6.0 Bridge Design

6.1 Field Check

Plan details for the field check portion of the design process are intended to familiarize our offices and departments with the site before physically visiting the site. The components discussed below are necessary elements of the skeleton of the final project plans. The onsite field check meeting to discuss important details of the project will produce a strategy for the remaining design of the project. This strategy will be enhanced depending on the amount of information provided to BLP in the field check plans. This section explains the bare minimum of what to include on each sheet required for field check plans. If, however, more information is available to the consultant, additional sheets and additional design information may be added to aid in better describing the overall project site, and aid in the cooperative effort of developing the final set of design plans.

The KDOT Bridge Design Manual available on the KDOT Authentication & Resource Tracking website (KART) includes recommendations of efficient span lengths depending on the superstructure type. Reference the following sections in the KDOT Bridge Design Manual for guidance. If the bridge design will not meet these recommendations, notify the BLP Project Manager with an explanation prior to the field check meeting.

- General — "Efficient" Length of Span Range Table, Chapter 2
- Prestressed Beams — Available K-Sections and NU-Sections Table, Chapter 5
- Steel Beams — Chapter 6

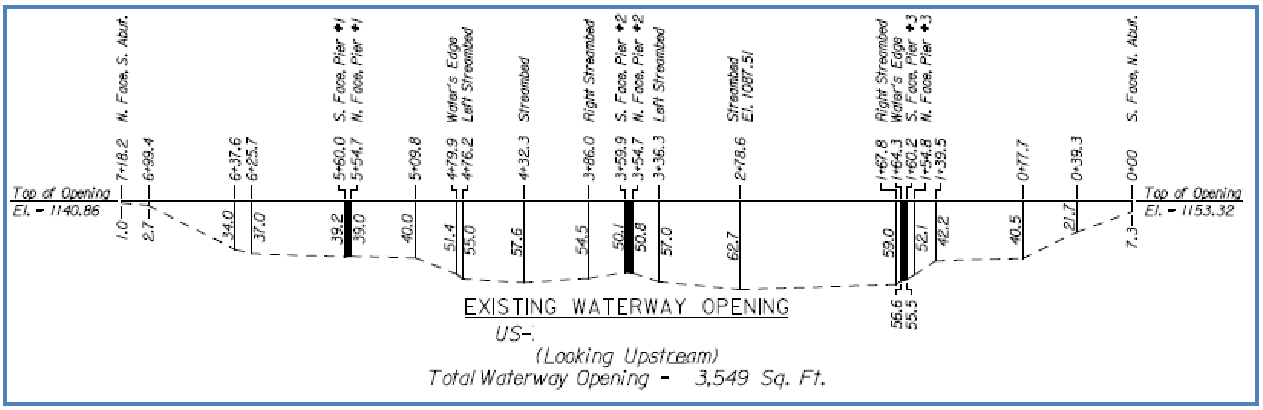
6.1.1 Bridge Plan Assembly

For all bridge length structures, the field check plan should contain, as a minimum, a Contour Map, a Construction Layout at the site of the bridge, and a typical section of the proposed bridge. As a typical drafting standard, the text on each sheet should be readable from either the bottom of the sheet or the right side of the sheet. As a rule of thumb, field check defines the point where the plans should be approximately 50% complete; however, the total of the bridge sheets may be at only 15-20% complete. At the time of Field Check, the probable structure has been decided upon, with span lengths and location of the bridge decided and the design of the bridge itself has advanced. Once this information has been confirmed by the participants at the field check meeting, the last major aspect, investigating geology, can be organized to allow the design of the bridge to progress to final stages. The three primary sheets necessary for field check plans will be mostly complete by the time of submittal.

A fifteen-digit structure ID is required for every bridge-length structure on the local system. The existing structure ID must be retired and removed from the National Bridge Inventory (NBI) if the bridge is replaced. A new structure ID must be assigned by KDOT BLP to any newly constructed bridge-length structure. If a particular number is desired by the owner to maintain their own numbering system for new bridges, this number must be decided upon and communicated to the consultant and KDOT BLP before field check plan submittal. The owner shall send an email to KDOT.BLPBridge@ks.gov to request a NBI number for the new structure. If the desired number is not on the field check plans, or no particular number is desired by the local public authority (LPA), a number will be assigned and reserved by BLP Bridge during the field check review stage of plan development. The designer shall include the new NBI number in the title block of all the bridge detail sheets.

6.1.2 Contour Map

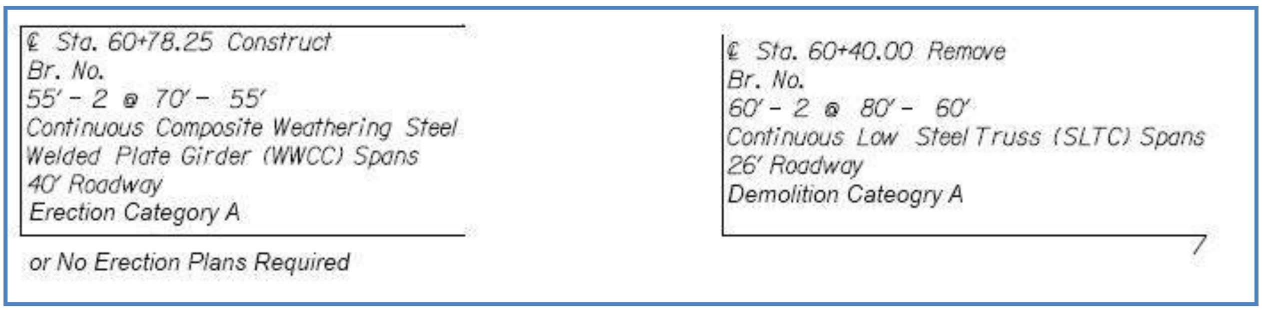
Using data compiled from a recent survey, the plan sheet contours shall be plotted at 2'-0" intervals in most cases. The typical scale for a contour map will be 1" = 50'. The contour map plan sheet shall include a simple line sketch elevation view of the existing waterway opening (and any adjacent structures) with substructure elements depicted, along with station and actual elevation or relative elevation of pertinent features such as bottom of streambed, top of opening, etc.



Plan view shall include:

- At least two P.O.T. references
- Centerline curve data if applicable
- Centerline with stations above or to the right
- Section, township, and range with property owner information
- Type of land use
- Any structures, fence lines, drainage structures, etc.
- Location, type, and size of utilities and owner information
- Stream name and direction of flow
- Contours at 2' intervals
- Existing road, path or rail and all existing structures
- Existing right-of-way and existing easements
- Proposed improvements, right-of-way, easements, construction limits
- Proposed bridge
- Proposed channel changes or improvements with stations, elevations, and line sketch of proposed typical cross-sections
- Shoofly detour alignment and structures, if applicable
- If possible, indicate where historic high-water elevation was established

- Standard north arrow with selected scale of the sheet
- "Remove" callout for the existing bridge, including the old NBI bridge number and demolition category
- "Construct" callout for the new bridge including the station at centerline, the new NBI bridge number and a short bridge description with the four-character structure designation. Also include the erection category. If no erection plans are required by KDOT Specifications, it is recommended the designer state "Erection Plans Not Required" instead of the erection category. There are some structures where the KDOT Specifications do not require erection plans but do require falsework plans. A note indicating "Category (X) Falsework" within the "Construct" callout is recommended in this case.



Several notes pertaining to the removal of the structure may be needed. If the bridge is steel and may have paint containing lead, this needs to be clearly stated on the contour map, as well as on any other sheets involving removal. If there is conclusive evidence or testing has indicated the use of lead paint on the existing bridge, state this in a note on the sheet. Disposal of this material will fall under the contractor's responsibility if there is no salvage on the part of the county. The LPA may wish to salvage part of the existing bridge so a note should specify what elements will be salvaged, where it will be stockpiled, and who will remove the material from the site. If the LPA does not wish to salvage any part of the bridge, it is recommended to place a note stating the same so the issue is clearly addressed and dismissed, or simply include the information in the note specifying the contractor will remove the existing bridge and remove the material from the site and the county does not wish to salvage any part of the bridge.

Any critical path notes should be placed on the sheet to aid in the overall construction plan. For example, if a channel change or channel improvement is required on a proposed project with limited headroom under the bridge, or if special bridge spill slopes and slope protection are to be constructed at the site, a note stating the grading contractor is required to excavate and complete the channel or spill slopes prior to construction of the bridge should be included.

If the location of the historic high-water elevation was established as a general observation like "the bridge overtopped in 2009 by approximately 1 to 2 feet according to local residents," place a note stating the same on the Contour Map. If a known elevation is achieved using visible drift, or high-water marks, indicate the location on the plan view and include a note stating how the elevation was established.

