 1.95r_t(E/F_{yr})(J/(S_{xc}h))^{.5}(1+(1+6.76(F_{yr}S_{xc}h/(EJ))^2)^{.5})^{.5}$ = 154.83 in (ABDS (A6.3.3-5))

$r_t = b_{fc}/(12(1+D_ct_w/(3b_{fc}t_{fc})))^{1/2}$ = 1.4038 in (ABDS (A6.3.3-10))

$J = Dt_w^3/3+b_{fc}t_{fc}^3(1-0.63t_{fc}/b_{fc})/3+b_{ft}t_{ft}^3(1-0.63t_{ft}/b_{ft})/3$ = 0.1511 in^4 (ABDS (A6.3.3-9))

$F_{cr} = (C_b\pi^2E/(L_b/r_t)^2)(1+0.078J(L_b/r_t)^2/(S_xh))^{0.5}$ = 119.21 ksi (ABDS (A6.3.3-8))

C_b = ***1***

Reference

Flexural Resistance on Tension Flange Yielding

$M_{nt} = R_{pt}M_{yt} =$ 850 k-in — ABDS (A6.4-1)

Flange Lateral Bending Stress

Use $f_l =$ ***30*** ksi

Check Shear (Unstiffened Webs)

$\phi_v V_n =$ 0.58C $\phi_v F_y A_w =$ 49.892 k > $V_u =$ 6.00 k OK — ABDS 6.10.9.2

$A_w = Dt_w =$ 1.7204 in^2

$\lambda_{w1} = 1.12(Ek/F_{yw})^{1/2} =$ 60.314 $\lambda_{w2} = 1.4(Ek/F_{yw})^{1/2} =$ 75.392

If $\lambda_w <= \lambda_{w1}$ C = 1 — ABDS (6.10.9.3.2-4)

If $\lambda_w > \lambda_{w1}$ and $<= \lambda_{w2}$, $C = \lambda_{w1}/\lambda_w =$ 1.8546 — ABDS (6.10.9.3.2-5)

If $\lambda_w > \lambda_{w2}$, $C = 1.51(Ek/F_{yw})/\lambda_w^2 =$ 4.1403 — ABDS (6.10.9.3.2-6)

λ_{w1} >= λ_w >= λ_{w2}, Use C = 1

k = ***5***

Check Floor Beam to Vertical Connection (Use the provisions of AISC K1)

V = ***6*** k Load Case = **3**

$M_{Joint\ Fixity} =$ ***7.3*** ft-k Member = ***FB003***

$M_{U\text{-}Frame} =$ 1.1334 ft-k

$M_{Total} =$ 8.4334 ft-k Flange Force = $P = M_{Total}/(d-t_f) =$ 12.958 k

Check Applicability: — AISC Tbl K1.2A

Strength:	F_y <= 52 ksi		**OK**
Ductility:	$F_y/F_u =$	0.7 <= 0.8	**OK**
Width Ratio:	$B_p/B =$	1 >= 0.25	**OK**
	$B_p/B =$	1 <= 1	**OK**
$B_p = b_f =$ 5.25 in > B,	use $B_p =$	4 in	
Wall Slenderness:	$B/t =$	14.2 <= 35	**OK**

Check Local Yielding of Plate

$R_n = (10F_y t/(B/t))B_p =$ 32.817 k <= $F_{yp}t_pB_p =$ 66 k, use 32.817 k — SSSB (K1-7)

$\phi R_n =$ 31.176 k >= P OK

$\phi =$ ***0.95***

Reference

Check Shear Yielding (Punching)

B-2t = 3.534 < B_p Limit State is Not Applicable

0.85B = 3.4 <= B_p Check Limit State

$R_n = (0.6F_yt(2t_p+2B_{ep})$ = 43.994 k — SSSB (K1-8)

$B_{ep} = 10B_p/(B/t)$ = 2.8169 in <= B_p, use 2.8169 in — SSSB (K1-18)

ϕR_n = N/A

ϕ = ***0.95***

Check Sidewall Local Yielding

B_p/B = 1 = 1 Check Limit State

$R_n = 2F_yt(5k+t_p)$ = 48.406 k — SSSB (K1-9)

k = 1.5t 0.3495 in

ϕR_n = 48.406 k >= P **OK**

ϕ = ***1***

Check Sidewall Local Crippling

B_p/B = 1 = 1 Check Limit State

$R_n = 1.6t^2(1+3t_p/(H-3t))(EF_y)^{1/2}Q_f$ = 149.6 k — SSSB (K1-10)

$Q_f = 1.3-0.4U/\beta$ = 1.1035 > 1 Use Q_f = 1

U = 0.4913

ϕR_n = 112.2 k >= P **OK**

ϕ = ***0.75***

Check Weld Connection

Weld Material Strength: F_{EXX} = ***70*** ksi

Flange Weld Capacity (Moment) = $R_n = R_rA_w$ = **23.46 k >= P** **OK**

Effective Weld Length = $L_e = 2(10/(B/t))(F_yt/(F_{yp}t_p))B_p+2t_p$ = 3.9502 in — SSSB (K4-4)

Fillet Weld Size = t = ***0.25*** in

$t_e = 0.707t$ = 0.1768 in

$A_w = L_et_e$ = 0.6982 in^2

$R_r = \alpha\phi_{e2}F_{EXX}$ = 33.6 ksi — ABDS 6.13.3.2.4

α = 0.6

Web Weld Capacity (Shear) = $R_n = R_rA_w$ = **88.844 k >= V** **OK**

Effective Weld Length = $l_w = 2(d-2t_f)$ = 14.96 in

Fillet Weld Size = t = ***0.25*** in

$t_e = 0.707t$ = 0.1768 in

$A_w = L_wt_e$ = 2.6442 in^2

$R_r = \alpha\phi_{e2}F_{EXX}$ = 33.6 ksi — ABDS 6.13.3.2.4

α = 0.6

Reference

F_y = 50000 psi   Top Chord = HSS4x4x1/4   A = 3.37 in^2

E = 29000 ksi   Orientation = X t_c = 0.233 in

Plating: N

Thickness	Width	Sides	Configuration
N/A	N/A	N/A	N/A

In-Plane						Out-of-Plane					
b_i	b/t_i	I_i	Z_i	S_i	r_i	b_o	b/t_o	I_o	Z_o	S_o	r_o
4	14.2	7.8	4.69	3.9	1.52	4	14.2	7.8	4.69	3.9	1.52

Load Case = ***1***   Member: ***TC004***

P_u = ***54.6*** k

M_{ui} = ***0.4*** ft-k K_i = ***1*** KL/r_i = 65.789 <= 120 **OK**   ABDS 6.9.3

M_{uo} = ***0.1*** ft-k K_o = 1.374 KL/r_o = 90.394 <= 120 **OK**   ABDS 6.9.3

V_u = ***0.1*** k   L = 100 in

Resistance Factors ϕ_f = 1 ϕ_c = 0.9 ϕ_v = 1   ABDS 6.5.4.2

Check Axial Compression Capacity

P_e/P_o = 0.7006 $P_n = (0.658^{(Po/Pe)})P_oA_g$ = 92.711 k   ABDS 6.9.4.1-1

$P_e = \pi^2E/(KL/r)^2$ = 35.028 ksi $P_n = 0.877P_eA_g$ = N/A k   ABDS 6.9.4.1-2

$P_o = QF_y$ = 50 ksi $P_r = \phi_cP_n$ = 83.44 k

Q = ***1***   ABDS 6.9.4.2

Check Moment Capacity   ABDS 6.12.2.2.2

$M_{ni} = M_p = F_yZ_i$ = 19.542 ft-k λ_{pf} >= $\lambda_{f\text{-}In}$ =< λ_{rf}

$M_{ni} = M_p-(M_p-F_yS_i)(3.57\lambda_{f\text{-}In}(F_y/E)^{1/2}-4.0)$ = N/A ft-k ϕ_fM_{ni} = 19.542 ft-k

$M_{no} = M_p = F_yZ_o$ = 19.542 ft-k λ_{pf} >= $\lambda_{f\text{-}Out}$ =< λ_{rf}

$M_{no} = M_p-(M_p-F_yS_o)(3.57\lambda_{f\text{-}Out}(F_y/E)^{1/2}-4.0)$ = N/A ft-k ϕ_fM_{no} = 19.542 ft-k

Check Shear Capacity

$V_r = \phi_vV_n$ = $\phi 0.58\ F_yA_vC_v$ = 50.907 k   ABDS 6.10.9.2

$A_v = 2(b_i-t_c)t_c$ = 1.7554 in^2

C_v = 1   ABDS 6.10.9.3.2

$1.12(kE/F_y)^{1/2}$ = 59.237 >= h/t

k_v = ***5***

Combined Axial Compression & Flexure P_u/P_r = 0.6544 >= 0.2   ABDS 6.9.2.2

$P_u/2.0P_r + M_{ui}/M_{ri} + M_{uo}/M_{ro}$ = N/A

$P_u/P_r + (8/9)(M_{ui}/M_{ri} + M_{uo}/M_{ro})$ = 0.6771 <= 1   **OK**

Combined Shear, Flexure & Axial Force

$(P_u/P_r+M_{ui}/M_{ri}+M_{uo}/M_{ro})+(V_u/V_r)^2$ = 0.68 <= 1   **OK**   SSSB H3.2

Find the Utilization Ratio   SSSB (K1-6)

$U = P_r/(A_gF_y)+M_i/(S_iF_c)+M_o/(S_oF_c)$ = 0.3548

Reference

F_y = 50000 psi Bottom Chord = HSS4x4x1/4 A = 3.37 in^2

F_u = 70000 psi Orientation = X t_c = 0.233 in

E = 29000 ksi Plating: N

Thickness	Width	Sides	Configuration
N/A	N/A	N/A	N/A

In-Plane						Out-of-Plane					
b_i	b/t_i	I_i	Z_i	S_i	r_i	b_o	b/t_o	I_o	Z_o	S_o	r_o
4	14.2	7.8	4.69	3.9	1.52	4	14.2	7.8	4.69	3.9	1.52

Load Case = ***1***

P_u = ***54.6*** k Member: ***BC004***

M_{ui} = ***0.6*** ft-k

M_{uo} = ***0.1*** ft-k L = 100 in

V_u = ***0.1*** k

Resistance Factors ϕ_f = 1 ϕ_y = 0.95 ϕ_u = 0.8 ϕ_v = 1 — ABDS 6.5.4.2

Check Axial Tension Capacity

$P_r = \phi_y P_{ny} = \phi_y F_y A$ = 160.08 k — $A_n = A$ = 3.37 in^2 — ABDS 6.8.2.1-1

$P_r = \phi_u P_{nu} = \phi_u F_u A_n R_p U$ = 188.72 k — R_p = ***1*** — ABDS 6.8.2.1-2

Use P_r = 160.08 k — U = ***1***

Check Moment Capacity — ABDS 6.12.2.2.2

$M_{ni} = M_p = F_y Z_i$ = 19.542 ft-k — λ_{pf} >= $\lambda_{f\text{-}In}$ =< λ_{rf}

$M_{ni} = M_p-(M_p-F_yS_i)(3.57\lambda_{f\text{-}In}(F_y/E)^{1/2}-4.0)$ = N/A ft-k — $\phi_f M_{ni}$ = 19.542 ft-k

$M_{no} = M_p = F_y Z_o$ = 19.542 ft-k — λ_{pf} >= $\lambda_{f\text{-}Out}$ =< λ_{rf}

$M_{no} = M_p-(M_p-F_yS_o)(3.57\lambda_{f\text{-}Out}(F_y/E)^{1/2}-4.0)$ = N/A ft-k — $\phi_f M_{no}$ = 19.542 ft-k

