Bridge Layout - Checklist

Structure:	Structure Number:
Contract Number:	Project Number & Phase:
Detailer:	Date:
Designer:	Date:
Checker:	Date:

Information Required

☐ 1. Bridge Site Submittal (BSS). The BSS shall be reviewed for completeness by Structure Design Preliminary Investigations Branch (PI), and any missing information shall be requested from the District Project Engineer. Once the BSS is processed by PI, the Structure Design Branch Project Engineer shall also perform a cursory check for all items that specifically relate to the structures work for the project. Some of the structure related information to identify includes:

- ☐ a) Typical sections and required horizontal clearances for all roadways
- ☐ b) Horizontal and vertical alignments for all roadways, railroads, and channels (existing/proposed) which are over, under, or near bridge
- ☐ c) Structure barrier type(s)
- ☐ d) Approach slab limits see *Memo to Designers*: 5-3 Structure Approach
- ☐ e) Locate limits of cut and fill grading, slope values, and determine whether slope paving is required at abutments
- ☐ f) Construction stage information and traffic handling requirements (e.g., available detours, lane requirement charts, etc.)
- ☐ g) Falsework traffic opening requirements
- ☐ h) Planned and future utilities
- ☐ i) Restrictions on support placement, such as sight distance set back, utility clearance, and environmental restrictions

☐ 2. Foundation Plan. The Foundation Plan is provided by Preliminary Investigations and should be reviewed for completeness and whether the survey datum used matches that of the District site data provided in the BSS.

- [ ] 3. Final Hydraulic Report. The information to identify includes:
  - [ ] a) Design high water flood elevation(s) and minimum soffit elevation. Bridge profile adjustment may be required.
  - [ ] b) Minimum freeboard clearance requirements for drift and debris issues
  - [ ] c) Recommended pier type and skew
  - [ ] d) Slope protection requirements, such as Rock Slope Protection (RSP)
- [ ] 4. Preliminary Foundation Report. Information to identify includes:
  - [ ] a) Foundation recommendations
  - [ ] b) Seismic data information
  - [ ] c) Groundwater, corrosion, and scour evaluations
- [ ] 5. As-Builts and existing maintenance reports for any adjacent structures, the information to identify includes:
  - [ ] a) Conflicts with existing structures, foundations, and utilities that will not be removed
  - [ ] b) Previously completeted maintenance work or proposed work
- [ ] 6. Aesthetic input from Bridge Architecture and Aesthetics Branch for bridge type selection, column shape, slope paving, and treatment for abutments, wingwalls, and barriers
- [ ] 7. Previous Advance Planning Studies

Bridge Layout Procedure

- [ ] 1. Plot clearances, right-of-way lines, and other controls in PLAN view to determine logical location of bridge supports.
- [ ] 2. Verify the provided bridge profile to determine critical elevations along the bridge layout. Plot the proposed abutment location and points of minimum vertical clearance.
  - [ ] a) Determine abutment type, see *Memo to Designers*: 5-1 Abutments.
  - [ ] b) Abutment location should allow 5 feet wide maintenance berm at the face of the abutment, with 3 feet vertical clearance to the soffit. If slope paving is used, do not use a berm; instead use a maximum 1.5:1 slope.

- [ ] 3. Determine the structure type and geometry of the typical section:
  - [ ] a) Locate the point of minimum vertical clearance and calculate the preliminary structure depth.
  - [ ] b) Using the depth to span ratio for the assumed structure type, determine the estimated longest span (Note: Bridge length and depth varies for each type of structure considered).
- [ ] 4. Determine the profile grade at the outside face of the exterior soffit or girder at each side of the bridge, taking account of super elevation and cross slope.
- [ ] 5. Determine ground elevations along the bridge.
- [ ] 6. Roughly locate the beginning (BB) and end (EB) of bridge where the bridge profile grade and ground elevation lines intersect. Things to consider:
  - [ ] a) Balance span lengths, frame stiffness, and column lengths
  - [ ] b) End spans of (0.75 x Adjacent Span Length) are preferred; use of end spans closer to (0.40 x Adjacent Span Length) should only be used in special situations, uplift is not allowed
  - [ ] c) Long structures with multiple frames should have a minimum of three bents per frame
- [ ] 7. Estimate number and size of columns. The guidelines below are general rules of thumb to be used as a starting point for design. Actual designs may fall outside of these guidelines depending on project constraints and as the designer exercises innovation to come up with a more feasible or economical solution.
  - [ ] a) Column size ratio (Column Diameter / Structure Depth)
    - 0.7 < column size ratio < 1.0
  - [ ] b) Column diameter ratio (Tallest Column Height (H))
    - H/12 < column diameter ratio < H/10
  - [ ] c) Single column: adequate for structure width up to 40 feet
  - [ ] d) Approximate number of columns for bridges wider than 40 feet (Note: More columns may be required on skewed bents)
    - Number of columns = bridge width / 25
  - [ ] e) Location of exterior columns (distance from the edge of deck)
    - 0.4 x column spacing
  - [ ] f) Bent Cap depth (Bent Cap Depth / Max Bridge Span Length)
    - Reinforced Concrete Box (0.15)
    - P/S Concrete Box (0.10)

- [ ] 8. Develop trial layouts and evaluate advantages and disadvantages of each alternative. Things to consider:
  - [ ] a) Clearance from the proposed supports to traffic
  - [ ] b) Balance between structure span length and stiffness
  - [ ] c) Total cost of combined bridge, retaining walls, and roadwork
  - [ ] d) Impact on utilities, traffic, and environment
  - [ ] e) Good aesthetics
  - [ ] f) Ease of access and safety during construction
- [ ] 9. Select the preferred bridge layout and verify original assumptions for bridge type, structure depth, span configuration, column length and size.
- [ ] 10. Verify minimum vertical and horizontal clearance requirements for final structure configuration.

Additional Considerations

- [ ] 1. Extend wingwalls about 8 feet beyond the grading slopes at each abutment; for minor structures less than 50 feet in length, wingwall limit may be reduced to 5 feet.
- [ ] 2. Minimize the number of deck joints on a bridge to avoid future maintenance.
- [ ] 3. Provide maximum practical clearance between traffic and columns, see *Bridge Design Aids*: 10-1 Clearance at Structures.
  - [ ] a) Use 30-foot clear recovery distance whenever possible.
  - [ ] b) Columns located near edge of traffic shoulders must be protected with MGS or other traffic barrier.
- [ ] 4. For footing, column, and falsework construction near traffic, see *Memo to Designers*: 21-19 Guidelines for Clearance to Construction Operations.
- [ ] 5. Identify falsework clearance issues with the construction of bridges that are skewed, curved, or widened with staged construction, see *Bridge Design Aids*: 10-1 Clearance at Structures.
- [ ] 6. Avoid skewed abutments to limit seismic concerns and constructability issues.
  - [ ] • In freeze-thaw areas, avoid skewed abutments that could catch snow plough blade. Provide joint protection where skew cannot be avoided.

- [ ] 7. Locate hinges to facilitate falsework shoring during construction and future maintenance access. Things to consider:
  - [ ] a) Avoid hinges over waterways and traffic.
  - [ ] b) Do not place hinges over traffic falsework openings due to heavy construction load transfer during prestressing.
  - [ ] c) Consider additional trial column designs and layouts on long bridges to evaluate various hinge spacing layouts.
  - [ ] d) Place the high side of hinge nearest to the bent, to allow deck drain pipe to be routed to nearest column.
  - [ ] e) A reasonable length to begin trial hinge layout is to place cantilevered hinge approximately (0.15 x Adjacent Span length) away from bent.