6.1.3 Construction Layout

The Construction Layout sheet should be at a larger scale as compared to the Contour Map so additional detail can be seen, detailed and dimensioned. 1" = 20' is a typical scale used for the sheet but may be increased if needed for easier dimensioning and labeling. This sheet will detail and dimension a plan view and an elevation view of the bridge along with various pieces of information pertinent to the bridge and construction site characteristics.

6.1.3.1 Compliance Requirements

The Construction Layout sheet will typically include contours at 2'-0" intervals like the Contour Map sheet. If the site is fairly level and 2'-0" contour intervals do not display enough detail, tighten the contour interval 1'-0". Always include a standard North arrow with the selected scale on the sheet.

B.M. #16 ¾" bolt head in SE end of S hubguard of bridge over Blue River
81.8' Lt. ℄Sta 56+81.0 Elev = 1146.04

B.M. #17 ¾" bolt head in NW end of N hubguard Big Blue River Bridge
118.7' Lt. ℄Sta 64+33.5 Elev - 1159.32

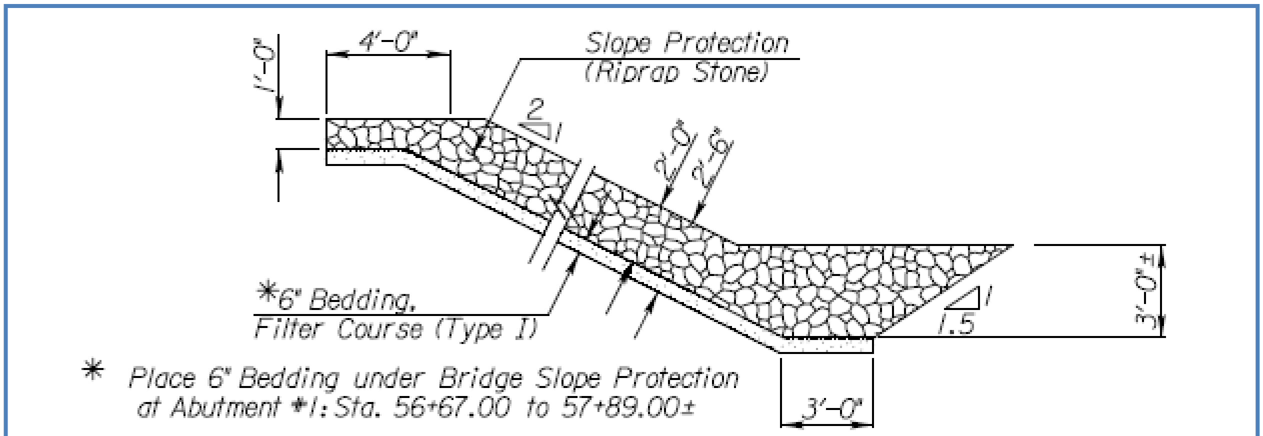
The designer should attempt to show a minimum of two benchmarks within the plan view limits, preferably on opposite sides/ends of the bridge. If the increased scale prevents locating the benchmarks on the plan view on the sheet, describe the locations and state the established elevation. The reference datum description typically placed on the first Plan and Profile sheet will likely need to be repeated on the Contour Map and Construction Layout sheets to simplify the process if the bridge sheets are separated out from the rest of the plan sheets for subcontractors' uses.

Centerline project and baseline should be clearly indicated. Stationing along project centerline should be shown in proportion to the project limits. Existing streambed and proposed streambed (and stationing) is to be clearly defined as well as the name of the stream and the flow direction. Also indicate direction of flow for railroad ditches if applicable.

Proposed foundation types and locations should be shown to aid in the geology investigation. Occasionally the project scope does not support the need for a separate geology sheet so the information provided by the final Geology Report will be placed on the Construction Layout sheet after the investigation.

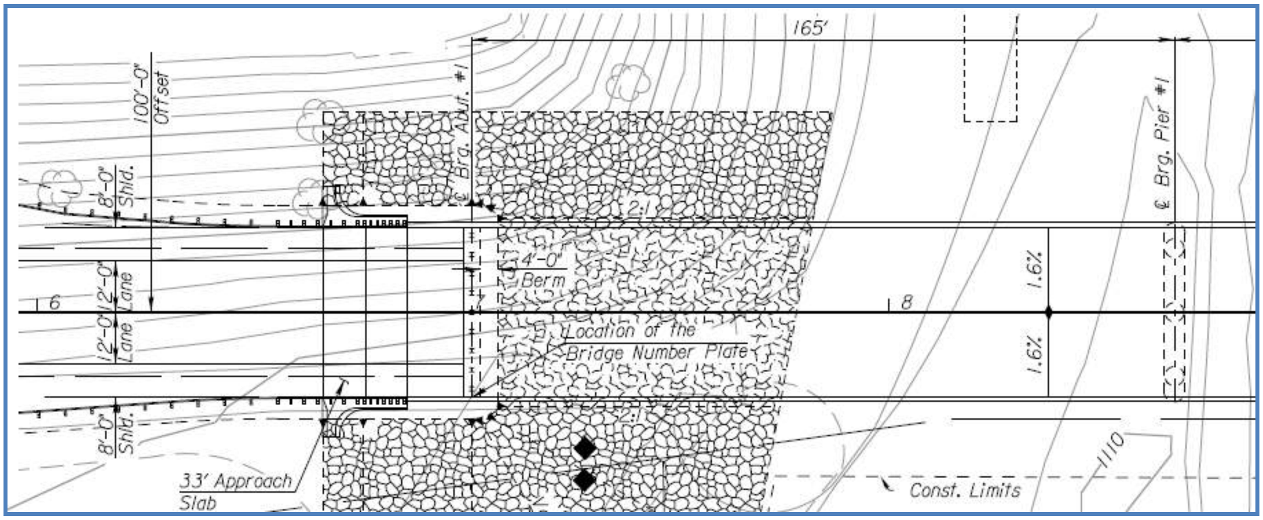
The extents of slope protection, shot rock, gabions, drip lines, walls, or other proposed bridges should be shown on the layout graphically with dimensions. Additionally, any channel improvements need to be detailed within the plan view along with section views of the improvements for construction purposes.

The bridge information in the plan view shall include:



ABUTMENT #1 SLOPE PROTECTION DETAIL
(Section A-A)

- Stationing
- Span dimensions from bearing to bearing
- Callout of substructure unit numbers
- Approach slab sizes
- Lane and shoulder width dimensions on each end of the bridge
- Proposed roadway width on the bridge (24' minimum)
- Proposed width of the rails or barriers
- Inside face of rail or barrier to crown grade dimension on each side of crown grade
- Cross-slope grades on each side of crown grade
- Crown grade offset from centerline dimension (if applicable)
- Proposed berm dimension at each abutment
- Location of bridge project marker plate (if applicable) (bridge project marker plates are non-participating items)
- Limits of slope protection at each abutment both graphically and dimensionally if the entire limits can fit within the trimmed view of the bridge at the increased scale.
- Indicate if the owner wishes to have a header board installed to protect the end of wearing surface of the bridge on light type surfacing roadways.

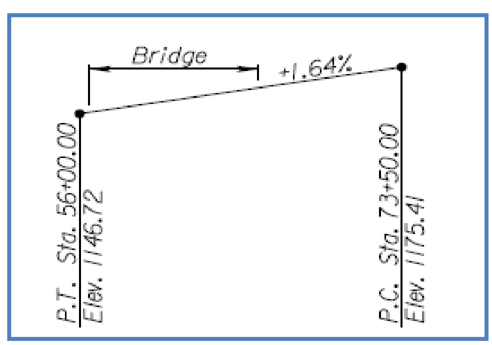


6.1.3.2 Elevation View

The elevation view provides a macro-view of the proposed bridge and the foundation elements. It is important to modify the scale for both plan and elevation view to accomplish the level of detail necessary on the sheet. The elevation is typically a longitudinal section at the centerline or crown grade of the bridge. All stations and top of deck elevations will be taken at the crown grade, profile grade or centerline of the bridge depending on the complexity of the bridge and the designer's preference. It is useful to include the graphic representation and dimensions from the nearest new foundations to the foundation elements of the existing bridge as information the bridge contractor may need in preparing a bid.

Each end of wearing surface (EWS) and centerline (CL) bearing will be labeled with an element number (Abutment 1, Pier 1, etc.), station to the nearest 0.01 foot, and elevation for top of deck to the nearest 0.01 foot. The elevations will be labeled according to which project line is used (crown grade, profile grade, etc.). Dimension individual span lengths, the remaining distance between centerline of abutment to EWS, as well as the entire EWS to EWS length.