Check Shear Capacity

$V_r = \phi_v V_n = \phi 0.58 F_y A_v C_v$ = 50.907 k — ABDS 6.10.9.2

$A_v = 2(b_i-t_c)t_c$ = 1.7554 in^2

C_v = 1 — ABDS 6.10.9.3.2

$1.12(k_vE/F_y)^{1/2}$ = 60.314 >= h/t

k_v = ***5***

Combined Axial Tension & Flexure — P_u/P_r = 0.3411 >= 0.2 — ABDS 6.9.2.2

$P_u/2.0P_r + M_{ui}/M_{ri} + M_{uo}/M_{ro}$ = N/A

$P_u/P_r + (8/9)(M_{ui}/M_{ri} + M_{uo}/M_{ro})$ = 0.3729 <= 1 **OK**

Combined Shear, Flexure & Axial Force

$(P_u/P_r+M_{ui}/M_{ri}+M_{uo}/M_{ro})+(V_u/V_r)^2$ = 0.3769 <= 1 **OK** — SSSB H3.2

Reference

F_y = 50000 psi — Vertical = HSS4x4x1/4 — A = 3.37 in^2

E = 29000 ksi — Orientation = X — t_c = 0.233 in

In-Plane						Out-of-Plane					
b_i	b/t_i	I_i	Z_i	S_i	r_i	b_o	b/t_o	I_o	Z_o	S_o	r_o
4	14.2	7.8	4.69	3.9	1.52	4	14.2	7.8	4.69	3.9	1.52

Load Case = ***1***

P = ***22.5*** k — Member: ***EV1***

M_i = ***1*** ft-k

M_{oa} = ***0.2*** ft-k — $M_o = M_{oa} + M_{Lat}$ = 1.3451 ft-k — M_{Lat} = 1.1451 ft-k

V_u = ***0.3*** k

K_i = ***1*** — L_i = 70 in — KL_i/r_i = 46.053 <= 120 **OK** — ABDS 6.9.3

K_o = ***2*** — L_o = 61.07 in — KL_o/r_o = 80.355 <= 120 **OK** — ABDS 6.9.3

Resistance Factors ϕ_f = 1 ϕ_c = 0.9 ϕ_v = 1 ϕ_{e1} = 0.85 — ABDS 6.5.4.2

Check Axial Compression Capacity

P_e/P_o = 0.8865 — $P_n = (0.658^{(Po/Pe)})P_oA_g$ = 105.09 k — ABDS 6.9.4.1-1

$P_e = \pi^2E/(KL/r)^2$ = 44.327 ksi — $P_n = 0.877P_eA_g$ = N/A k — ABDS 6.9.4.1-2

$P_o = QF_y$ = 50 ksi — $P_r = \phi_cP_n$ = 94.581 k

Q = ***1*** — ABDS 6.9.4.2

Check Moment Capacity — ABDS 6.12.2.2.2

$M_{ni} = M_p = F_yZ_i$ = 19.542 ft-k — λ_{pf} >= $\lambda_{f\text{-}In}$ =< λ_{rf}

$M_{ni} = M_p-(M_p-F_yS_i)(3.57\lambda_{f\text{-}In}(F_y/E)^{1/2}-4.0)$ = N/A ft-k — ϕ_fM_{ni} = 19.542 ft-k

$M_{no} = M_p = F_yZ_o$ = 19.542 ft-k — λ_{pf} >= $\lambda_{f\text{-}Out}$ =< λ_{rf}

$M_{no} = M_p-(M_p-F_yS_o)(3.57\lambda_{f\text{-}Out}(F_y/E)^{1/2}-4.0)$ = N/A ft-k — ϕ_fM_{no} = 19.542 ft-k

Check Shear Capacity

$V_r = \phi_vV_n$ = $\phi 0.58\ F_yA_vC_v$ = 50.907 k — ABDS 6.10.9.2

$A_v = 2(b_i-t_c)t_c$ = 1.7554 in^2

C_v = 1 — ABDS 6.10.9.3.2

$1.12(kE/F_y)^{1/2}$ = 59.237 >= h/t

k_v = ***5***

Combined Axial Compression & Flexure — P_u/P_r = 0.2379 >= 0.2 — ABDS 6.9.2.2

$P_u/2.0P_r + M_{ui}/M_{ri} + M_{uo}/M_{ro}$ = N/A

$P_u/P_r + (8/9)(M_{ui}/M_{ri} + M_{uo}/M_{ro})$ = 0.3446 <= 1 **OK**

Combined Shear, Flexure & Axial Force

$(P_u/P_r+M_{ui}/M_{ri}+M_{uo}/M_{ro})+(V_u/V_r)^2$ = 0.3579 <= 1 **OK** — SSSB H3.2

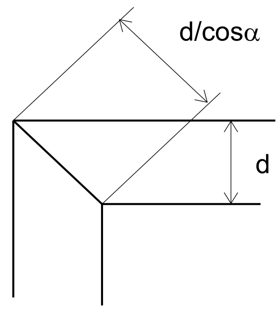
Find the Utilization Ratio — SSSB (K1-6)

$U = P_r/(A_gF_y)+M_i/(S_iF_c)+M_o/(S_oF_c)$ = 0.2778

Reference

Check Chord Connection

P_u = 11.25 k Use only 1/2 P due to double mitered diagonal
M_i = 1 k-ft α = 40
M_o = 0.2 k-ft



Overlapped Diagonal = Y
d = 4 in
w = 4 in

Weld Length = $l_w = 2d/\cos\alpha$ = 10.443 in
$S_{iw} = (d/\cos\alpha)^2/3$ = 9.0885 in^2
$S_{ow} = (d/\cos\alpha)w$ = 20.887 in^2

$f_w = (P_u/l_w+M_i/S_{iw})/t_e$ = 10.29 ksi
$f_w = (P_u/l_w+M_o/S_{ow})/t_e$ = 5.1166 ksi

$t_e = t_c$ = 0.233 in

$R_r = \alpha\phi_{e1}F_{EXX}$ = 35.7 ksi <= F_y, Use 35.7 ksi > f_w **OK** ABDS 6.13.3.2.2
F_{EXX} = ***70*** ksi
α = 0.6

Reference

F_y = 50000 psi Vertical = HSS4x3x1/4 A = 2.91 in^2

E = 29000 ksi Orientation = X t_c = 0.233 in

In-Plane						Out-of-Plane					
b_i	b/t_i	I_i	Z_i	S_i	r_i	b_o	b/t_o	I_o	Z_o	S_o	r_o
4	14.2	6.15	3.81	3.07	1.45	3	9.88	3.91	3.12	2.61	1.16

Load Case = ***1***

P = ***19*** k Member: ***V002***

M_i = ***2*** ft-k

M_o = ***0.2*** ft-k $M_o = M_{oa} + M_{Lat}$ = 2.2223 ft-k M_{Lat} = 2.0223 ft-k

V_u = ***0.6*** k

K_i = ***1*** L_i = 70 in KL_i/r_i = 48.276 <= 120 **OK** ABDS 6.9.3

K_o = ***2*** L_o = 61.07 in KL_o/r_o = 105.29 <= 120 **OK** ABDS 6.9.3

Resistance Factors ϕ_f = 1 ϕ_c = 0.9 ϕ_v = 1 ϕ_{e2} = 0.8 ABDS 6.5.4.2

Check Axial Compression Capacity

P_e/P_o = 0.5163 $P_n = (0.658^{(Po/Pe)})P_oA_g$ = 64.686 k ABDS 6.9.4.1-1

$P_e = \pi^2E/(KL/r)^2$ = 25.817 ksi $P_n = 0.877P_eA_g$ = N/A k ABDS 6.9.4.1-2

$P_o = QF_y$ = 50 ksi $P_r = \phi_cP_n$ = 58.218 k

Q = ***1*** ABDS 6.9.4.2

Check Moment Capacity ABDS 6.12.2.2.2

$M_{ni} = M_p = F_yZ_i$ = 15.875 ft-k λ_{pf} >= $\lambda_{f\text{-}In}$ =< λ_{rf}

$M_{ni} = M_p-(M_p-F_yS_i)(3.57\lambda_{f\text{-}In}(F_y/E)^{1/2}-4.0)$ = N/A ft-k ϕ_fM_{ni} = 15.875 ft-k

$M_{no} = M_p = F_yZ_o$ = 13 ft-k λ_{pf} >= $\lambda_{f\text{-}Out}$ =< λ_{rf}

$M_{no} = M_p-(M_p-F_yS_o)(3.57\lambda_{f\text{-}Out}(F_y/E)^{1/2}-4.0)$ = N/A ft-k ϕ_fM_{no} = 13 ft-k

Check Shear Capacity

$V_r = \phi_vV_n$ = $\phi 0.58\ F_yA_vC_v$ = 50.907 k ABDS 6.10.9.2

$A_v = 2(b_i-t_c)t_c$ = 1.7554 in^2

C_v = 1 ABDS 6.10.9.3.2

$1.12(kE/F_y)^{1/2}$ = 59.237 >= h/t

k_v = ***5***

Combined Axial Compression & Flexure P_u/P_r = 0.3264 >= 0.2 ABDS 6.9.2.2

$P_u/2.0P_r + M_{ui}/M_{ri} + M_{uo}/M_{ro}$ = N/A

$P_u/P_r + (8/9)(M_{ui}/M_{ri} + M_{uo}/M_{ro})$ = 0.5903 <= 1 **OK**

Combined Shear, Flexure & Axial Force

$(P_u/P_r+M_{ui}/M_{ri}+M_{uo}/M_{ro})+(V_u/V_r)^2$ = 0.6234 <= 1 **OK** SSSB H3.2

Find the Utilization Ratio SSSB (K1-6)

$U = P_r/(A_gF_y)+M_i/(S_iF_c)+M_o/(S_oF_c)$ = 0.4913

Reference

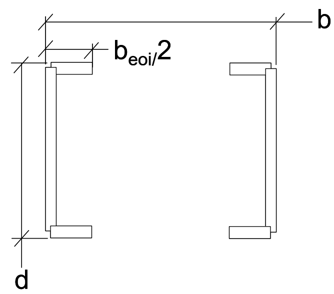
Check Chord Connection

P_u = 19 k
M_i = 2 k-ft
M_o = 0.2 k-ft
Overlapped Diagonal = ***N***

$\beta = B_b/B$ = 0.75
θ = 90 °

d = 4 in
b = 3 in
$b_{eoi} = [10/(B/t)][F_y t/(F_y t_p)]B_p]$ = 1.7475 in
Use b_{eoi} = 1.7475 in
when $\beta > 0.85$ or $\theta > 50^o$, $b_{eoi}/2$ shall not exceed 2t = 0.466 in

Side Weld Size = t_w = ***0.25*** in
$t_{ed} = .707t_w$ or t = 0.1768 in
Face Fillet Weld Size = t_w = ***0.25*** in
$t_{eb} = .707t_w$ = 0.1768 in



Weld Area = $l_w = 2dt_{ed}+2b_{eoi}t_{eb}$ = 2.0317 in^2 — SSSB Tbl K4.1
$S_{iw} = t_{ed}d^2/3+t_{eb}b_{eoi}d$ = 2.1781 in^3 — SSSB Tbl K4.1
$S_{ow} = t_{ed}db+t_{eb}(b^2/3-(b-b_{eoi})^3/(3b))$ = 2.6127 in^3 — SSSB Tbl K4.1

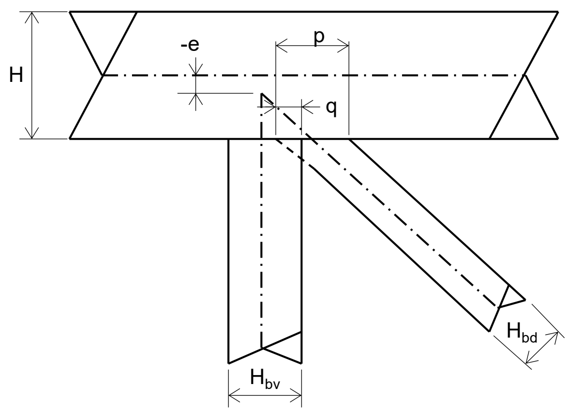
(tension) $f_w = (M_i/S_{iw}+Mo/S_{ow})$ = 11.937 ksi
(compression) $f_w = (P_u/l_w+M_i/S_{iw}+M_o/S_{ow})$ = 21.289 ksi

