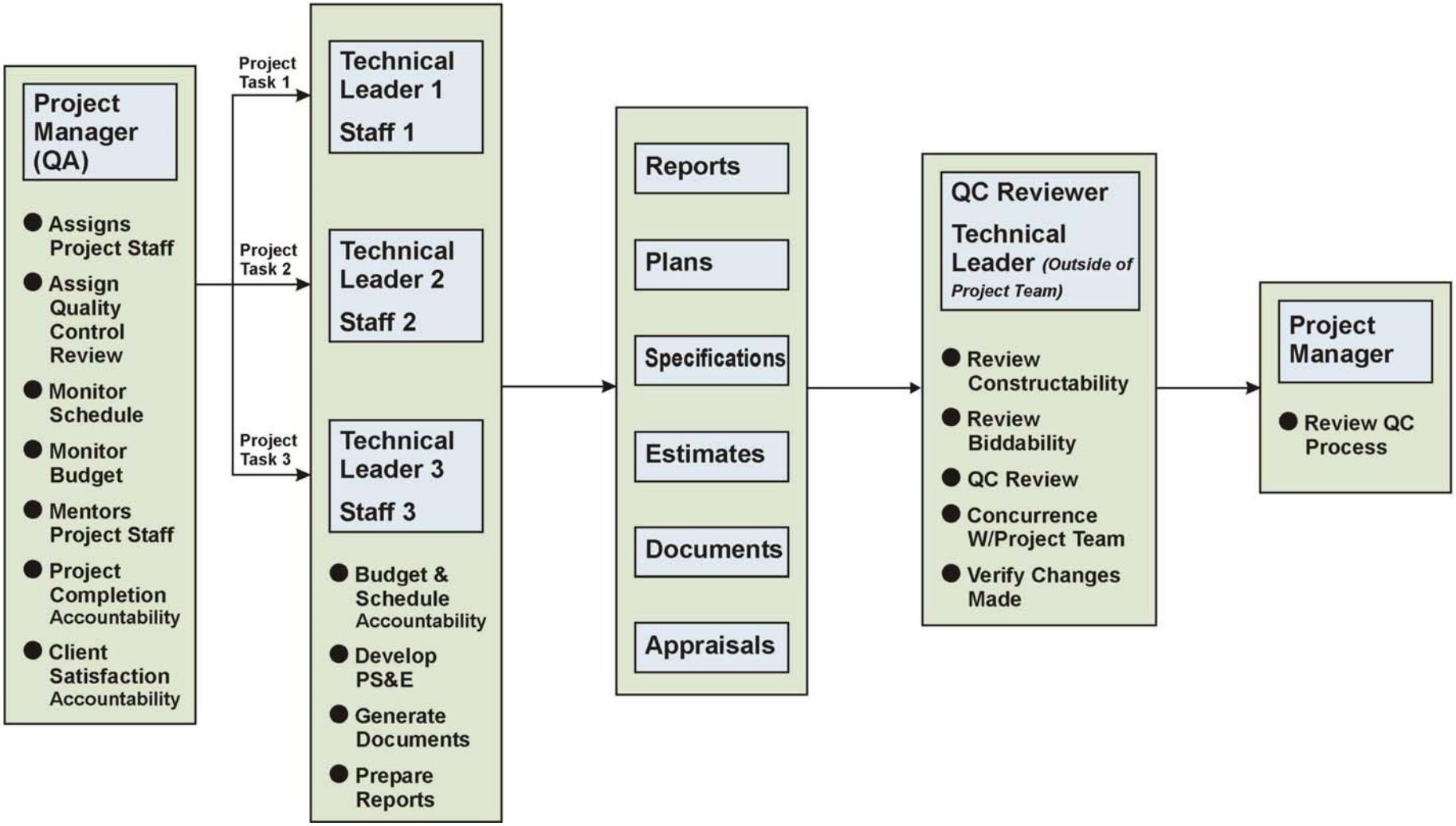
QA / QC Process

Becher Hoppe
Engineers and Architects
Improving Communities



Becher Hoppe QA/QC Guidelines & Checklist for:

Preliminary Structure Plans Development

Requirements of Drawing

Plan View

The plan view is preferably placed in the upper left-hand portion of the sheet at the largest scale practical (1"=10') and shows the following basic information:

1. Structure span lengths, (center-to-center of piers and to centerline of bearing at abutments, end distance from centerline of bearing to back face of abutment and overall length of structure).

2. Dimensions along the reference line except for structures on a curve in which case they are along a tangent to the curve.