Callout the grade of the roadway, if constant, or simply label as crown grade vertical curve or something similar and provide a line sketch of the vertical curve near the elevation view. This sketch should contain a not-to-scale graphic of the vertical curve including all pertinent curve information and show the bridge location relative to the curve. Horizontal curve data, if applicable, should also be stated on this sheet for further discussion during a field check meeting.



Include elevations of top of pile or top of shaft, top of berm, and various hydraulic elevations including ordinary high water (OHW), design high water, and historic high water. Also include the clearance dimension to low structure from design high water and show the excavation boundary plane line and elevation.

6.1.3.3 Drainage Data

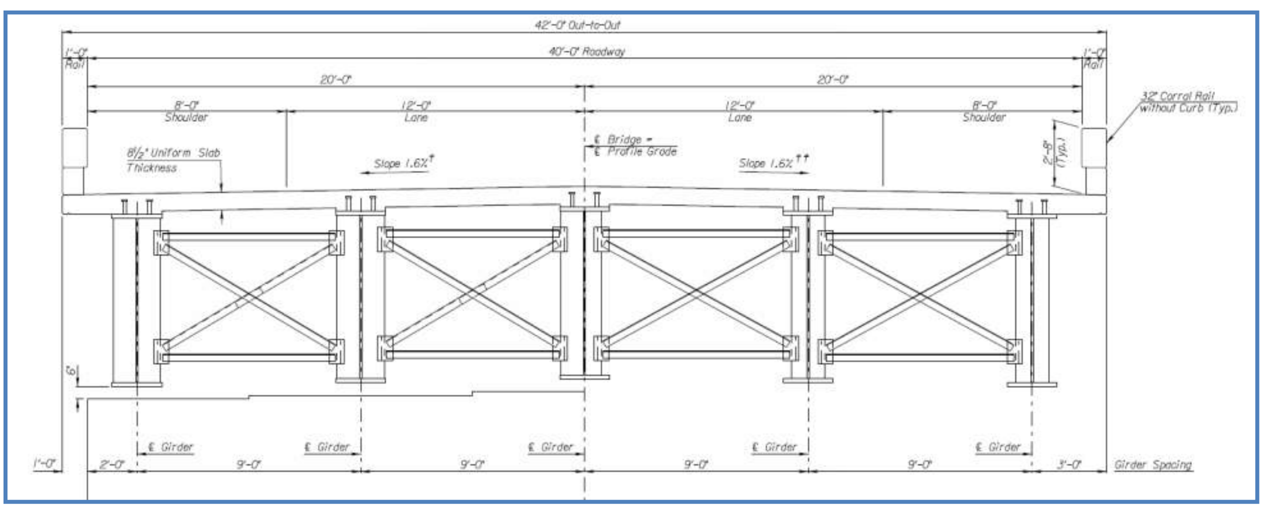
A preliminary Hydraulic Assessment Checklist (HAC) will provide the information required to fill out a standard drainage data note. The correct drainage data note will need to be on the plans with the data filled in from the HAC. The data required to be on the final plans changes occasionally, so it is necessary to use the latest electronic HAC and the latest standard note available from the KDOT website.

6.1.3.4 Typical Section

A typical section is required for each proposed bridge and is very useful to have prepared for the field check plan stage. The complexity of the bridge determines how many typical sections may be required in the final plans. The purpose of the typical section sheet in the final plans is to display typical dimensions, vertical and horizontal spacings, reinforcing steel sizes, cross slopes, bearing types, and elevations, and to indicate stations of the changing typical section in more complex bridges. For purposes of field check, the typical section is used to depict a rough approximation of bridge type and size with dimensions, proposed rail type and size, deck type and thickness, and proposed cross slope of the bridge.

A typical section can be included on another sheet if the bridge is reasonably simple. For example, a RCB standard drawing includes the elevation view of the bridge, the typical section of the bridge, and the bill of reinforcing for the box all on the same sheet. The simplicity of this type of bridge dictates the simplicity of the typical section.

As bridges increase in complexity, the typical section sheet needs to display more information. If the bridge is a relatively basic open span bridge the typical section may include a section near mid-span, and one near an interior support, or a half section at an interior support with the other half depicting the section at mid-span.



6.2 Office Check

Plan details for the Office Check portion of the design plans concentrate on preparing the remainder of the sheets to explain the details and specifications of the designed bridge. The components discussed below are the necessary elements. The field check plan review and onsite field check meeting addressed changes necessary to the first submittal. These corrections should have been resolved by discussion or added or corrected on the Office Check plans. Confirming the field check plans allows for the geology investigation to take place to furnish that information to the designer for the remaining design of the bridge. This section explains the minimum of what to include for Office Check plans (See *Section 5.5* in this Manual).

6.2.1 Bridge Plan Assembly

The Office Check plans should contain, as a minimum, a General Notes and Quantities sheet (for open span bridges), a completed Contour Map, a completed Construction Layout (with geology information if a separate sheet is not included), and various structural detail sheets depending on the complexity of the bridge as well as the many standard drawings necessary for a KDOT let project. Office Check plans should be 95-99% complete. The bridge should be designed and detailed, foundation types, sizes and lengths (depths) calculated and detailed, berm slopes finalized for size and grade, and the final type, size and thickness of any stream protection measures detailed. If the project necessitates any temporary structures, these structures should be fully designed and detailed at the time the Office Check plans are submitted.

6.2.1.1 General Notes

This sheet will incorporate standard notes into the project as the first sheet concerning bridge length structures. All standard notes are available from KDOT's website: Bridge Section Standard Documents.

Many of the standard KDOT notes contain language referencing "KDOT," "State," "State Bridge Office," or similar entities. Some of these references need to remain as in the case of "…refer to KDOT Specifications…" however, when the language refers to KDOT as the oversight agency, or as the owner, these terms need to be modified to reflect the world of local projects. In a general sense the terms can be modified to "Owner" or "Owner's Engineer," but the designer will need to approach each note modification with a critical eye to assure the correct terms are modified and the note maintains the original intent.

> Example:
> *FALSEWORK INSPECTION: This project has falsework plan requirements which are considered "Category 2" by KDOT specifications. If falsework deficiencies or variations from the approved and sealed plans are found, the falsework design Engineer of Record will provide written approval of the changes. If for the convenience of the Contractor the falsework becomes "Category 1" by the use of non-typical supports; then the inspection and review requirement of "Category 1" will be fully enforced, but at no cost to the Owner. "Category 2" falsework inspection is not paid for directly but is subsidiary to other bid items.*

The bridge deck finishing and bridge deck curing notes below may be used on LPA bridge projects if the following conditions are met:

- The bridge is a KDOT standard reinforced concrete haunched slab (RCSH) without an overlay.
- The bridge is located on a road with a functional classification of "Local" or "Minor Collector".
- The bridge is on a low volume road with 400 ADT or less.
- The bridge is not on a road with an asphalt or concrete surface.
- The bridge and road surfaces will not receive deicing materials.

BRIDGE DECK FINISHING: Give the surface a suitable texture by transverse grooving perpendicular to the center line of the bridge with a tining float having a single row of fins. Make the grooving approximately 3/16 inch in width at ¾ inch centers, with a depth of approximately ⅛ inch.

BRIDGE DECK CURING: Within 15 minutes, or as soon as the surface water disappears, apply 2 coats of Type 2 white liquid membrane forming compound at a minimum rate per coat of 1 gallon per 200 square feet of concrete surface. Place the second coat at right angles to the first coat. Protect the curing membrane against marring for a minimum of 7 days. The Engineer may limit work during this 7-day period.

The "Contractor Furnished PDA" bid item used by LPAs to pay for what is normally referred to as "Test Pile" or "Test Pile Special" must be accompanied by the following note. When this bid item is included, the project specific special provision titled: "Contractor Furnished Pile Driving Analyzer (PDA)" should be included with the letting document packet.

CONTRACTOR FURNISHED PDA: Use the Pile Driving Analyzer equipment at the locations shown on the Construction Layout. Use Pile Driving Analyzer equipment and methods compliant with KDOT Special Provision. The piling shall remain in place as permanent piling. Drive the piling to the resistance value of (Strength I divided by Phi).

At any location where problems are experienced, pile damage is suspected, or the Pile Driving Formula Load occurs significantly above the design pile tip elevation, the Owner's designated Engineer may request that the Pile Driving Analyzer (PDA) equipment be used.