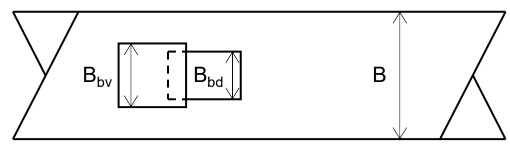
$R_r = \alpha\phi_{e2}F_{EXX}$ = 33.6 ksi <= F_y, Use 33.6 ksi > f_w **OK** — ABDS 6.13.3.2.4
F_{EXX} = ***70*** ksi
α = 0.6

(compression) $R_r = \phi_c F_y$ = 45 ksi > f_w **OK**

Reference

	Section	Orientation	Thickness (in)		Height (in)		Width (in)	
Top Chord :	HSS4x4x1/4	X	$t =$	0.233	$H =$	4	$B =$	4
Vertical:	HSS4x4x1/4	X	$t_{bv} =$	0.233	$H_{bv} =$	4	$B_{bv} =$	4
Diagonal:	HSS3x2x1/4	Y	$t_{bd} =$	0.233	$H_{bd} =$	2	$B_{bd} =$	3





$\theta =$ 34.931 deg

$F_y = F_{ybv} = F_{ybd} =$ 50 ksi

$F_u =$ 70 ksi

$E =$ 29000 ksi

Area of Diagonal = $A_g =$ 1.97 in^2

Load Case = ***1*** Member: ***D001***

Load Applied to Diagonal = P = ***32.9*** k *T* (T = Tension, C = Compression)

$q =$ 1.7465 in $O_v = q/p =$ 50.00%

$p = H_{bd}/\sin\theta =$ 3.4929 in $e =$ -0.6032

Check Applicability: SSSB Tbl K2.2A

Joint Eccentricity:	-.55H =	-2.2	<= e	**OK**
	0.25H =	1	>= e	**OK**
Branch Angle:		θ >= 30°		**OK**
Chord Wall Slenderness:	B/t=	14.2	<= 30	**OK**
	H/t=	14.2	<= 35	**OK**
Tension Branch Wall Slenderness:	$B_{bd}/t_{bd} =$	9.88	<= 35	**OK**
Comp Branch Wall Slenderness:	$B_{bd}/t_{bd} =$	9.88	N/A	**N/A**
	$1.1(E/F_y)^{0.5} =$ 26.492	>=	B_{bd}/t_{bd}	**N/A**
Width Ratio:	B_{bd}/B & $H_{bd}/B =$	0.5	>= 0.25	**OK**
Aspect Ratio:	H/B & $H_{bd}/B_{bd} =$	0.6667	>= 0.5	**OK**
	H/B & $H_{bd}/B_{bd} =$	1	<= 2.0	**OK**
Overlap:	$O_v =$	50.00%	>=25%	**OK**
	$O_v =$	50.00%	<=100%	**OK**
Branch Width Ratio:	$B_{bd}/B_{bv} =$	0.75	>= 0.75	**OK**
Branch Thickness Ratio:	$t_{bd}/t_{bv} =$	1	<=1	**OK**
Strength:		F_y <= 52 ksi		**OK**
Ductility:	$F_y/F_u =$	0.71	<= 0.8	**OK**

BIG R BRIDGE

Project:	PRESSENTIN PARK BRIDGE 3	By:	ENL
Job No.:	BR19-00321/3	Date:	12/24/2019
Subject:	OVERLAPPED END DIAGONAL CHECKS	Page:	26 of 44

Reference

Check Connection for Local Yielding due to Uneven Load Distribution: — SSSB Tbl K2.2

$b_{eoi} = (10/(B/t))((F_y t)/(F_y t_{bd}))B_{bd} =$ 2.1127 in <= B_{bd} use 2.1127 in — SSSB (K2-20)

$b_{eov} = (10/(B_{bv}/t_{bv}))((F_y t_{bv})/(F_y t_{bd}))B_{bd} =$ 2.1127 in <= B_{bd} use 2.1127 in — SSSB (K2-21)

25% <= O_v < 50%

$P_n = \phi F_y t_{bd}((O_v/50)(2H_{bd}-4t_{bd})+b_{eoi}+b_{eov}) =$ N/A N/A **N/A** — SSSB (K2-17)

50% <= O_v < 80%

$P_n = \phi F_y t_{bd}(2H_{bd}-4t_{bd}+b_{eoi}+b_{eov}) =$ 80.719 k >=P **OK** — SSSB (K2-18)

80% <= O_v <= 100%

$P_n = \phi F_y t_{bd}(2H_{bd}-4t_{bd}+B_{bd}+b_{eov}) =$ N/A N/A **N/A** — SSSB (K2-19)

$\phi =$ ***0.95***

Resistance Factors — ABDS 6.5.4.2

$\phi_y =$ 0.95 $\phi_u =$ 0.8 $\phi_{e2} =$ 0.8

Check Axial Tension Capacity

$P_r = \phi_y P_{ny} = \phi_y F_y A =$ 93.575 k — ABDS 6.8.2.1-1

$P_r = \phi_u P_{nu} = \phi_u F_u A_n R_p U =$ 110.32 k Use $P_r =$ 93.575 k >=P **OK** — ABDS 6.8.2.1-2

$A_n = A_g =$ 1.97 in^2

$R_p =$ ***1***

$U =$ ***1***

Check Connection

$l_w = 2O_v/50[(1-O_v/100)(H_{bd}/\sin\theta)+O_v/100(H_{bd}/\sin(\theta+\beta))]+b_{eoi}+b_{eov} =$ N/A in

$l_w = 2[(1-O_v/100)(H_{bd}/\sin\theta)+O_v/100(H_{bd}/\sin(\theta+\beta))]+b_{eoi}+b_{eov} =$ 10.158 in

$l_w = 2[(1-O_v/100)(H_{bd}/\sin\theta)+O_v/100(H_{bd}/\sin(\theta+\beta))]+B_b+b_{eov} =$ N/A in

Use $l_w =$ 10.158 in — SSSB Tbl K4.1

when B_{bd}/B > 0.85, $b_{eoi}/2$ shall not exceed 2t = 0.466 in Use $b_{eoi} =$ 2.1127 in

and when B_{bd}/B_{bv} > 0.85, $b_{eov}/2$ shall not exceed $2t_{bv}$ = 0.466 in Use $b_{eov} =$ 2.1127 in

Fillet Weld Size = t = ***0.25*** in

$t_e = 0.707t =$ 0.1768 in

$f_w = (P/l_w)/t_e =$ 18.325 ksi

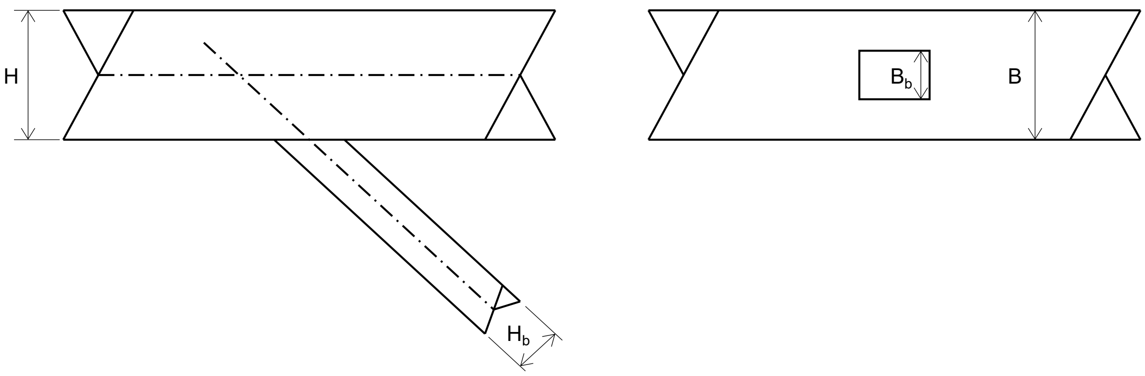
$R_r = \alpha\phi_{e2}F_{EXX} =$ 33.6 ksi <= F_y, Use 33.6 ksi > f_w **OK** — ABDS 6.13.3.2.4

$F_{EXX} =$ ***70*** ksi

$\alpha =$ 0.6

Reference

				In-Plane		Out-of-Plane	
	Orientation	A	t_c	b	S	b	S
Chord: HSS4x4x1/4	X	3.37	0.233	4	3.9	4	3.9
Branch: HSS2x2x1/4	X	1.51	0.233	2	0.747	2	0.747



B = 4 H = 4 t = 0.233 θ = 36.219

B_b = 2 H_b = 2 t_b = 0.233

$\beta = B_b/B$ = 0.5 $F_y = F_{yb}$ = 50 ksi F_u = 70 ksi

$\gamma = B/2t$ = 8.5837 E = 29000 ksi

$\eta = H_b/B\sin\theta$ = 0.8462

Load Case = ***1*** Member: ***D002***

Load Applied to Diagonal = P = ***21.7*** k *T* (T = Tension, C = Compression)

Chord-Stress Interaction Parameter:

Q_f = 1 (Q_f = 1 if Chord is in Tension, $Q_f = 1.3-0.4U/\beta$ if Chord is in Compression) SSSB K1-5a

U = 0.3548

Check Applicability: SSSB Tbl K2.2

Branch Angle:		θ >= 30°		**OK**
Chord Wall Slenderness:	B/t & H/t=	14.2	<= 35	**OK**
Tension Branch Wall Slenderness:	B_b/t_b =	5.58	<= 35	**OK**
Comp Branch Wall Slenderness:	B_b/t_b =	5.58	N/A	**N/A**
	$1.25(E/F_y)^{0.5}$ = 30.104	>=	B_b/t_b	**N/A**
Width Ratio:	B_{bd}/B & H_{bd}/B =	0.5	>= 0.25	**OK**
Aspect Ratio:	H/B & H_{bd}/B_{bd} =	1	>= 0.5	**OK**
	H/B & H_{bd}/B_{bd} =	1	<= 2.0	**OK**
Strength:		F_y <= 52 ksi		**OK**
Ductility:	F_y/F_u =	0.71	<= 0.8	**OK**

Reference

Check Chord Wall Plastification: — SSSB Tbl K2.2

β <= 0.85, Check Limit State

$P_n = \phi(F_y t^2(2\eta/(1-\beta)+4/(1-\beta)^{0.5})Q_f/\sin\theta) =$ 41.537 k >=P **OK** — SSSB (K2-7)

$\phi =$ ***1***

Check Shear Yielding (Punching):

$(1-1/\gamma) =$ 0.8835 >= β Check Limit State

β < 0.85 & B/t >= 10 Limit State is Not Applicable

$P_n = \phi(0.6F_y tB(2\eta+2\beta_{eop})/\sin\theta) =$ N/A **N/A** — SSSB (K2-8)

$\phi =$ ***0.95***

$\beta_{eop} = 5\beta/\gamma =$ 0.2913 <= β, use $\beta_{oep} =$ 0.2913

Check Sidewall Strength:

β <> 1, Limit State is Not Applicable

(i) Local Yielding:

$P_n = \phi(2F_y t(5k+l_b)/\sin\theta) =$ N/A **N/A** — SSSB (K2-9)

$\phi =$ ***1***

$k = 1.5t =$ 0.3495 in

$l_b = H_b/\sin\theta =$ 3.3848 in

(ii) Sidewall Local Crippling

$P_n = \phi(1.6t^2(1+3l_b/(H-3t))(EF_y)^{0.5}Q_f/\sin\theta) =$ N/A **N/A** — SSSB (K2-10)

$\phi =$ ***0.75***

Check Local Yielding due to Uneven Load Distribution:

β < 0.85, Limit State is Not Applicable

$P_n = \phi(F_{yb}t_b(2H_b+2b_{eoi}-4t_b)) =$ N/A **N/A** — SSSB (K2-12)

$\phi =$ ***0.95***

$b_{eoi} = (10/(B/t))(F_y t/(F_{yb}tb))B_b <= B_b =$ 1.165 in — SSSB (K2-13)

Resistance Factors — ABDS 6.5.4.2

$\phi_y =$ 0.95 $\phi_u =$ 0.8 $\phi_{e2} =$ 0.8

Check Axial Tension Capacity

$P_r = \phi_y P_{ny} = \phi_y F_y A =$ 71.725 k — ABDS 6.8.2.1-1

$P_r = \phi_u P_{nu} = \phi_u F_u A_n R_p U =$ 58.464 k Use $P_r =$ 58.464 k >=P **OK** — ABDS 6.8.2.1-2

$A_n = Ag - t_b B_b =$ 1.044 in^2 (Assume only 3 sides are welded)

$R_p =$ ***1***

$U =$ ***1***

Reference

Check Connection

Weld Length = $l_w = 2H_{bd}/\sin\theta + b_{eoi}$ = 7.9347 in (Assume only 3 sides are welded) — SSSB Tbl K4.1

when $\beta > 0.85$ or $\theta > 50^o$, $b_{eoi}/2$ shall not exceed 2t = 0.466 in Use b_{eoi} = 1.165 in

Fillet Weld Size = t = ***0.25*** in

$t_e = 0.707t$ = 0.1768 in

$f_w = (P/l_w)/t_e$ = 15.473 ksi

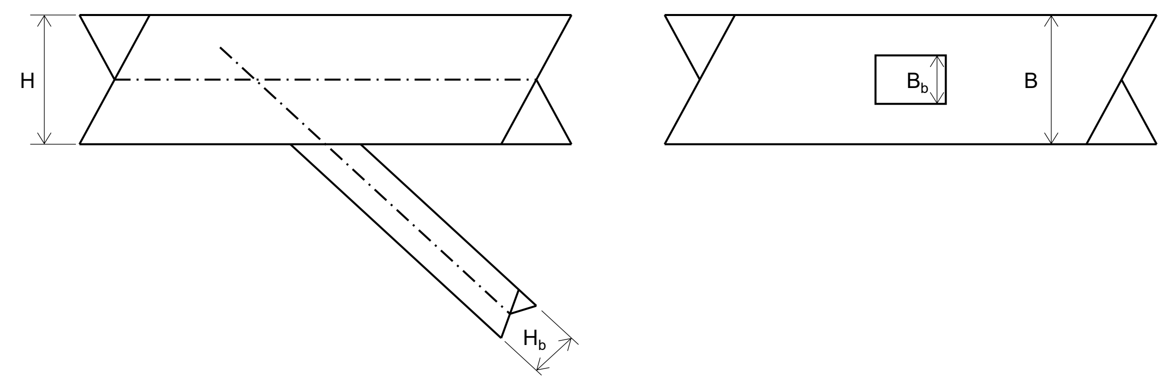
$R_r = \alpha\phi_{e2}F_{EXX}$ = 33.6 ksi <= F_y, Use 33.6 ksi > f_w **OK** — ABDS 6.13.3.2.4

F_{EXX} = ***70*** ksi

α = 0.6

Reference

		Orientation	A	t_c	In-Plane b	In-Plane S	Out-of-Plane b	Out-of-Plane S
Chord :	HSS4x4x1/4	Y	3.37	0.233	4	3.9	4	3.9
Branch:	HSS3x3x1/4	X	2.44	0.233	3	2.01	3	2.01



B = 4 H = 4 t = 0.233 θ = 37.235
B_b = 3 H_b = 3 t_b = 0.233

$\beta = B_b/B$ = 0.75 $F_y = F_{yb}$ = 50 ksi F_u = 70 ksi
$\gamma = B/2t$ = 8.5837 E = 29000 ksi
$\eta = H_b/B\sin\theta$ = 1.2395

Load Case = ***3***
P = ***14*** k Member: ***BD001***

Chord-Stress Interaction Parameter:

Q_f = ***1*** (Q_f = 1 if Chord is in Tension, $Q_f = 1.3-0.4U/\beta$ if Chord is in Compression) SSSB Tbl K2.2

Check Applicability: SSSB Tbl K2.2

Branch Angle:		θ >= 30°	**OK**
Chord Wall Slenderness:	B/t & H/t=	14.2 <= 35	**OK**
Tension Branch Wall Slenderness:	B_b/t_b =	9.88 <= 35	**OK**
Comp Branch Wall Slenderness:	B_b/t_b =	9.88 <= 35	**OK**
	$1.25(E/F_y)^{0.5}$ = 30.104	>= B_b/t_b	**OK**
Width Ratio:	B_{bd}/B & H_{bd}/B =	0.75 >= 0.25	**OK**
Aspect Ratio:	H/B & H_{bd}/B_{bd} =	1 >= 0.5	**OK**
	H/B & H_{bd}/B_{bd} =	1 <= 2.0	**OK**
Strength:		F_y <= 52 ksi	**OK**
Ductility:	F_y/F_u =	0.71 <= 0.8	**OK**

Reference

Check Chord Wall Plastification: SSSB Tbl K2.2

β <= 0.85, Check Limit State

$P_n = \phi(F_y t^2(2\eta/(1-\beta)+4/(1-\beta)^{0.5})Q_f/\sin\theta) =$ 80.373 k >=P **OK** SSSB (K2-7)

$\phi =$ ***1***

Check Shear Yielding (Punching):

$(1-1/\gamma) =$ 0.8835 >= β Check Limit State

β < 0.85 & B/t >= 10 Limit State is Not Applicable

$P_n = \phi(0.6F_y tB(2\eta+2\beta_{eop})/\sin\theta) =$ N/A **N/A** SSSB (K2-8)

$\phi =$ ***0.95***

$\beta_{eop} = 5\beta/\gamma =$ 0.4369 <= β, use $\beta_{oep} =$ 0.4369

Check Sidewall Strength:

β <> 1, Limit State is Not Applicable

(i) Local Yielding:

$P_n = \phi(2F_y t(5k+l_b)/\sin\theta) =$ N/A **N/A** SSSB (K2-9)

$\phi =$ ***1***

$k = 1.5t =$ 0.3495 in

$l_b = H_b/\sin\theta =$ 4.958 in

(ii) Sidewall Local Crippling

$P_n = \phi(1.6t^2(1+3l_b/(H-3t))(EF_y)^{0.5}Q_f/\sin\theta) =$ N/A **N/A** SSSB (K2-10)

$\phi =$ ***0.75***

Check Local Yielding due to Uneven Load Distribution:

β < 0.85, Limit State is Not Applicable

$P_n = \phi(F_{yb}t_b(2H_b+2b_{eoi}-4t_b)) =$ N/A **N/A** SSSB (K2-12)

$\phi =$ ***0.95***

$b_{eoi} = (10/(B/t))(F_y t/(F_{yb}tb))B_b <= B_b =$ 1.7475 in SSSB (K2-13)

Resistance Factors ABDS 6.5.4.2

$\phi_y =$ 0.95 $\phi_u =$ 0.8 $\phi_c =$ 0.9 $\phi_{e2} =$ 0.8

Check Axial Tension Capacity

$P_r = \phi_y P_{ny} = \phi_y F_y A =$ 115.9 k ABDS 6.8.2.1-1

$P_r = \phi_u P_{nu} = \phi_u F_u A_n R_p U =$ 97.496 k Use $P_r =$ 97.496 k >=P **OK** ABDS 6.8.2.1-2

$A_n = Ag - t_b B_b =$ 1.741 in^2 (Assume only 3 sides are welded)

$R_p =$ ***1***

$U =$ ***1***

Reference

Check Axial Compression Capacity

K = ***1***

L = 121.97 in KL/r = 109.88 <= 140 **OK** ABDS 6.9.3

r = 1.11 in^3

P_e/P_o = 0.4741 $P_n = (0.658^{(Po/Pe)})P_oA_g$ = 50.459 k ABDS 6.9.4.1-1

$P_e = \pi^2E/(KL/r)^2$ = 23.704 ksi $P_n = 0.877P_eA_g$ = N/A k ABDS 6.9.4.1-2

$P_o = QF_y$ = 50 ksi $P_r = \phi_c P_n$ = 45.413 k **OK**

Q = ***1*** ABDS 6.9.4.2

Check Connection

Weld Length = $l_w = 2H_{bd}/\sin\theta + b_{eoi}$ = 11.663 in (Assume only 3 sides are welded) SSSB Tbl K4.1

when $\beta > 0.85$ or $\theta > 50^o$, $b_{eoi}/2$ shall not exceed 2t = 0.466 in Use b_{eoi} = 1.7475 in

Fillet Weld Size = t = ***0.25*** in

$t_e = 0.707t$ = 0.1768 in

$f_w = (P/l_w)/t_e$ = 6.7911 ksi

$R_r = \alpha\phi_{e2}F_{EXX}$ = 33.6 ksi <= F_y, Use 33.6 ksi > f_w **OK** ABDS 6.13.3.2.4

F_{EXX} = ***70*** ksi

α = 0.6

Check Connection for Fatigue ABDS 6.6.1.2.5-1

P = ***2.2*** k Load Case = ***Fatigue***

Member = ***BD001***

Constant-Amplitude Fatique Threshold = $(\Delta F)_{TH}$ = 4.5 ksi ABDS Table 6.6.1.2.5-3

Detail Category = ***E***

$f_w = (P/l_w)/t_e$ = 1.0672 **ksi < F** **OK for Infinite Life**

Reference

Structure Information:

Expansion Coefficient = α = ***0.0000065*** /°F

Expansion Length = L = 58.333 ft

Skew = 0 °

Temperature Information:

Mean High = T_H = ***120*** °F

Mean Low = T_L = ***-30*** °F

Max Base = T_{BMax} = ***55*** °F   Min Base = T_{BMin} = ***35*** °F

Total Movements:

$\Delta_{Rise} = \alpha(T_H - T_{BMin})Lm$ = 0.3868 in

$\Delta_{Fall} = \alpha(T_{BMax} - T_L)Lm$ = 0.3868 in

Perpendicular Movements:

$\Delta_{P\ Rise} = \Delta_{Rise}Cos(Skew)$ = 0.3868 in

$\Delta_{P\ Fall} = \Delta_{Fall}Cos(Skew)$ = 0.3868 in

0.7735 in

Racking Movements:

$\Delta_{R\ Rise} = \Delta_{Rise}Sin(Skew)$ = 0 in

$\Delta_{R\ Fall} = \Delta_{Fall}Sin(Skew)$ = 0 in

0 in

Gaps:

Gap at $T_B = G_B$ = 1 in

Minimum Installation Gap = G_M = ***0.125*** in

Minimum Gap = $G_B - \Delta_{P\ Rise}$ = 0.6133 in   > ***0.125*** in   **OK**

Maximum Gap = $G_B + \Delta_{P\ Fall}$ = 1.3868 in   < ***1.5*** in   **OK**

Maximum Temperature for Installation Gap:

$T_{Max} = T_B + (G_B - 1/4 - G_M)/(\alpha LmCos(Skew))$ = 192.36 °F

Gap Variance per 10°F:

$G_V = \alpha LmCos(Skew)10$ = 0.0455 in

Bearing Force:

R_{LL} = 7.9 k (Unfactored w/o IM)

R_{DL} = 7.3 k (Unfactored)

R = 15.2 k (Unfactored)

Anchor Bolt Checks — Reference

Horizontal Loads:

WS_H =	3.85 k	R_u (LC 3) = $(\gamma_{WS}WS_H^2+\gamma_{TU}TU_L^2)^{1/2}$ =	6.2279 k	ABDS Tbl 3.4.1-1
WA =	0 k	R_u (LC 4) = $\gamma_{EQ}(0.3EQ_H^2+EQ_L^2)^{1/2}$ =	17.595 k	ABDS 3.8.10
EQ_H/R =	8.7 k	R_u (LC 5) = $\gamma_{WA}WA$ =	0 k	ABDS Tbl 3.4.1-1
EQ_L/R =	17.4 k			
TU_L =	2.6 k	R_u = 17.595 k		

Uplift Load:

DC =	-7.3 k	Pu (LC 3) = $\gamma_{DC}DC+\gamma_{DW}DW+\gamma_{WS}WS_H$ =	2.39 k
DW =	0 k	P_u (LC 5) = $\gamma_{WA}WA$ =	0 k
WS_H =	6.4 k		
WA =	0 k	P_u = 2.39 k	

Load Factors

γ_{DC}	γ_{DW}	γ_{WS}	γ_{EQ}	γ_{WA}	γ_{TU}
0.9	***0.65***	*1.4*	*1*	*1*	***1.2***

Bearing Plate Thickness = t = 0.75 in

Bearing Plate Clear Distance = L_c = 1.125 in

Bearing Plate Tensile Strength = F_u = ***70*** ksi

Number of Bolts = n = 2

Anchor Bolt Diameter = d = 1 in

Area of Bolt = A_b = 0.7854 in^2

F_{ub} = 75 ksi (F1554 Grade 55 Bolts) — ABDS 6.4.3

Resistance Factors — ABDS 6.5.4.2

ϕ_f	ϕ_v	ϕ_{bb}	ϕ_t	ϕ_s	ϕ_{e2}
1	***1***	***0.8***	***0.8***	***0.75***	*0.8*

Bolt Capacity in Shear

$\phi_s R_n$ = (0.8)0.48 $\phi_s A_b F_{ub} N_s n$ = 33.929 k >= R_u **OK** — ABDS 6.13.2.12

N_s = ***1***

Bolt Capacity in Tension

$\phi_t T_n$ = 0.76 $\phi_t A_b F_{ub} n$ = 71.628 k >= P_u **OK** — ABDS 6.13.2.10

Bearing Resistance at Bolt Holes

$\phi_{bb}R_{nb} = \phi_{bb}L_c t F_u n$ = 94.5 k >= R_u **OK** — ABDS 6.13.2.9

$\phi_{bb}R_{nb} = \phi_{bb}2.0dtF_u n$ = 168 k >= R_u **OK** — ABDS 6.13.2.9

Capacity of Weld

$R_r = (0.6\phi_{e2}F_{EXX})(0.707t)l_w$ = 71.266 k >= γR_u **OK** — ABDS 6.13.3.2.4

Weld Length = l_w = 12 in

Weld Size = t = ***0.25*** in

F_{EXX} = ***70*** ksi

BR19-00321-3

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Company: BIG R BRIDGE, LLC   Engineer: Eva Leong

VisualAnalysis 12.00.0020 Report

Model Summary

Structure Type: Space Frame

54 Nodes, and 449 Degrees of Freedom

70 Member Elements

The model is linear.

The model will have 317 unique mode shapes.

The size of the model is:

58 ft, in the X direction

5.833 ft, in the Y direction

6 ft, in the Z direction

Nodes

Node	X	Y	Z	Fix DX	Fix DY	Fix DZ	Fix RX	Fix RY	Fix RZ
	ft	ft	ft						
N001	0	0	0	No	Yes	No	No	No	No
N001-0	0	0	-6	Yes	Yes	Yes	No	No	No
N002	8.167	0	0	No	No	No	No	No	No
N002-0	8.167	0	-6	No	No	No	No	No	No
N003	16.5	0	0	No	No	No	No	No	No
N003-0	16.5	0	-6	No	No	No	No	No	No
N004	24.833	0	0	No	No	No	No	No	No
N004-0	24.833	0	-6	No	No	No	No	No	No
N005	33.167	0	0	No	No	No	No	No	No
N005-0	33.167	0	-6	No	No	No	No	No	No
N006	41.5	0	0	No	No	No	No	No	No
N006-0	41.5	0	-6	No	No	No	No	No	No
N007	49.833	0	0	No	No	No	No	No	No
N007-0	49.833	0	-6	No	No	No	No	No	No
N008	58	0	0	No	Yes	No	No	No	No
N008-0	58	0	-6	No	Yes	Yes	No	No	No
N101	0	5.833	0	No	No	No	No	No	No
N101-0	0	5.833	-6	No	No	No	No	No	No
N102	8.167	5.833	0	No	No	No	No	No	No
N102-0	8.167	5.833	-6	No	No	No	No	No	No
N103	16.5	5.833	0	No	No	No	No	No	No
N103-0	16.5	5.833	-6	No	No	No	No	No	No
N104	24.833	5.833	0	No	No	No	No	No	No
N104-0	24.833	5.833	-6	No	No	No	No	No	No

N105	33.167	5.833	0	No	No	No	No	No	No
N105-0	33.167	5.833	-6	No	No	No	No	No	No
N106	41.5	5.833	0	No	No	No	No	No	No
N106-0	41.5	5.833	-6	No	No	No	No	No	No
N107	49.833	5.833	0	No	No	No	No	No	No
N107-0	49.833	5.833	-6	No	No	No	No	No	No
N108	58	5.833	0	No	No	No	No	No	No
N108-0	58	5.833	-6	No	No	No	No	No	No
N109	8.354	5.833	0	No	No	No	No	No	No
N110	16.688	5.833	0	No	No	No	No	No	No
N111	25.021	5.833	0	No	No	No	No	No	No
N112	16.313	0	0	No	No	No	No	No	No
N113	24.646	0	0	No	No	No	No	No	No
N114	32.979	0	0	No	No	No	No	No	No
NB001	0	0.744	0	No	No	No	No	No	No
NB001-0	0	0.744	-6	No	No	No	No	No	No
NB002	8.167	0.744	0	No	No	No	No	No	No
NB002-0	8.167	0.744	-6	No	No	No	No	No	No
NB003	16.5	0.744	0	No	No	No	No	No	No
NB003-0	16.5	0.744	-6	No	No	No	No	No	No
NB004	24.833	0.744	0	No	No	No	No	No	No
NB004-0	24.833	0.744	-6	No	No	No	No	No	No
NB005	33.167	0.744	0	No	No	No	No	No	No
NB005-0	33.167	0.744	-6	No	No	No	No	No	No
NB006	41.5	0.744	0	No	No	No	No	No	No
NB006-0	41.5	0.744	-6	No	No	No	No	No	No
NB007	49.833	0.744	0	No	No	No	No	No	No
NB007-0	49.833	0.744	-6	No	No	No	No	No	No
NB008	58	0.744	0	No	No	No	No	No	No
NB008-0	58	0.744	-6	No	No	No	No	No	No

Member Elements

Member	Section	Material	(1)Node	(2)Node	Rz1	Ry1	Rx1	Rz2	Ry2	Rx2
BC001	HSS4x4x1/4	ASTM A8	N001	N002	Rigid	Rigid	Rigid	Rigid	Rigid	Rigid
BC001-0	HSS4x4x1/4	ASTM A8	N001-0	N002-0	Rigid	Rigid	Rigid	Rigid	Rigid	Rigid
BC002	HSS4x4x1/4	ASTM A8	N002	N003	Rigid	Rigid	Rigid	Rigid	Rigid	Rigid
BC002-0	HSS4x4x1/4	ASTM A8	N002-0	N003-0	Rigid	Rigid	Rigid	Rigid	Rigid	Rigid
BC003	HSS4x4x1/4	ASTM A8	N003	N004	Rigid	Rigid	Rigid	Rigid	Rigid	Rigid
BC003-0	HSS4x4x1/4	ASTM A8	N003-0	N004-0	Rigid	Rigid	Rigid	Rigid	Rigid	Rigid
BC004	HSS4x4x1/4	ASTM A8	N004	N005	Rigid	Rigid	Rigid	Rigid	Rigid	Rigid
BC004-0	HSS4x4x1/4	ASTM A8	N004-0	N005-0	Rigid	Rigid	Rigid	Rigid	Rigid	Rigid
BC005	HSS4x4x1/4	ASTM A8	N005	N006	Rigid	Rigid	Rigid	Rigid	Rigid	Rigid
BC005-0	HSS4x4x1/4	ASTM A8	N005-0	N006-0	Rigid	Rigid	Rigid	Rigid	Rigid	Rigid
BC006	HSS4x4x1/4	ASTM A8	N006	N007	Rigid	Rigid	Rigid	Rigid	Rigid	Rigid

BC006-0	HSS4x4x1/4	ASTM A8	N006-0	N007-0	Rigid	Rigid	Rigid	Rigid	Rigid	Rigid
BC007	HSS4x4x1/4	ASTM A8	N007	N008	Rigid	Rigid	Rigid	Rigid	Rigid	Rigid
BC007-0	HSS4x4x1/4	ASTM A8	N007-0	N008-0	Rigid	Rigid	Rigid	Rigid	Rigid	Rigid
BD001	HSS3x3x1/4	ASTM A8	N001-0	N002	Free	Free	Free	Free	Free	Rigid
BD002	HSS3x3x1/4	ASTM A8	N002	N003-0	Free	Free	Free	Free	Free	Rigid
BD006	HSS3x3x1/4	ASTM A8	N006-0	N007	Free	Free	Free	Free	Free	Rigid
BD007	HSS3x3x1/4	ASTM A8	N007	N008-0	Free	Free	Free	Free	Free	Rigid
D001	HSS3x2x1/4	ASTM A8	N101	N002	Free	Free	Free	Free	Free	Rigid
D001-0	HSS3x2x1/4	ASTM A8	N101-0	N002-0	Free	Free	Free	Free	Free	Rigid
D002	HSS2x2x1/4	ASTM A8	N109	N112	Free	Free	Free	Free	Free	Rigid
D002-0	HSS2x2x1/4	ASTM A8	N102-0	N003-0	Free	Free	Free	Free	Free	Rigid
D003	HSS2x2x1/4	ASTM A8	N110	N113	Free	Free	Free	Free	Free	Rigid
D003-0	HSS2x2x1/4	ASTM A8	N103-0	N004-0	Free	Free	Free	Free	Free	Rigid
D004	HSS2x2x1/4	ASTM A8	N111	N114	Free	Free	Free	Free	Free	Rigid
D004-0	HSS2x2x1/4	ASTM A8	N104-0	N005-0	Free	Free	Free	Free	Free	Rigid
D005	HSS2x2x1/4	ASTM A8	N005	N106	Free	Free	Free	Free	Free	Rigid
D005-0	HSS2x2x1/4	ASTM A8	N005-0	N106-0	Free	Free	Free	Free	Free	Rigid
D006	HSS2x2x1/4	ASTM A8	N006	N107	Free	Free	Free	Free	Free	Rigid
D006-0	HSS2x2x1/4	ASTM A8	N006-0	N107-0	Free	Free	Free	Free	Free	Rigid
D007	HSS3x2x1/4	ASTM A8	N007	N108	Free	Free	Free	Free	Free	Rigid
D007-0	HSS3x2x1/4	ASTM A8	N007-0	N108-0	Free	Free	Free	Free	Free	Rigid
EV1	HSS4x4x1/4	ASTM A8	N001	N101	Rigid	Rigid	Rigid	Rigid	Rigid	Rigid
EV1-0	HSS4x4x1/4	ASTM A8	N001-0	N101-0	Rigid	Rigid	Rigid	Rigid	Rigid	Rigid
EV2	HSS4x4x1/4	ASTM A8	N008	N108	Rigid	Rigid	Rigid	Rigid	Rigid	Rigid
EV2-0	HSS4x4x1/4	ASTM A8	N008-0	N108-0	Rigid	Rigid	Rigid	Rigid	Rigid	Rigid
FB001	W8x18	ASTM A8	NB001	NB001-0	Rigid	Rigid	Rigid	Rigid	Rigid	Rigid
FB002	W8x18	ASTM A8	NB002	NB002-0	Rigid	Rigid	Rigid	Rigid	Rigid	Rigid
FB003	W8x18	ASTM A8	NB003	NB003-0	Rigid	Rigid	Rigid	Rigid	Rigid	Rigid
FB004	W8x18	ASTM A8	NB004	NB004-0	Rigid	Rigid	Rigid	Rigid	Rigid	Rigid
FB005	W8x18	ASTM A8	NB005	NB005-0	Rigid	Rigid	Rigid	Rigid	Rigid	Rigid
FB006	W8x18	ASTM A8	NB006	NB006-0	Rigid	Rigid	Rigid	Rigid	Rigid	Rigid
FB007	W8x18	ASTM A8	NB007	NB007-0	Rigid	Rigid	Rigid	Rigid	Rigid	Rigid
FB008	W8x18	ASTM A8	NB008	NB008-0	Rigid	Rigid	Rigid	Rigid	Rigid	Rigid
TC001	HSS4x4x1/4	ASTM A8	N101	N102	Rigid	Rigid	Rigid	Rigid	Rigid	Rigid
TC001-0	HSS4x4x1/4	ASTM A8	N101-0	N102-0	Rigid	Rigid	Rigid	Rigid	Rigid	Rigid
TC002	HSS4x4x1/4	ASTM A8	N102	N103	Rigid	Rigid	Rigid	Rigid	Rigid	Rigid
TC002-0	HSS4x4x1/4	ASTM A8	N102-0	N103-0	Rigid	Rigid	Rigid	Rigid	Rigid	Rigid
TC003	HSS4x4x1/4	ASTM A8	N103	N104	Rigid	Rigid	Rigid	Rigid	Rigid	Rigid
TC003-0	HSS4x4x1/4	ASTM A8	N103-0	N104-0	Rigid	Rigid	Rigid	Rigid	Rigid	Rigid
TC004	HSS4x4x1/4	ASTM A8	N104	N105	Rigid	Rigid	Rigid	Rigid	Rigid	Rigid
TC004-0	HSS4x4x1/4	ASTM A8	N104-0	N105-0	Rigid	Rigid	Rigid	Rigid	Rigid	Rigid
TC005	HSS4x4x1/4	ASTM A8	N105	N106	Rigid	Rigid	Rigid	Rigid	Rigid	Rigid
TC005-0	HSS4x4x1/4	ASTM A8	N105-0	N106-0	Rigid	Rigid	Rigid	Rigid	Rigid	Rigid
TC006	HSS4x4x1/4	ASTM A8	N106	N107	Rigid	Rigid	Rigid	Rigid	Rigid	Rigid