6.2.1.2 Quantities

This sheet will incorporate standard bid items into the project as the first or second sheet concerning bridge length structures. All standard bid items are available from KDOT's website.

https://kdotapp.ksdot.gov/BidItemList/BidItemList.aspx

6.2.1.3 Contour Map

Review the requirements within the field check section for the Contour Map. Any missing or unknown information at the time of field check should now be on the sheet. Particularly, salvage information and any critical path items should now be known, and notes placed on the sheet.

6.2.1.4 Construction Layout

The information from the final HAC will be transferred onto this sheet in the appropriate drainage data note. The final HAC shall consist of revisions to the preliminary HAC and include potential scour information. Necessary calculations shall be performed and the data shall be entered on the HAC so the data is available for the Bridge Scour Appraisal Form.

Kansas Department of Transportation, Drainage Design Manual, January 2023 Edition, Table 2.4-1 gives the Guidelines for Design Recurrence Interval then states the following:

> "These guidelines should be applied to the extent practicable for new and existing highway drainage structures. On highway reconstruction or replacement projects, where existing facilities and right-of-way often dictate highway profiles, it may not be feasible to meet these guidelines. In such cases, the designer should endeavor to provide the highest degree of protection that is cost-effective under the existing circumstances. Federal, state, or local floodplain ordinances requiring a greater degree of protection may take precedence over these guidelines."

Additionally, the KDOT Bridge Design Manual states:

> "…the true design frequency is the frequency flow which overtops the roadway and puts it out of service, or it is the frequency which satisfies the requirements of the allowable water surface elevations."

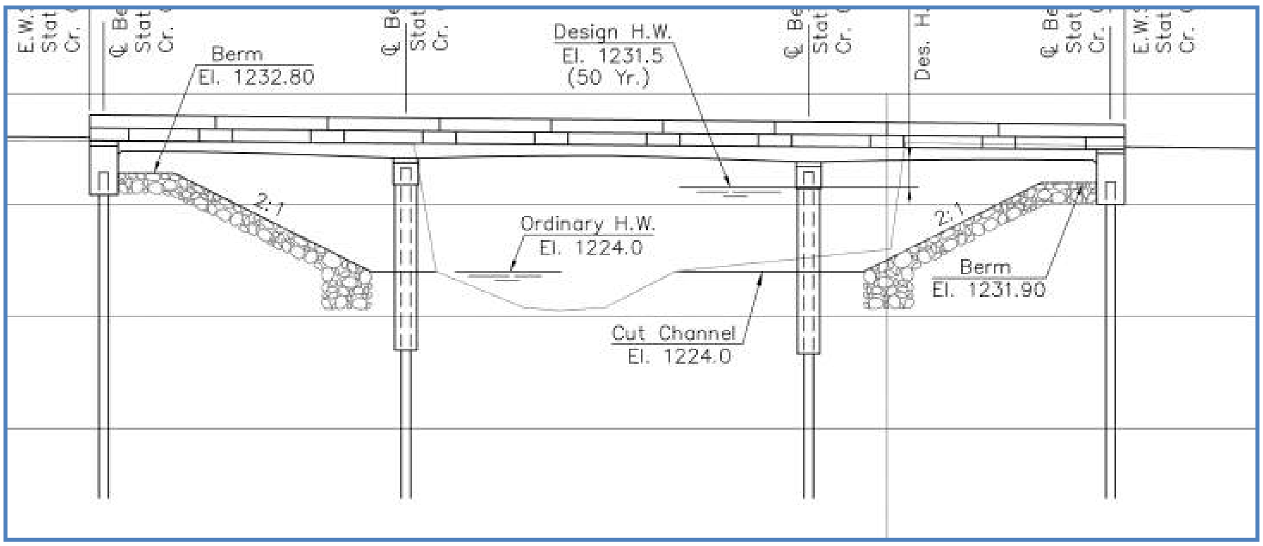
In a sag vertical alignment where there is no overflow area, the design frequency will be equal to the frequency that will still provide the freeboard decided upon at the field check meeting. Where an overflow area is provided, the design frequency is the frequency that takes the bridge out of full service, or simply at the frequency the road overtops. However, if a Q25 design is all that is necessary for the classification from Table 2.4-1, and Q25 does not overtop the road or even approach the required freeboard, the designer does not typically need to calculate larger frequency intervals unless it is required by other specifications/agencies.

The Construction Layout sheet will show the location of all PDA pile, both in the plan view and elevation view. All pile will be labeled, number and length, at each substructure unit in the elevation view. PDA pile must be called out separately due to the additional ten foot of pile length required to perform the PDA test.

Berm slopes are typically 2:1. The slope may be slightly adjusted as needed for the site conditions and soil conditions. Some type of slope protection is common either along the drip lines of the bridge or protecting the entire slope to prevent erosion from stream flows. The information needed to decide the thickness and size of the slope protection is determined from the hydraulic analysis and the geology report for soil types.

For stream crossings, typically the bottom of the toe of the slope protection will need to be above the ordinary high water elevation. If the slope protection is carried down to the streambed at a 2:1 slope, this necessitates longer bridges, and creates a lower "channel" on either side of the real streambed. Creating two ditches of slope protection on either side of the streambed elevation is not an acceptable practice from a design standpoint, or an environmental agency standpoint.

Below is an example of bridge berms with slope protection and a special toe. The toe does pierce below the ordinary high water elevation, but the rock is located well removed from the streambed and is protected by a fair amount of in-situ streambed material. This design keeps the stream within the natural stream channel during normal flows, and during higher frequency events the berms are protected from erosion. The existing banks are cut horizontal at the ordinary high water elevation and the design does not create "ditches" on either side of the streambed during normal flows. A designer could also make the decision to protect the horizontal cut to the edge of the natural channel to incorporate some scour protection around the piers, but all riprap would still be above the OHW elevation which is much more acceptable from an environmental agency viewpoint.



For grade separation bridges, the berm slopes will be protected as determined by analysis and any open ditches which convey drainage through the bridge will need to be maintained with the ditch bottoms receiving a minimum of a two-foot thick riprap lining.

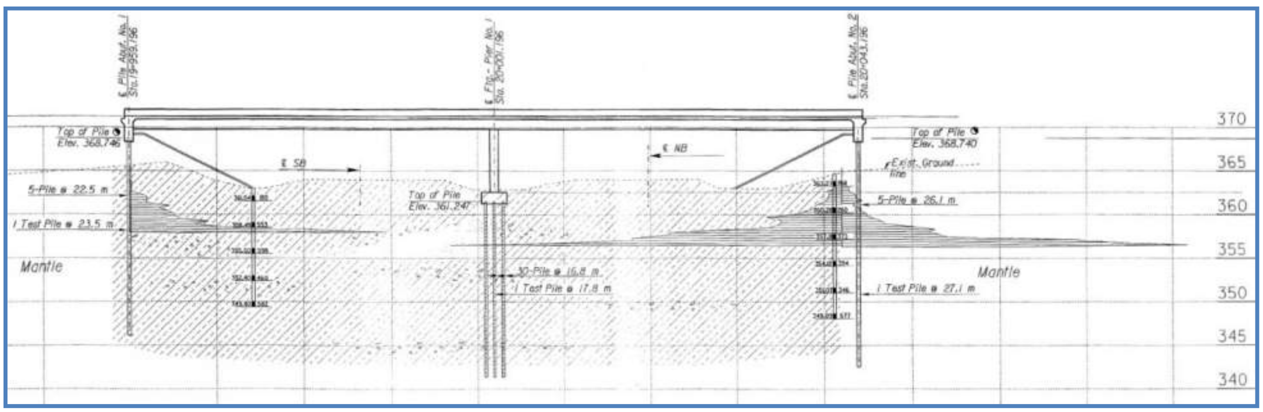
Minimum horizontal and vertical clearances, ditch widths and lane widths must be in accordance with the appropriate specifications given the type of traffic on the bridge and, if applicable, the type of traffic being spanned by the bridge. Dimension required clearances on the plan and elevation views.

6.2.1.5 Geology Sheet

If a bridge is complex a separate geology sheet may be required. A typical geology sheet contains a simplified plan view with bridge dimensions, dimension and spacing of foundation elements, and the type and location of any geology investigation holes (core hole, power auger, air hammer, etc.). The simplified elevation view of the bridge typically contains only stations of the foundation elements, top of pile or shaft elevations, and the data gathered from the geology investigations, as well as the various geology layers which occur beneath the bridge laid out in a matrix of stations vs. elevations.

A probe investigation of a proposed bridge-length culvert is not recommended. If only a probe investigation is done, it must be supported with recorded geology within a reasonable distance of the project site. It is recommended every bridge-length box have a geology boring performed (with SPT testing, Cone Penetrometer, or some type of similar testing done to quantify subsurface conditions) at CL of roadway CL proposed bridge (or at a location as close as reasonably possible to CL-CL).

The Contractor Furnished PDA bid item is used when driving PDA pile is desired at the site to verify the generalized geology information and to maximize pile resistance. In order to maximize the design capacity of the production pile versus the cost of the Contractor Furnished PDA Section 10.5.5.2.3 in the AASHTO LRFD Bridge Design Specifications should be considered. The location of the PDA pile must be designated on the plan and elevation views on the Construction Layout sheet and restated on the separate geology sheet, if applicable.



6.2.1.6 <u>Typical Section</u>

More complex girders, bar patterns, or bridge geometry can lead to several typical sections. For example, if a bridge transitions from a full-super to a normal cross-section across the length of the bridge a typical section would need to be shown at the station of full super, at the station to start the super-transition, at the station the super reaches +1.6%, +1.6%, the station where 1.6%-0.0% is achieved, and where the normal cross-section (1.6%, -1.6%) occurs. If a site necessitates odd span arrangements the bar patterns may be different across the changing span lengths, so the typical section would need to address these types of changes in some fashion.

In the Office Check plans, the typical section will show details of superstructure components. Longitudinal reinforcement size and spacing at mid-span and at supports, transverse reinforcement, clearance dimensions, cover dimensions, location of drip grooves, rail dimensions and various other details will be displayed on this sheet as well as the macro dimensions of the major elements.

Bridge roadway width should meet the following criteria:

DESIGN GUIDELINES - NEW AND RECONSTRUCTED BRIDGES

DESIGN ELEMENT			
AADT -- DESIGN YEAR (vehicles/day)	Under 400	400 - 2000	Over 2000
MINIMUM CLEAR ROADWAY WIDTH FOR BRIDGES (1)	Traveled way + 2 ft. (each side)	Traveled way + 4 ft. (each side) (2)	Approach roadway width (3)

Notes:

(1)Existing minor collector or local road bridges with less than 2000 veh/day may remain in place without widening unless there is evidence of a site-specific crash pattern related to the bridge width.

(2)Where the approach roadway width (traveled way plus shoulders) is surfaced, that surface width should be carried across the structures.

(3)For bridges in excess of 100 ft or any on local roads, the minimum width of traveled way plus 3 ft on each side is acceptable.

References:

"A Policy on Geometric Design of Highways and Streets", AASHTO, 2018

"Guidelines for Geometric Design of Low-Volum Roads", AASHTO, 2019

6.2.1.7 Framing Plan

For span bridges incorporating steel or concrete girders or beams, a framing plan is required. The framing plan is a layout of the entire skeleton of the superstructure which shows permanent and temporary diaphragms to be used during erection, labels of each girder/beam, bearing locations, and bearing stiffener desired locations after erection of the girders/beams. Several elevation views and section views at supports and bearings to aid in girder/beam erection processes are useful for construction inspectors to verify the final conditions are as the designer intended.

6.2.2 Scour Vulnerability

A scour appraisal of the bridge site needs to be completed for all open span bridges and culverts without floors that are founded in erodible material. Shallow footings keyed into rock would not need a scour analysis carried out. However, **every** bridge shall have a Bridge Scour Appraisal Form completed with comments indicating either how the scour appraisal was completed or the reason why a scour appraisal was not necessary. This form is to be completed by the engineer responsible for the bridge design. See the appendix for an example of the form. The Bridge Scour Appraisal Form is available for download on the KART website under "Local Projects Bridge Inspection Docs and Forms".

6.2.3 Load Ratings

Load ratings are required for all bridges. The engineer responsible for the bridge design or initial safety inspection shall follow the current AASHTO Manual for Bridge Evaluation (MBE) specifications and KDOT BLP Bridge Inspection Manual when load rating the bridge. Load ratings should be calculated prior to opening the bridge to traffic and are required to be calculated within 90 days of opening.
Load and Resistance Factor Rating (LRFR), Load Factor Rating (LFR), and Allowable Stress Rating (ASR) are all acceptable methods to load rate bridges.

- Bridges designed by LRFD Specifications after October 1, 2010 are required to be load rated using LRFR.
- Bridges designed by either Allowable Stress Design (ASD) or Load Factor Design (LFD) Specifications may be rated using either LFR or LRFR methods.
- Allowable Stress Rating may be used for timber and masonry bridges.

The live load carrying capacity is calculated as an inventory rating and operating rating or as a safe legal load capacity, depending on the method of load rating that is used. If necessary, a posting level may also be determined for the structure.

Safe Legal Load Capacity (Reported as the Operating Rating on the LRSS) is the maximum legal live load that can safely be carried by a bridge as determined by the LRFR method. The LRFR method is required to be used for rating all bridges designed using LRFD after 10/1/2010.

Operating Rating (OR) generally describes the maximum permissible live load to which the structure may be subjected. Allowing unlimited numbers of vehicles to use the bridge at the operating level may shorten the life of the bridge. Operating rating levels are determined using LFR and ASR methods.

Inventory Rating (IR) is the level that generally corresponds to the customary design level of stresses but reflects the existing bridge and material conditions with regard to deterioration and loss of section. Load ratings based on the inventory level result in a live load which can safely utilize an existing structure for an indefinite period of time. Inventory rating levels are determined using LFR and ASR methods.

Design Load is the live load the structure was designed to carry.

Posting Level is a load level, typically recommended by an engineer and established by the bridge owner, that reflects the maximum vehicle weights that can legally cross a bridge. The posting limits shall be displayed on each end of the bridge using MUTCD approved signs. The Posting Level must be lower than or equal to the OR and safe legal load capacity values and greater than or equal to three tons. Postings should be made as soon as possible but not later than 30 days after inspection or other notification determines a need.

A Load Rating Summary Sheet (LRSS) is required to be completed for all the required rating trucks. The LRSS shall be sealed and signed by the Professional Engineer licensed in Kansas with the overall responsibility for analysis of the bridge and the final load rating. An electronic version of the form in Microsoft Excel format is available from the KART website under **Local Projects Inspection Docs and Forms**. An example of this form can be found in Appendix E.
The following is the minimum load rating information that shall be included on the LRSS:

- Method used for rating (ASR, LFR, or LRFR) (Report only one rating method)
- The Condition Rating for the Deck, Superstructure, Substructure, and Culvert at the time of the rating
- How section properties were determined
- Assumptions made and rationale used
- Material properties
- Tensile strength of steel, F_y
- Compressive strength of concrete, f'_c
- Any loss of section to account for deteriorated conditions
- Any other assumptions such as area of steel (A_s), lateral bracing, or number of live load lanes
- For Load and Resistance Factor Ratings
- IR and OR for design truck (HL-93)
- Safe load capacity of:
- AASHTO legal rating trucks (T3, T3S2, T3-3)
- Special Haul Vehicles (SHV) (SU4, SU5, SU6, SU7)
- Notional Rating Load (NRL)
- Emergency Vehicles (EV2, EV3)
- These safe load capacities shall be reported in the LRSS in the operating rating column.
- For Load Factor and Allowable Stress Ratings
- IR and OR for the following:
- Design Truck (HS-20)
- AASHTO legal rating trucks (T3, T3S2, T3-3)
- Special Haul Vehicles (SHV) (SU4, SU5, SU6, SU7)
- Notional Rating Load (NRL) truck
- Emergency Vehicles (EV2, EV3)
- Method used for calculating (AASHTOWare BrR, BRASS, self-developed programs, or spreadsheets, hand calculations, etc.)

The actual calculations are not required. The intent is to have enough supplemental information included to make it possible for others to verify the load rating values listed on the LRSS in the bridge record.

The design plans, rating model, and LRSS should be modified with regard to the construction of the bridge to account for any construction modifications or errors. One example of a construction modification which would be necessary to document on the "As-built" plans would be if bearing for all steel pile was achieved 4-5 feet above or below anticipated pile tip elevations. Another would be if the inspector inadvertently used the wrong bearing values to drive to during the pile driving operation and all pile were driven to a bearing 10-15% less than what was specified on the plans. These are small bits of information which could be vital in the future for a bridge widening, or an analysis of the bridge in terms of scour.

6.3 Final Check

Plans for the Final Check submittal shall be complete. All suggestions need to have been addressed in some form by the time final plans are submitted. All comments which have been made by BLP on previous submittals are made to improve the plans by suggesting or requiring changes. Suggestions and comments by BLP do not override design decisions made by the designer or the owner. The designer's or owner's choice to disregard BLP markups needs to be approved prior to subsequent plan submittal. The designer needs to communicate the reasoning behind dismissing a markup.