TC006-0	HSS4x4x1/4	ASTM A8	N106-0	N107-0	Rigid	Rigid	Rigid	Rigid	Rigid	Rigid
TC007	HSS4x4x1/4	ASTM A8	N107	N108	Rigid	Rigid	Rigid	Rigid	Rigid	Rigid
TC007-0	HSS4x4x1/4	ASTM A8	N107-0	N108-0	Rigid	Rigid	Rigid	Rigid	Rigid	Rigid
V002	HSS4x3x1/4	ASTM A8	N002	N102	Rigid	Rigid	Rigid	Rigid	Rigid	Rigid
V002-0	HSS4x3x1/4	ASTM A8	N002-0	N102-0	Rigid	Rigid	Rigid	Rigid	Rigid	Rigid
V003	HSS4x3x1/4	ASTM A8	N003	N103	Rigid	Rigid	Rigid	Rigid	Rigid	Rigid
V003-0	HSS4x3x1/4	ASTM A8	N003-0	N103-0	Rigid	Rigid	Rigid	Rigid	Rigid	Rigid
V004	HSS4x3x1/4	ASTM A8	N004	N104	Rigid	Rigid	Rigid	Rigid	Rigid	Rigid
V004-0	HSS4x3x1/4	ASTM A8	N004-0	N104-0	Rigid	Rigid	Rigid	Rigid	Rigid	Rigid
V005	HSS4x3x1/4	ASTM A8	N005	N105	Rigid	Rigid	Rigid	Rigid	Rigid	Rigid
V005-0	HSS4x3x1/4	ASTM A8	N005-0	N105-0	Rigid	Rigid	Rigid	Rigid	Rigid	Rigid
V006	HSS4x3x1/4	ASTM A8	N006	N106	Rigid	Rigid	Rigid	Rigid	Rigid	Rigid
V006-0	HSS4x3x1/4	ASTM A8	N006-0	N106-0	Rigid	Rigid	Rigid	Rigid	Rigid	Rigid
V007	HSS4x3x1/4	ASTM A8	N007	N107	Rigid	Rigid	Rigid	Rigid	Rigid	Rigid
V007-0	HSS4x3x1/4	ASTM A8	N007-0	N107-0	Rigid	Rigid	Rigid	Rigid	Rigid	Rigid

Load Combination Summary

Factored Combination: Fatigue

Factor : Service Case

0.22 x WS

Factored Combination: LC 1) Strength I (PL)

Factor : Service Case

1.25 x DC

1.75 x PL

Factored Combination: LC 2) Strength I (LL)

Factor : Service Case

1.25 x DC

1.75 x LL

Factored Combination: LC 3) Strength III

Factor : Service Case

1.25 x DC

1.40 x WS

Member Uniform Loads

Load Cas	Member	Direction	Offset	ıd Offset	Force
			ft	ft	K/ft
DC	FB001	Force Y	0	6	-0.261
DC	FB002	Force Y	0	6	-0.511
DC	FB003	Force Y	0	6	-0.511
DC	FB004	Force Y	0	6	-0.511

DC	FB005	Force Y	0	6	-0.511
DC	FB006	Force Y	0	6	-0.511
DC	FB007	Force Y	0	6	-0.511
DC	FB008	Force Y	0	6	-0.261
PL	FB001	Force Y	0	6	-0.383
PL	FB002	Force Y	0	6	-0.75
PL	FB003	Force Y	0	6	-0.75
PL	FB004	Force Y	0	6	-0.75
PL	FB005	Force Y	0	6	-0.75
PL	FB006	Force Y	0	6	-0.75
PL	FB007	Force Y	0	6	-0.75
PL	FB008	Force Y	0	6	-0.383
WS	BC001	Force Z	0	8.167	0.062
WS	BC001-0	Force Z	0	8.167	0.062
WS	BC002	Force Z	0	8.333	0.062
WS	BC002-0	Force Z	0	8.333	0.062
WS	BC003	Force Z	0	8.333	0.062
WS	BC003-0	Force Z	0	8.333	0.062
WS	BC004	Force Z	0	8.333	0.062
WS	BC004-0	Force Z	0	8.333	0.062
WS	BC005	Force Z	0	8.333	0.062
WS	BC005-0	Force Z	0	8.333	0.062
WS	BC006	Force Z	0	8.333	0.062
WS	BC006-0	Force Z	0	8.333	0.062
WS	BC007	Force Z	0	8.167	0.062
WS	BC007-0	Force Z	0	8.167	0.062
WS	TC001	Force Z	0	8.167	0.062
WS	TC001-0	Force Z	0	8.167	0.062
WS	TC002	Force Z	0	8.333	0.062
WS	TC002-0	Force Z	0	8.333	0.062
WS	TC003	Force Z	0	8.333	0.062
WS	TC003-0	Force Z	0	8.333	0.062
WS	TC004	Force Z	0	8.333	0.062
WS	TC004-0	Force Z	0	8.333	0.062
WS	TC005	Force Z	0	8.333	0.062
WS	TC005-0	Force Z	0	8.333	0.062
WS	TC006	Force Z	0	8.333	0.062
WS	TC006-0	Force Z	0	8.333	0.062
WS	TC007	Force Z	0	8.167	0.062
WS	TC007-0	Force Z	0	8.167	0.062

Member Point Loads

Load Cas	Member	Direction	Offset	Force
			ft	K

LL	FB001	Force Y	0.75	-1.52
LL	FB001	Force Y	3.417	-1.52
LL	FB004	Force Y	0.75	-0.48
LL	FB004	Force Y	3.417	-0.48
LL	FB005	Force Y	0.75	-1.52
LL	FB005	Force Y	3.417	-1.52

Nodal Loads

Load Cas	Node	Direction	Force
			K
DC	N101	DY	-0.055
DC	N101-0	DY	-0.055
DC	N102	DY	-0.108
DC	N102-0	DY	-0.108
DC	N103	DY	-0.108
DC	N103-0	DY	-0.108
DC	N104	DY	-0.108
DC	N104-0	DY	-0.108
DC	N105	DY	-0.108
DC	N105-0	DY	-0.108
DC	N106	DY	-0.108
DC	N106-0	DY	-0.108
DC	N107	DY	-0.108
DC	N107-0	DY	-0.108
DC	N108	DY	-0.055
DC	N108-0	DY	-0.055

BR19-00321-3

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Company: BIG R BRIDGE, LLC Engineer: Eva Leong

VisualAnalysis 12.00.0020 Report

Nodal Displacements

Node	Result Case Nam	DX	DY	DZ
		in	in	in
N005	DC	0.041	-0.351	0.025
N005	LL	0.007	-0.109	0.016
N005	PL	0.045	-0.392	0.031
N005	WS	-0.042	-0.239	**0.987**

Member End Reactions

Member	Result Case Nam	Offset	Fx	Vy	Vz	Mx	My	Mz
		ft	K	K	K	K-ft	K-ft	K-ft
FB001	LC 1) Strength I (Pl	0	-0.072	3.035	**-0.045**	**0**	0.14	0.149
FB001	LC 1) Strength I (Pl	6	-0.072	-3.071	-0.045	0	-0.132	0.04
FB001	LC 2) Strength I (LL	0	-0.026	4.549	-0.013	-0.001	0.039	-0.221
FB001	LC 2) Strength I (LL	6	-0.026	-2.86	-0.013	-0.001	-0.042	-0.031
FB001	LC 3) Strength III	0	0.855	2.381	0.425	**-0.006**	-1.258	**-3.401**
FB001	LC 3) Strength III	6	0.855	0.292	0.425	-0.006	1.294	4.619
FB003	LC 1) Strength I (Pl	0	**-0.11**	**5.893**	0.094	-0.001	-0.279	-0.008
FB003	LC 1) Strength I (Pl	6	-0.11	**-5.95**	0.094	-0.001	0.283	-0.18
FB003	LC 2) Strength I (LL	0	-0.063	1.958	0.048	-0.001	-0.145	0.095
FB003	LC 2) Strength I (LL	6	-0.063	-2.01	0.048	-0.001	0.144	-0.062
FB003	LC 3) Strength III	0	**3.248**	3.745	**0.938**	-0.004	**-2.819**	-3.311
FB003	LC 3) Strength III	6	3.248	-0.223	0.938	-0.004	**2.81**	**7.255**

Member Internal Forces

Member	Result Case Nam	Offset	Fx	Vy	Vz	Mx	My	Mz
		ft	K	K	K	K-ft	K-ft	K-ft
BC004	LC 1) Strength I (Pl	0	54.55	0.02	0	0	-0.021	0.545
BC004	LC 1) Strength I (Pl	2.083	54.55	-0.01	0	0	-0.021	0.555
BC004	LC 1) Strength I (Pl	4.167	54.55	-0.04	0	0	-0.021	0.503
BC004	LC 1) Strength I (Pl	6.25	54.55	-0.07	0	0	-0.021	0.388
BC004	LC 1) Strength I (Pl	8.333	54.591	-0.101	0	0	-0.021	0.211
BC004	LC 2) Strength I (LL	0	30.112	0.037	-0.005	-0.031	0.004	0.282
BC004	LC 2) Strength I (LL	2.083	30.112	0.008	-0.005	-0.031	-0.007	0.329
BC004	LC 2) Strength I (LL	4.167	30.112	-0.022	-0.005	-0.031	-0.018	0.313
BC004	LC 2) Strength I (LL	6.25	30.112	-0.052	-0.005	-0.031	-0.029	0.235
BC004	LC 2) Strength I (LL	8.333	31.503	0.905	-0.005	-0.031	-0.04	0.28
BC004	LC 3) Strength III	0	53.291	0.017	-0.366	-0.032	-1.416	0.283