As major portions of the plans are reviewed, the reviewer will often focus on suggested corrections, or newly added details or sheets. As the plans progress, if a detail has been reviewed and is in no need of modifying, that detail typically receives only a cursory review on successive submittals. The designer shall not change details after Office Check submittal without drawing attention to those changes to the reviewer by explaining the modification, addition, or deletion to the project manager. An email shall be sent to the reviewer highlighting the modifications to the plan sheets.

Minor corrections, quantity modifications, erosion control items, or perhaps incorrect details which may have been missed during previous reviews will likely be the only changes left to be made to Final Check plans. The plans, specifications and estimate (PS&E) submittal will be inclusive of all the noted changes from the previous review. For information see Section 5.7 in this Manual.

Appendix A – Index of Items

Geotechnical Bridge Foundation Investigation Practice

The procedures employed in any subsurface exploration program are dependent upon a variety of factors which vary from site to site. The project design objectives and the expected site conditions have a major influence on the subsurface exploration and the development of a drilling plan. The objectives of a drilling plan should be to adequately characterize the subsurface conditions at the site so: a) The designer can analyze the conditions to formulate a cost-effective solution, and b) The contractor can, in conjunction with any necessary site investigation, prepare a bid which will reflect the work anticipated based on the conditions to be encountered. A secondary objective is to obtain maximum subsurface information from a minimum number of exploratory borings.

The following is a list of requirements for a foundation investigation for state or federally funded bridge projects developed for funding through the Kansas Department of Transportation.

- Perform a site-specific investigation for all span bridge or bridge-size box projects.

- Make one boring at the centerline of each pier bent and abutment for a bridge or center of structure for RCB/RFB. A probe investigation may be carried out for bridge size boxes if additional geology investigations have been done in the surrounding area of the proposed structure to support this substandard practice. Additional borings shall be made as necessary to develop a continuous soils and geology profile through the structure area including the bottom of the channel. When the drilling plan can be supplemented with additional information, one boring at the centerline of each abutment may be considered to meet the minimum requirement. The supplemental information should be considered only if it is documented and directly supports an accurate soils and geology profile. When rock is encountered at a span structure, a minimum of at least one of the required borings will obtain a core of the bedrock. An unconfined compression test should be taken at each change in lithology and at a minimum of every 5 feet of depth. Borings should be advanced at least 5 feet below the recommended foundation element elevations.(6)

  (Taking advantage of a substandard "probe" investigation at the site for a proposed bridge-size box will not account for the characteristics of the subsurface material(s). The probe may indicate the presence of rock within the immediate reach of the streambed, but this information may be a false negative, or a false positive. Also, it is not only rock which can cause issues for bridge-size boxes. Soils incapable of supporting load may be present a couple feet below streambed. Utilizing a probe investigation for a proposed structure may result in the wrong type of structure (RCB instead of RFB) being selected for design, it may result in large change orders submitted during construction due to stabilizing unsuitable material or removing and replacing unusable material to construct the box on or using a probe may result in building a more expensive RFB when an RCB would have performed adequately.)

- When approach fill embankments of significant height are used at bridge ends founded on compressible material, make at least one boring at the critical location for each embankment location to determine potential problems associated with settlement and stability of the embankment. The borings for the embankments can usually be combined with the borings made for the abutments of the structure. Address slope stability and settlement issues in the geotechnical report.

- Obtain sufficient soil and rock samples from all borings to adequately characterize the subsurface materials to a depth appropriate for the loads and the foundation system to be proposed.(1)

- Appropriate soil sampling should be obtained at five-foot intervals in the soil mantle on at least one of the borings where soil thickness and site conditions warrant. The standard penetration test is the minimum acceptable sampling technique.(2) (An incomplete test (50/3", 50/6", etc.) is not an acceptable substitute for testing of material which should be cored. At any point, if there is an incomplete test a core should be taken from that elevation to the bottom of the boring. This is regardless of whether the proposed foundations will be drilled shafts or driven pile. In most cases retrieving only a five-foot core sample is not an acceptable sample.

- Field documentation of rock units present at the site are to be characterized as to stratigraphy (geologic nomenclature of each unit), lithology (basic type of material), physical condition (weathering, bedding, color, etc.) and engineering properties (jointing, strength, etc.).(3)

- Perform sufficient laboratory testing to characterize all subsurface material.(4)

- Information shown on the boring logs should include the following:
  - Depth and type of all samples obtained.
  - A visual and textural description of the subsurface material.
  - Thickness and geologic nomenclature of each stratum encountered.
  - A record of the Standard Penetration Test as well as any other tests that have been run.
  - An accurate location and top of hole elevation for each boring.
  - Stabilized groundwater elevation.

- When rock is encountered at shallow depths, make additional transverse borings.(5)

- Furnish a set of Office Check plans by the designer to the geologist and/or geotechnical engineer for review of the items related to the geological investigation. Following the review, the plans should be returned to the designer with any necessary comments.

- Perform the geotechnical site investigations under the supervision of a licensed geologist or geotechnical engineer.

- For all foundations state in the recommendations the geotechnical nominal resistance calculated, geotechnical factored resistance, phi factor used, and the governing factor for the design. The units for pile foundations should be in kips. Skin friction resistance and end bearing resistance should be in kips/sq. ft. for drilled shaft foundations. Spread footing resistance should be reported in kips/sq. ft.

<u>To provide further guidance, the following "Standard Practice" for soil foundation investigations for bridges is outlined.</u>

If a new embankment will be placed on a soil foundation, an existing embankment will be widened or the grade elevated by 10 feet, an existing bridge shortened by the replacement structure, or if the new structure will be built on an offset alignment; perform the following for a soils foundation investigation:

1. If the depth to bedrock is 10 feet or more, obtain undisturbed soil samples at 5 foot intervals throughout the soils profile on at least one abutment location. If the soils (depths, types) vary between the two abutments, perform a similar sampling strategy at the second abutment.

2. Perform consolidation testing on each recovered sample below the water table. As a minimum, perform unconfined compression testing on each recovered sample.

3. Perform slope stability analysis of the proposed configuration. If the safety factors are questionable, perform more advanced strength testing.

4. Perform a settlement analysis including amount of settlement anticipated and the time frame for the settlement to occur.

5. Author an LRFD Geology report detailing findings of the investigation complete with recommendations. A sample report is in the Appendix.

Possible ASTM Standard Tests (varies by site characteristics): D1586, D2936, D 2938, D3740, D5434, D5549, D5607, D6032. This is not an exhaustive list of tests required to create a quality geology report for the bridge site(s), but it does cover many of the basics.

Footnotes:

(1) Soil and rock strengths are needed for the Engineer to calculate bearing capacities for various foundation elements.

(2) This test should be performed only in non-cohesive soils. Correlations in cohesive soils are discouraged unless considerable data exists to justify the results.

(3) This is necessary so the engineer knows what conditions were found in the borings and can apply their knowledge and experience with identified members to adequately perform an analysis. Further, this information allows contractors who are familiar with geologic members know how they can be excavated to submit an accurate bid.
(4) Laboratory testing of material obtained from borehole samples is needed for the designer to perform an engineering analysis which is the basis for recommendations. For example, on any foundation that relies on end bearing (e.g., a spread footing or drilled shaft), an unconfined compression test of the material on which the foundation will be bearing is considered the minimum testing that should be performed.
(5) Bedrock encountered at shallow depths may in fact be a “floater” and not a continuous formation of rock. If the bedrock encountered is a “floater” then the amount of rock excavation will be incorrectly identified and the geology of the site will be misrepresented.
(6) The Engineer should know what material lies below the foundation element to ensure that the foundation element is on competent material. Therefore, the boring should extend a minimum of 5’ below the bottom of the proposed foundation element. It’s also necessary so minor deviations in the excavation limits can be compensated without additional cost.

Geology Report Information

LRFD Geology incorporates a variety of resistance factors to arrive at a maximum resistance for drilled shaft, spread footing, or pile foundations.

The pile damage resistance factor (ϕ_c) (H-pile) of 0.6 (without pile points/tips) or 0.5 (when pile points/tips are used) is applied to calculate the maximum structural resistance of the steel pile (AASHTO 6.5.4.2).

HP10x42 with an area of 12.4 sq. in. and a yield stress of 50 ksi will have a maximum structural resistance of 372 kips if pile tips are not used and 310 kips if tips are used. This is the maximum structural capacity of the steel pile.