BC004	LC 3) Strength III	2.083	53.291	-0.012	-0.187	-0.032	-1.991	0.288
BC004	LC 3) Strength III	4.167	53.291	-0.042	-0.007	-0.032	-2.193	0.231
BC004	LC 3) Strength III	6.25	53.291	-0.072	0.174	-0.032	-2.018	0.11
BC004	LC 3) Strength III	8.333	53.414	-0.044	0.354	-0.032	-1.47	-0.06
BD001	Fatigue	0	2.19	0	0	0	0	0
BD001	Fatigue	2.533	2.19	0	0	0	0	0
BD001	Fatigue	5.067	2.19	0	0	0	0	0
BD001	Fatigue	7.6	2.19	0	0	0	0	0
BD001	Fatigue	10.134	2.19	0	0	0	0	0
BD001	LC 1) Strength I (PL	0	0.231	0.053	0	0	0	0
BD001	LC 1) Strength I (PL	2.533	0.231	0.026	0	0	0	0.1
BD001	LC 1) Strength I (PL	5.067	0.231	0	0	0	0	0.133
BD001	LC 1) Strength I (PL	7.6	0.231	-0.026	0	0	0	0.1
BD001	LC 1) Strength I (PL	10.134	0.231	-0.053	0	0	0	0
BD001	LC 2) Strength I (LL	0	0.097	0.053	0	0	0	0
BD001	LC 2) Strength I (LL	2.533	0.097	0.026	0	0	0	0.1
BD001	LC 2) Strength I (LL	5.067	0.097	0	0	0	0	0.133
BD001	LC 2) Strength I (LL	7.6	0.097	-0.026	0	0	0	0.1
BD001	LC 2) Strength I (LL	10.134	0.097	-0.053	0	0	0	0
BD001	LC 3) Strength III	0	14.017	0.053	0	0	0	0
BD001	LC 3) Strength III	2.533	14.017	0.026	0	0	0	0.1
BD001	LC 3) Strength III	5.067	14.017	0	0	0	0	0.133
BD001	LC 3) Strength III	7.6	14.017	-0.026	0	0	0	0.1
BD001	LC 3) Strength III	10.134	14.017	-0.053	0	0	0	0
D001	LC 1) Strength I (PL	0	32.844	0.034	0	0	0	0
D001	LC 1) Strength I (PL	2.509	32.832	0.017	0	0	0	0.064
D001	LC 1) Strength I (PL	5.018	32.82	0	0	0	0	0.086
D001	LC 1) Strength I (PL	7.527	32.808	-0.017	0	0	0	0.064
D001	LC 1) Strength I (PL	10.036	32.796	-0.034	0	0	0	0
D001	LC 2) Strength I (LL	0	16.394	0.034	0	0	0	0
D001	LC 2) Strength I (LL	2.509	16.382	0.017	0	0	0	0.064
D001	LC 2) Strength I (LL	5.018	16.37	0	0	0	0	0.086
D001	LC 2) Strength I (LL	7.527	16.358	-0.017	0	0	0	0.064
D001	LC 2) Strength I (LL	10.036	16.345	-0.034	0	0	0	0
D001	LC 3) Strength III	0	18.798	0.034	0	0	0	0
D001	LC 3) Strength III	2.509	18.785	0.017	0	0	0	0.064
D001	LC 3) Strength III	5.018	18.773	0	0	0	0	0.086
D001	LC 3) Strength III	7.527	18.761	-0.017	0	0	0	0.064
D001	LC 3) Strength III	10.036	18.749	-0.034	0	0	0	0
D002	LC 1) Strength I (PL	0	21.715	0.026	0	0	0	0
D002	LC 1) Strength I (PL	2.467	21.706	0.013	0	0	0	0.047
D002	LC 1) Strength I (PL	4.934	21.696	0	0	0	0	0.063
D002	LC 1) Strength I (PL	7.4	21.687	-0.013	0	0	0	0.047
D002	LC 1) Strength I (PL	9.867	21.678	-0.026	0	0	0	0

D002	LC 2) Strength I (LL	0	11.95	0.026	0	0	0	0
D002	LC 2) Strength I (LL	2.467	11.941	0.013	0	0	0	0.047
D002	LC 2) Strength I (LL	4.934	11.931	0	0	0	0	0.063
D002	LC 2) Strength I (LL	7.4	11.922	-0.013	0	0	0	0.047
D002	LC 2) Strength I (LL	9.867	11.913	-0.026	0	0	0	0
D002	LC 3) Strength III	0	12.692	0.026	0	0	0	0
D002	LC 3) Strength III	2.467	12.682	0.013	0	0	0	0.047
D002	LC 3) Strength III	4.934	12.673	0	0	0	0	0.063
D002	LC 3) Strength III	7.4	12.664	-0.013	0	0	0	0.047
D002	LC 3) Strength III	9.867	12.654	-0.026	0	0	0	0
EV1	LC 1) Strength I (PL	0	-22.469	-0.257	-0.045	-0.101	0.054	0.977
EV1	LC 1) Strength I (PL	1.458	-19.414	-0.303	0.026	0.039	-0.11	0.582
EV1	LC 1) Strength I (PL	2.917	-19.393	-0.303	0.026	0.039	-0.071	0.132
EV1	LC 1) Strength I (PL	4.375	-19.372	-0.303	0.026	0.039	-0.033	-0.306
EV1	LC 1) Strength I (PL	5.833	-19.351	-0.303	0.026	0.039	0.007	-0.756
EV1	LC 2) Strength I (LL	0	-14.361	-0.144	-0.034	-0.1	-0.097	0.516
EV1	LC 2) Strength I (LL	1.458	-9.792	-0.158	-0.007	-0.061	0.093	0.302
EV1	LC 2) Strength I (LL	2.917	-9.771	-0.158	-0.007	-0.061	0.083	0.068
EV1	LC 2) Strength I (LL	4.375	-9.75	-0.158	-0.007	-0.061	0.072	-0.16
EV1	LC 2) Strength I (LL	5.833	-9.729	-0.158	-0.007	-0.061	0.061	-0.394
EV1	LC 3) Strength III	0	-13.602	-0.564	**0.397**	0.438	-0.546	0.714
EV1	LC 3) Strength III	1.458	-11.2	-0.139	-0.458	-0.821	2.842	0.195
EV1	LC 3) Strength III	2.917	-11.179	-0.139	-0.458	-0.821	2.162	-0.011
EV1	LC 3) Strength III	4.375	-11.158	-0.139	-0.458	-0.821	1.497	-0.212
EV1	LC 3) Strength III	5.833	-11.137	-0.139	-0.458	-0.821	0.817	-0.417
TC004	LC 1) Strength I (PL	0	-54.572	0.133	0	0	-0.044	0.203
TC004	LC 1) Strength I (PL	2.083	-54.613	0.041	0	0	-0.043	0.33
TC004	LC 1) Strength I (PL	4.167	-54.613	0.011	0	0	-0.043	0.385
TC004	LC 1) Strength I (PL	6.25	-54.613	-0.019	0	0	-0.043	0.378
TC004	LC 1) Strength I (PL	8.333	-54.613	-0.049	0	0	-0.043	0.307
TC004	LC 2) Strength I (LL	0	-30.134	**1.129**	0.009	0.004	-0.062	-0.127
TC004	LC 2) Strength I (LL	2.083	-31.525	0.048	0.009	0.004	-0.044	0.2
TC004	LC 2) Strength I (LL	4.167	-31.525	0.018	0.009	0.004	-0.026	0.269
TC004	LC 2) Strength I (LL	6.25	-31.525	-0.012	0.009	0.004	-0.008	0.276
TC004	LC 2) Strength I (LL	8.333	-31.525	-0.042	0.009	0.004	0.011	0.219
TC004	LC 3) Strength III	0	-30.491	0.161	-0.354	-0.007	-1.338	0.243
TC004	LC 3) Strength III	2.083	-30.613	0.01	-0.176	-0.007	-1.882	0.317
TC004	LC 3) Strength III	4.167	-30.613	-0.02	0.006	-0.007	-2.061	0.306
TC004	LC 3) Strength III	6.25	-30.613	-0.05	0.185	-0.007	-1.863	0.234
TC004	LC 3) Strength III	8.333	-30.613	-0.08	0.366	-0.007	-1.284	0.097
V002	LC 1) Strength I (PL	0	-19.006	**-0.591**	-0.229	0.106	-0.036	**1.351**
V002	LC 1) Strength I (PL	1.458	-13.015	-0.559	-0.054	0.009	0.169	0.536
V002	LC 1) Strength I (PL	2.917	-12.997	-0.559	-0.054	0.009	0.088	-0.294
V002	LC 1) Strength I (PL	4.375	-12.979	-0.559	-0.054	0.009	0.01	-1.104

V002	LC 1) Strength I (Pl	5.833	-12.961	-0.559	-0.054	0.009	-0.071	**-1.934**
V002	LC 2) Strength I (LL	0	-9.339	-0.314	-0.099	0.018	0.053	0.705
V002	LC 2) Strength I (LL	1.458	-7.316	-0.293	-0.01	-0.046	0.003	0.275
V002	LC 2) Strength I (LL	2.917	-7.297	-0.293	-0.01	-0.046	-0.012	-0.159
V002	LC 2) Strength I (LL	4.375	-7.279	-0.293	-0.01	-0.046	-0.026	-0.583
V002	LC 2) Strength I (LL	5.833	-7.261	-0.293	-0.01	-0.046	-0.041	-1.017
V002	LC 3) Strength III	0	-10.777	-0.415	**-1.41**	-0.149	0.29	0.777
V002	LC 3) Strength III	1.458	-7.735	-0.292	-0.544	-0.531	2.359	0.266
V002	LC 3) Strength III	2.917	-7.717	-0.292	-0.544	-0.531	1.553	-0.168
V002	LC 3) Strength III	4.375	-7.699	-0.292	-0.544	-0.531	0.765	-0.592
V002	LC 3) Strength III	5.833	-7.681	-0.292	-0.544	-0.531	-0.042	-1.026

Project: Pressentin Park Side Channel Restoration and Recreational Improvements Project

Date:

SCHEDULE "H" -- HABITAT ELEMENTS

BID ITEM	SPEC REF	STD ITEM	ITEM DESCRIPTION	UNIT MEASURE	APPROX. QUANTITY	UNIT PRICE	COST
H-001	1-09.7	0001	MOBILIZATION	LS	1		
H-002	1-04.4(1)	7728	MINOR CHANGE	EST	FA	$ 10,000.00	$ 10,000.00
H-003	1-05.4	7038 GSP	HABITAT SURVEYING	LS	1		
H-004	1-05.18 SP	SPECIAL	HABITAT RECORD DRAWINGS (MINIMUM BID $4,000)	LS	1		
H-005	1-07.15(1)	7736	SPCC PLAN	LS	1		
H-006	1-07.16(4)	SPECIAL	ARCHAEOLOGICAL AND HISTORICAL SALVAGE	EST	FA	$ 30,000.00	$ 30,000.00
H-007	1-10.05(1)	6971 GSP	PROJECT TEMPORARY TRAFFIC CONTROL	LS	1		
H-008	2-01.5 SP	SPECIAL	CLEARING	AC	3		
H-009	2-01.5	0025	CLEARING AND GRUBBING	AC	5		
H-010	2-03.5	1035	CHANNEL EXCAVATION	CY	34300		
H-011	2-03.5	0400	CHANNEL EXCAVATION INCL. HAUL	CY	12100		
H-012	2-03.5 SP	SPECIAL	EMBANKMENT COMPACTION - TERRACE CAP NEAR DAY USE AREA	CY	986		
H-013	2-03.5 SP	SPECIAL	EMBANKMENT COMPACTION - ORCHARD GRADING (EAST)	CY	3075		
H-014	2-03.5 SP	SPECIAL	EMBANKMENT COMPACTION - MEADOW GRADING (WEST)	CY	16102		
H-015	2-03.5 SP	SPECIAL	EMBANKMENT COMPACTION - DAY USE AREA	CY	1751		
H-016	6-20.5 SP	SPECIAL	INSTALL PEDESTRIAN BRIDGE #1 (83.5 FT)	LS	1		
H-017	6-20.5 SP	SPECIAL	INSTALL VEHICLE BRIDGE #2 (78.5 FT)	LS	1		
H-018	6-20.5 SP	SPECIAL	INSTALL PEDESTRIAN BRIDGE #3 (58.5 FT)	LS	1		
H-019	6-21.5 SP	SPECIAL	FURNISH AND INSTALL GRS ABUTMENTS FOR PEDESTRIAN BRIDGE #1	LS	1		
H-020	6-21.5 SP	SPECIAL	FURNISH AND INSTALL GRS ABUTMENTS FOR VEHICLE BRIDGE #2	LS	1		
H-021	6-21.5 SP	SPECIAL	FURNISH AND INSTALL GRS ABUTMENTS FOR PEDESTRIAN BRIDGE #3	LS	1		
H-022	8-01.5	6630	HIGH VISIBILITY FENCE	LF	80		
H-023	8-01.5	6490	EROSION CONTROL AND WATER POLLUTION PREVENTION	LS	1		
H-024	8-01.5 SP	SPECIAL	HOG FUEL	CY	2,135		
H-025	8-02.5 SP	SPECIAL	TOPSOIL TYPE B - SIDE CHANNEL	CY	3,590		
H-026	8-02.5 SP	SPECIAL	SEEDING, FERTILIZING, AND MULCHING - EROSION CONTROL SEEDING	AC	6		
H-027	8-05.5 SP	SPECIAL	INLET ELS TYPE 1, N1-1 AND N1-2	EA	2		
H-028	8-05.5 SP	SPECIAL	INLET ELS TYPE 1, N1-3 AND N1-4	EA	2		
H-029	8-05.5 SP	SPECIAL	INLET ELS TYPE 2	EA	4		
H-030	8-05.5 SP	SPECIAL	HABITAT ELS TYPE 1	EA	6		
H-031	8-05.5 SP	SPECIAL	HABITAT ELS TYPE 2	EA	31		
H-032	8-05.5 SP	SPECIAL	HABITAT ELS TYPE 3	EA	14		
H-033	8-05.5 SP	SPECIAL	OUTLET ELS	EA	1		
						SubTotal Schedule H:	

The above unit prices shall be utilized for any additive and deductive work within 15% of the TOTAL CONTRACT ESTMATED BID QUANTITY. The unit price shall provide the contractor with full compensation for the cost of labor, materials, equipment, overhead, profit and any additional costs associated with the unit bid.

Project Pressentin Park Side Channel Restoration and Recreational Improvements Project   Date: ____________

SCHEDULE "R" -- RECREATION ELEMENTS

BID ITEM	SPEC REF	STD ITEM	ITEM DESCRIPTION	UNIT MEASURE	APPROX. QUANTITY	UNIT PRICE	COST
R-001	1-09.7	0001	MOBILIZATION	LS	1		
R-002	1-04.4(1)	7728	MINOR CHANGE	EST	FA	$ 10,000.00	$ 10,000.00
R-003	1-05.4	7038 GSP	RECREATION SURVEYING	LS	1		
R-004	1-05.18 SP	SPECIAL	RECREATION RECORD DRAWINGS (MINIMUM BID $4,000)	LS	1		
R-005	1-07.15(1)	7736	SPCC PLAN	LS	1		
R-006	2-03.5 SP	SPECIAL	EXCAVATION INCLUDING HAUL	CY	80		
R-007	2-03.5	0470	EMBANKMENT COMPACTION - RAISED GRASS TENT PADS	CY	20		
R-008	2-03.5	0470	EMBANKMENT COMPACTION - VEHICLE ACCESS ROADS AND TRAILS	CY	1,731		
R-009	2-12.5 SP	SPECIAL	HIGH VISIBILITY FENCE MATERIAL	SY	5,000.0		
R-010	2-12.5	7552	CONSTRUCTION GEOTEXTILE FOR SOIL STABILIZATION	SY	130		
R-011	2-12.5	7550	CONSTRUCTION GEOTEXTILE FOR UNDERGROUND DRAINAGE	SY	180		
R-012	4-04.5 SP	SPECIAL	CRUSHED SURFACING TOP COURSE: 3/8" - 0"	TON	1,500.0		
R-013	4-04.5	5120	CRUSHED SURFACING TOP COURSE (CSTC)	TON	98		
R-014	5-04.5	5875	COMMERCIAL HMA	TON	41.0		
R-015	7-05.5 SP	SPECIAL	GRAVEL BACKFILL FOR DRYWELLS	CY	16		
R-016	7-09.5 SP	SPECIAL	1 1/2" POLYETHYLENE WATER SERVICE	LF	575		
R-017	7-09.5	3838	BLOWOFF ASSEMBLY	EA	2		
R-018	7-09.5 SP	SPECIAL	YARD HYDRANT	EA	1		
R-019	7-09.5	7017	GRAVEL BACKFILL FOR PIPE ZONE BEDDING	CY	24		
R-020	8-01.5	6490	EROSION CONTROL AND WATER POLLUTION PREVENTION	LS	1		
R-021	8-02.3(2)B	SPECIAL	WEED AND PEST CONTROL PLAN	LS	1		
R-022	8-02.5	6414	SEEDING, FERTILIZING, AND MULCHING - PARK SEED MIX	AC	2		
R-023	8-02.5 SP	SPECIAL	ENGINEERED WOOD FIBER MULCH	CY	10		
R-024	8-04.5 SP	SPECIAL	CEMENT CONCRETE CURB	LF	49		
R-025	8-06.5 SP	SPECIAL	CEMENT CONCRETE PADS	SY	55		
R-026	8-14.5	7055	CEMENT CONCRETE SIDEWALK	SY	50		
R-027	8-19.5 SP	SPECIAL	2-3 MAN ROCK SCRAMBLE BOULDER	EA	14		
R-028	8-19.5 SP	SPECIAL	4-5 MAN ROCK SCRAMBLE BOULDER	EA	5		
R-029	8-19.5 SP	SPECIAL	TRAIL AND CAMPGROUND EDGE ROCKS	TON	23		
R-030	8-19.5 SP	SPECIAL	MOUND SLIDE	EA	1		
R-031	8-19.5 SP	SPECIAL	BICYCLE RACK	EA	6		
						SubTotal Schedule R:	

Schedule R Additive Alternate Bid Items

R-032	**8-26**	**SPECIAL**	**ALTERNATE A1 MEADOW PICNIC SHELTER**	**EA**	**1**		
R-033	**8-26**	**SPECIAL**	**ALTERNATE A2 ORCHARD PICNIC SHELTER**	**EA**	**1**		

The above unit prices shall be utilized for any additive and deductive work within 15% of the TOTAL CONTRACT ESTMATED BID QUANTITY. The unit price shall provide the contractor with full compensation for the cost of labor, materials, equipment, overhead, profit and any additional costs associated with the unit bid.

BIDDER'S QUALIFICATION CERTIFICATE

The undersigned hereby certifies and submits the following qualifications:

I. Name and Address ____

2. Washington Registration No. _____________ Expires: _______/_______/_______(M/D/Y)

3. Number of years in contracting business under present name: ______ years

4. Particular types of construction work performed by your company:

____

____

5. List and provide a brief summary of several recent construction projects performed that meet the **SUPPLEMENTAL RESPONSIBLE BIDDER CRITERIA** as specified in this contract:

Project 1 Name:____

Contractor project manager name and phone number:____________________________

____

Owner name and phone number:____

____

Owner's project manager name and phone number:______________________________

____

Description of project and how project meets Supplemental Responsible Bidder

Criteria:____

____

____

____

____

Initial contract value:_____________________

Final contract value:_____________________

Initial contract time:______________________ to ______________________

Final contract time:______________________ to ______________________

Hydraulic Project Approval Permit Number:____

Project 2 Name:____

Contractor project manager name and phone number:________________________________

____

Owner name and phone number:____

____

Owner's project manager name and phone number:__________________________________

____

Description of project and how project meets Supplemental Responsible Bidder Criteria:_____________

____

____

____

____

Initial contract value:______________________

Final contract value:______________________

Initial contract time:______________________ to ______________________

Final contract time:______________________ to ______________________

Hydraulic Project Approval Permit Number:_________

Project 3 Name:____

Contractor project manager name and phone number:________________________________

____

Owner name and phone number:____

____

Owner's project manager name and phone number:__________________________________

____

Description of project and how project meets Supplemental Responsible Bidder Criteria:_____________

____

____

____

____

Initial contract value:____________________

Final contract value:____________________

Initial contract time:____________________ to ____________________

Final contract time:____________________ to ____________________

Hydraulic Project Approval Permit Number:____

Project 4 Name:____

Contractor project manager name and phone number:____________________________________

____

Owner name and phone number:____

____

Owner's project manager name and phone number:_______________________________________

____

Description of project and how project meets Supplemental Responsible Bidder Criteria:____

____

____

____

____

Initial contract value:____________________

Final contract value:____________________

Initial contract time:____________________ to ____________________

Final contract time:____________________ to ____________________

Hydraulic Project Approval Permit Number:____

Project 5 Name: ____

Contractor project manager name and phone number:____________________________________

____

Owner name and phone number:____

____

Owner's project manager name and phone number:_______________________________________

____

Description of project and how project meets Supplemental Responsible Bidder Criteria:____________

____

____

____

____

Initial contract value:____________________

Final contract value:____________________

Initial contract time:____________________ to ____________________

Final contract time:____________________ to ____________________

Hydraulic Project Approval Permit Number:____

Project 6 Name: ____

Contractor project manager name and phone number:______________________________

____

Owner name and phone number:____

____

Owner's project manager name and phone number:_____________________________

____

Description of project and how project meets Supplemental Responsible Bidder Criteria:____________

____

____

____

____

Initial contract value:____________________

Final contract value:____________________

Initial contract time:____________________ to ____________________

Final contract time:____________________ to ____________________

Hydraulic Project Approval Permit Number:____

6. Gross amount of contracts now in hand $____

7. Bank Reference(s):

Name Address Account No. Type

a. ____

b. ____

By:__________________________________ Title:______________________
(Authorized Signature)

8. Litigation Background (all projects in past 5 years resulting in partial or final settlement of the contract by arbitration or litigation in the courts):

Client Contract Amount Total $ claims Settlement $

a. ____

b. ____

9. Choose one of the following:

☐ Bidder has Industrial Insurance coverage for employees working in Washington as required in Title 51 RCW; or

☐ Bidder is not required to have Industrial Insurance coverage as required in Title 512 RCW.

10. Choose one of the following:

☐ Bidder's Washington Employment Security Department registration number is _______________________; or

☐ Bidder is not required to register with the Washington Employment Security Department pursuant to Title 50 RCW.

11. Choose one of the following:

☐ Bidder' Washington State Department of Revenue registration number is: _______________________; or

☐ Bidder is not required to register with the Washington State Department of Revenue pursuant to Title 82 RCW.

I am the _______________________ (title) of Bidder, have authority to bind Bidder, am over the age of 18, and have personal knowledge of the facts set forth above.

Dated this ___________ day of ____________________, 2021, at _____________________ (city),

_______________________ (state).

Signature ____

Print Name ______________________________________

Title ____

End of Bidder's Qualification Certificate