The geologic layer also receives a bearing resistance factor (ϕ_{dyn}) ranging from 0.10 to 0.80 (AASHTO Table 10.5.5.2.3-1). 0.10 is the resistance factor to be used if the ENR formula is used without any dynamic or static testing on the piles and no field verification of hammer performance. 0.80 can be used with dynamic testing performed on 100% of production piles along with a static load test for each site condition. 0.55-0.65 is typically used if PDA testing is performed on a minimum of 2 piles (current AASHTO specification) at the site then driving criteria is established using the PDA results and the rest of the pile are driven to that criteria using the modified ENR formulas given in the KDOT Specifications. There is also a table for resistance factors (ϕ_{stat}) (AASHTO Table 10.5.5.2.3-2). One resistance determination method titled "End Bearing in Rock – Canadian Geotech. Society, 1985" allows a resistance factor of 0.45. This value has been commonly used if no dynamic testing will be performed on site. However, when this phi has been used on projects it has often remained somewhat ambiguous whether the geologic capacity has actually been determined from this method.

Using the maximum resistance factor of 0.65 for dynamic testing, the above capacities are reduced to 242 kips and 202 kips, respectively. The factored nominal resistance for an HP 10x42 pile should not be higher than 121 tons or 101 tons in most geology reports depending on whether pile points are recommended or not. To achieve a higher phi for dynamic testing is cost-prohibitive for an LPA project.

Driving stresses are limited in steel pile to 0.9 times the yield strength of the steel. In most situations 50ksi steel is supplied for steel pile. This equates to a driving capacity of 558 kip, or 279 ton for HP10x42 pile. This does not typically limit the final capacity of the pile due to the damage factor, and bearing resistance factor, but needs to be monitored in circumstances where pile are driven through thick layers of stiff clay, or through thin layers of shale or bedrock in order to get to a layer of geology which will support the loads of the structure.

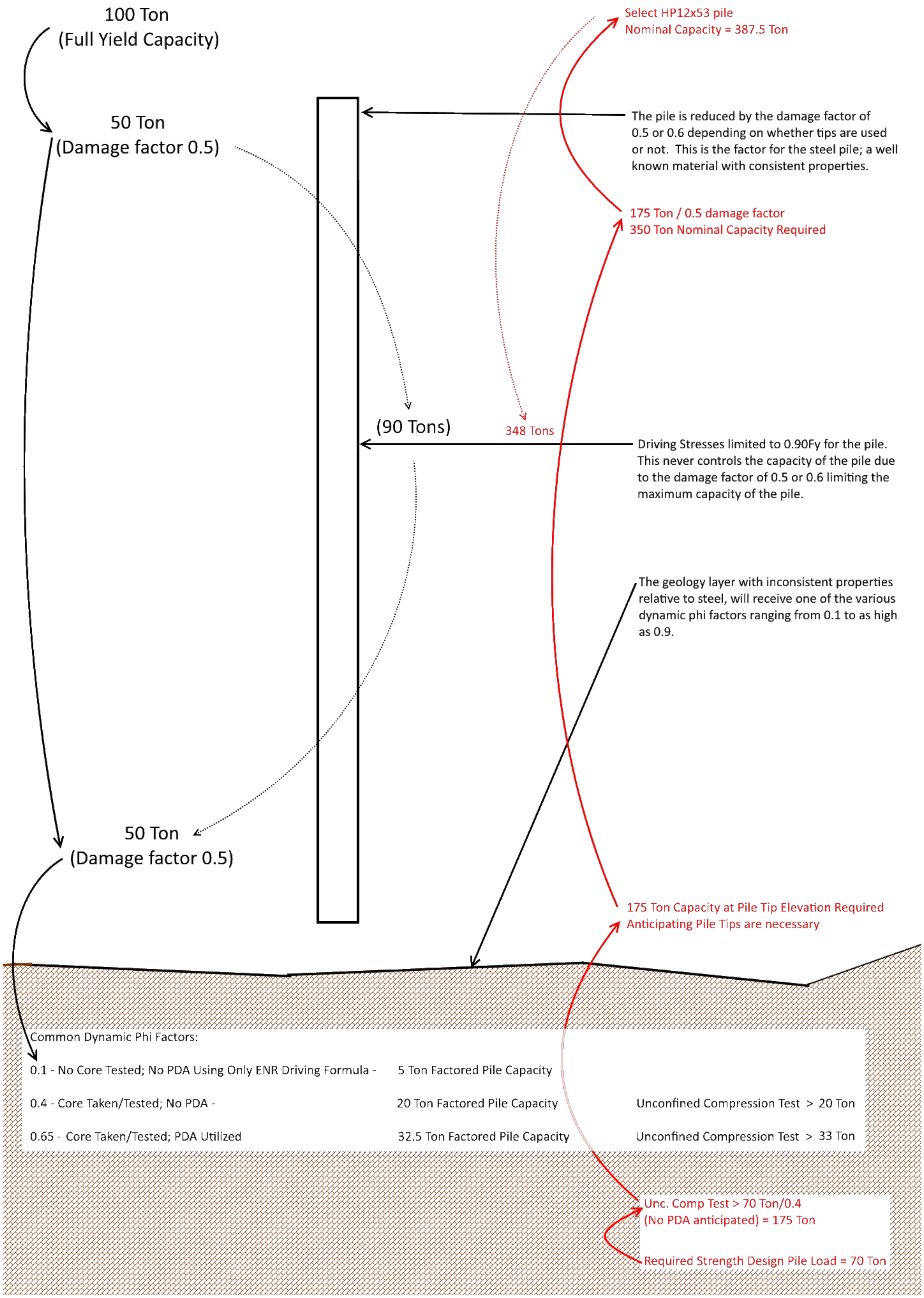
The term "practical refusal" should not appear in any geology report concerning bridge foundations. The factored nominal resistance of the foundation element should be called out. The capacity of the geologic member should be clearly stated on the borehole report/table. The engineer will specify what Strength 1 design load the foundations must support and determine the size and arrangement of the foundation elements to use based upon the factored nominal resistance clearly labeled for various pile sizes in the report.

The example below, for use by the design engineer, will hopefully aid in both the preliminary and final design of the pile foundations. The left side (in black text) is simply an aid to display how much capacity of a fictional 100-ton capacity pile is “lost” in the LRFD design process. A pile with a capacity of 100 tons is shown and this value is reduced using the different factors until the dynamic phi factor is selected in the table at the bottom. The far right values in the table would finally give what the unconfined compression test of the geology cores must be (50 Ton for both phi dynamic factors). The tons required at the pile tip determine what the unconfined compression must be for the geology layer, and then the phi dynamic reduces the amount of that geologic capacity the engineer may use. The structure Strength 1 loads must be less than 20 Ton, or 32.5 Ton, depending on the phi dynamic factor used.

The design method, in red, begins at the bottom with the known Strength 1 factored load of 70 ton. The example project is anticipated to have a quality geology investigation performed, but it is not anticipated to have Contractor Furnished PDA performed. Given those two criteria, it is determined to assign a dynamic phi of 0.4 for the pile design. An unconfined compression test of 175 ton is required. Once the geologic capacity is determined, the structural design of the pile must be carried out.

It has been anticipated pile tips or pile points will be used on the project. A damage factor of 0.5 is specified by AASHTO. Ultimately the 175 Ton geologic capacity is divided by the 0.5 damage factor to arrive at a 350 Ton nominal pile capacity. An HP12x53 pile is selected with a nominal capacity of 387.5 Ton. In this case the driving stresses of 0.9*Fy*As will be 348 Tons; this value must not be exceeded during the pile driving procedure.

The diagram referred to above is located on the next page.



100 Ton
(Full Yield Capacity)
50 Ton
(Damage factor 0.5)
Select HP12x53 pile
Nominal Capacity = 387.5 Ton
The pile is reduced by the damage factor of 0.5 or 0.6 depending on whether tips are used or not. This is the factor for the steel pile; a well known material with consistent properties.
175 Ton / 0.5 damage factor
350 Ton Nominal Capacity Required
(90 Tons)
348 Tons
Driving Stresses limited to 0.90Fy for the pile. This never controls the capacity of the pile due to the damage factor of 0.5 or 0.6 limiting the maximum capacity of the pile.
The geology layer with inconsistent properties relative to steel, will receive one of the various dynamic phi factors ranging from 0.1 to as high as 0.9.
50 Ton
(Damage factor 0.5)
175 Ton Capacity at Pile Tip Elevation Required
Anticipating Pile Tips are necessary
Common Dynamic Phi Factors:
0.1 - No Core Tested; No PDA Using Only ENR Driving Formula - 5 Ton Factored Pile Capacity
0.4 - Core Taken/Tested; No PDA - 20 Ton Factored Pile Capacity Unconfined Compression Test > 20 Ton
0.65 - Core Taken/Tested; PDA Utilized 32.5 Ton Factored Pile Capacity Unconfined Compression Test > 33 Ton
Unc. Comp Test > 70 Ton/0.4
(No PDA anticipated) = 175 Ton
Required Strength Design Pile Load = 70 Ton

Typical Geology Report Foundation Recommendations

Abutment and Pier Foundations

We recommend pile foundations for the abutments and piers for these bridges. Elevations are given for 10x42, 12x53, and 12x74 H-piling. The pile will penetrate the mantle and achieve the required resistance within the underlying weathered shale and sandstone of the Stranger Formation. The designed resistance is governed by the drivability of the pile. A Phi factor of 0.60 is given based on the geologic investigation performed and knowledge of the site.

The following table gives the top of bedrock elevation for the Stranger Formation and the maximum anticipated pile tip elevation at each abutment and pier. If piling achieves bearing at a higher elevation, further driving should cease to avoid damage to the pile. Caution must be exercised not to overdrive the piling resulting in damage to the H-pile

Road Over Unnamed Creek (D)
Br. No. 000000000000001

Location	Centerline Station	Bedrock Elevation	H Pile HP 10x42 Elevation	H Pile HP 12x53 Elevation	H Pile HP 12x74 Elevation
Abutment 1	701+05	765.4	762.0	761.0	760.0
Pier 1	701+47	764.8	761.5	760.5	759.5
Pier 2	702+03	763.8	762.0	761.0	760.0
Abutment 2	702+45	764.0	762.2	761.2	760.2

LRFD Design
Resistance and Phi Factor Information (damage factor of 0.6 already applied to arrive at Rn)

	Pile HP 10x42	Pile HP-12x53	Pile HP-12x74
Rn (kips)	372	465	654
Rr (kips)	223	279	392.4
Phi Factor	0.60	0.60	0.60

Bridge Scour Appraisal Form Example

Scour Appraisal NBI Item 113 or SNBI Items B.C.11 & B.AP.03

Structure Information

NBI Structure Number	000221068901234	Year Built	1925
LPA Bridge ID	J.0-10.4	Feature Intersected	Myres Creek
Owner	Example County	Facility Carried	255th Road

Is bridge a culvert with floor?* No

*Scour analysis not required if bridge has floor

Culvert Bridge with Floor

This section does not apply

Channel Condition Rating Item 61 or B.C.09	
Culvert Condition Rating Item 62 or B.C.04	

Open Span Bridge

	Left overbank	Main Channel	Right overbank
Contraction Scour (ft)	1.5	2.5	4.6
Pier Scour (ft)	NA	8.2	NA
Abutment Scour (ft)	15		12
Long term degradation (ft)	2.1	2.1	2.1
Total scour (ft)	18.6	12.8	12.8
Rock Scour Assessed?	N/A	N/A	N/A
Foundation depth (ft)	25	20	25
Channel Condition Rating Item 61 or B.C.09			5
Waterway Adequacy Rating Item 71			6
or Overtopping Likelihood Item B.AP.02			
All foundations stable for estimated scour depths?			Yes
Date Analysis Completed			3/4/2023

Scour flood frequency (yrs)	100
Scour discharge (cfs)	5,000

Comments (include analysis method used):

Degradation of channel = 2' over past 70 years, no rock near surface.
Scour analysis performed using HEC-RAS.
Extensive drift on Pier #2.

Extensive Scour Observed?	No
Scour countermeasures in place?	No
Plan of Action (POA) Required?	No

Scour Vulnerability NBI 113	**5**
or	
Scour Condition Rating SNBI B.C.11	
Scour Vulnerability SNBI B.AP.03	

Form completed by:

Name	John Q Public	Date	3/15/2023
Company	Consultant USA		

Form Revised 2023

Load Rating Summary Sheet Example (page 1 of 2)

Load Rating Summary Sheet for Local Bridges

NBI Bridge # :	000000000045310	**County:** Allen		Inspection Key :		ADT :	125 vpd
LPA Bridge ID :	22	**Owner:** Iola PCG		Year Built :	2019	ADTT :	05 %
Route Carried :	RS 110			Year Reconst. :		f'c :	4.0 ksi
NBI Item 43 :	402 SBMC			Design Load :	HL93	fy :	60.0 ksi
Structure Type :	**Steel Beam, Continuous**					Fy :	50.0 ksi

Rating Information Provided : ☑ Plans ☐ Field Measurements ☐ Testing ☐ No Information Exists

Load Rating Manuals:		**General Load Rating Information:**		**Condition Ratings:**	
		Overburden Type :	Gravel	Deck:	7
LFR/ASR Version :	N/A	Overburden (in.) :	4"	Superstructure:	6
LRFR Version :	2017 AASHTO Design Specs (8th Ed.)	Overlay Type :	None	Substructure:	8
MBE Version :	2018 MBE (3rd Ed.)	Overlay (in.) :		Culvert:	N
		Culvert Fill Height (ft.) :	N/A	Channel:	

Method Used: LRFR

$\gamma_{LL\,INV}$: 1.75 γ_C : 0.85
$\gamma_{LL\,OP}$: 1.35 γ_S : 1.0

	Truck	Tons	RF_{INV}	$Tons_{INV}$	RF_{OP}	$Tons_{OP}$	Controlling Structural Element
Design	HL-93	---	1.310	-------	1.830	-------	-M Girder/Beam Int
Design	HS20-44	36	-------	-------	-------	-------	
AASHTO Load Rating	T3	25	-------	-------	3.238	80.9	-M Girder/Beam Int
AASHTO Load Rating	T3S2	36	-------	-------	2.576	92.7	-M Girder/Beam Int
AASHTO Load Rating	T3-3	40	-------	-------	2.560	102.4	-M Girder/Beam Int
AASHTO Load Rating	SU4	27	-------	-------	2.949	79.6	-M Girder/Beam Int
AASHTO Load Rating	SU5	31	-------	-------	2.604	80.7	-M Girder/Beam Int
AASHTO Load Rating	SU6	34.75	-------	-------	2.336	81.1	-M Girder/Beam Int
AASHTO Load Rating	SU7	38.75	-------	-------	2.115	81.9	-M Girder/Beam Int
AASHTO Load Rating	NRL	40	-------	-------	2.036	81.4	-M Girder/Beam Int
AASHTO Load Rating	EV2	28.75	-------	-------	3.415	98.1	-M Girder/Beam Ext
AASHTO Load Rating	EV3	43	-------	-------	2.293	98.5	-M Girder/Beam Ext

Load Rating Evaluation Summary :
(Areas investigated in load rating)

- +M Girder/Beam ☑ Int ☑ Ext
- -M Girder/Beam ☑ Int ☑ Ext
- ☐ -M Slab ☐ +M Slab
- ☐ Culvert Walls
- ☑ Shear at/near Supports
- ☐ Truss Members
- ☐ Floor Beams
- ☐ Stringers
- ☐ Pins
- ☐ Hangers
- ☐ Fatigue Prone Details
- ☐ Deck Overhang
- ☐ Deck between Girders
- ☐ Substructure (NBI Item 60 < 4)
- ☐ Masonry Arch
- ☐ CMP

See next page for posting requirements

NBI Item 70 (Relationship of Operating Rating to Maximum Legal Load) :
Equal to or above legal loads

Additional Comments *(include any section loss, assumptions, hand calc. references, etc.)*
AASHTOWare BrR Version 6.8.3 model was used to generate this load rating based on design plans. A new, sealed Load Rating Summary Sheet will be required with any new load rating or if the BrR model is modified.

Printed Name (P.E.): Wizard of Oz
License #: 3003
P.E. Licensed in Kansas
Seal & Date

PE Stamp Here - signed and dated

Company : ABCD
Analyst : SBS
Analysis Date : 11/21/2018

The Rating(s) for this structure is (are) based on a theoretical analysis of the structural elements involved, and on a limited amount of information concerning their condition. The calculated values are the maximum posting limits. The LPA shall not post the structure at a load exceeding these values. The LPA may decide to post the structure at lower load limits.
Revised 2-5-2020

Load Rating Summary Sheet Example (page 2 of 2)

Kansas Department of Transportation

Load Rating Summary Sheet for Local Bridges

NBI Bridge # :	000000000045310	County:	Allen
LPA Bridge ID :	22	Owner:	Iola PCG
Route Carried :	RS 110		

Maximum Legal Posting Limits

NO POSTING NECESSARY