3. Stations are required at centerline of piers, centerline of bearing at abutments, and end of deck or slab.

4. Stations at intersection with reference line of roadway underneath for grade separation structures.

5. Direction of stationing increase for highway or railroad beneath a structure.

6. Detail the extent of slope paving or riprap.

7. Direction of stream flow and name if a stream crossing.

8. Highway number and direction and number of traffic lanes.

9. Horizontal clearance dimensions, pavement, shoulder, sidewalk, and structure roadway widths.

10. Median width if dual highway.

11. Skew angles and angles of intersection with other highways, streets or railroads.

12. Horizontal curve data if within the limits of the structure showing station of P.C., P.T., and P.I. Complete curve data of all horizontal curves which may influence layout of structure.

13. Location of and vertical clearance at point of critical vertical clearance if highway or railroad separation. (For both roadway directions on divided highways).

14. If floor drains are proposed the type, approximate spacing, and whether downspouts are to be used.

15. Existing structure description, number, station at each end, buildings, underground utilities and pole lines giving owner's name and whether to remain in place, be relocated or abandoned.

16. Indicate which wingwalls have beam guard rail attached if any and wing lengths.

17. Structure numbers on plan. North Arrow.

18. Excavation protection for railroads.

19. Location of deck lighting or utilities if any.

20. Name Plate location. Locate the structure name plate on the roadway side of the first right wing traveling in the highway cardinal directions of North or East.

21. Bench Mark Cap Location

22. Locations of surface drains on approach pavement.

23. Tangent Offsets between reference line and tangent line along CL substructure unit.

Elevation View

The elevation view is preferably placed below the plan view. If the structure is not skewed the substructure units are to be a straight projection from the plan view. If skewed, the elevation is a view normal to substructure units. The view shows the following basic information:

1. Profile of existing groundline or streambed.

2. Cross-section of highway or channel below showing back slopes at abutments.

3. Elevation of top of berm and rate of back slope used in figuring length of structure.

4. Type and extent of slope paving or riprap on back slopes.

5. Proposed elevations of bottom of footings and type of piling if required.

6. Depth of footings for piers of stream crossing and if a seal is required, show and indicate by a note.

7. Location and amount of minimum vertical clearance.

8. Streambed, observed and high water elevations for stream crossings.

9. Location of underground utilities, with size, kind of material and elevation indicated.

10. Location of fixed and expansion bearings.

11. Location and type of expansion devices.

12. Use a scale of 1” = 10’ whenever possible.

Cross-Section View

The cross-section view need only be a half section if symmetrical about a reference line, otherwise it is a full section taken normal to reference line. Use a scale of (1” = 4’) whenever possible. A view of a typical pier is shown as a part of the cross-section. The view shows the following general information:

1. Slab thickness, curb height and width, type of railing.

2. Horizontal dimensions tied into a reference line or centerline of roadway.

3. Steel beam or girder spacing with beam/girder depth.

4. For prestressed girders approximate position of exterior girders.

5. Direction and amount of crown or superelevation.

6. Point referred to on profile grade.

7. Type of pier with size and number of columns proposed.

8. For solid, hammerhead or other type pier approximate size to scale.

9. If length of concrete pier cap between outer pier columns exceeds approximately 60 feet, provide an opening in the cross girder for temperature changes and concrete shrinkage, or design the pier cap for temperature and shrinkage to eliminate the opening.

10. Dimension minimum depth of bottom of footings below ditch or finished ground Line or if railroad crossing below top of rail.

11. Location for public and private utilities to be carried in the superstructure. Label owner's name of utilities.

12. Location of lighting on the deck or under the deck if any.

Other Requirements

1. Profile grade line across structure showing tangent grades and length of vertical curve. Station and elevation of P.C., P.I., P.T., and centerline of all substructure units. Profile grade line of highway beneath structure if highway separation or of top rail if railroad separation. Stations along top of rail are to be tied into actual stationing as established by railroad company.

2. Channel change section if applicable. Approximate stream bed elevation at low point.

3. Any other view or detail which may influence the bridge type, length or clearance.

4. List design data including:

   A. Ultimate Stresses for Materials:

      1) Concrete Superstructure
      2) Concrete Substructure
      3) Bar Steel Reinforcement
      4) Structural Steel
      5) Prestressed Concrete
      6) Prestressing Steel

   B. Foundations

      1) Soil Bearing Pressure
      2) Pile Type and Capacity (see 6.3.2.1)

   C. Ratings

      1) Live Load:
      2) Design Loading: HL-93
      3) Inventory Rating Factor: RF = X.XX
      4) Operating Rating Factor: RF = X.XX
      5) Wisconsin Standard Permit Vehicle (Wis-SPV)

      (See Chapter 45 – Bridge Rating (45.8.2) for additional information)

   D. Hydraulic Data

E. Base Flood

1) 100 Year Discharge
2) Stream Velocity
3) 100 Year Highwater Elevation
4) Q2 & Q2 Elevation (Based on new structure opening)
5) Waterway Area
6) Drainage Area
7) Scour Critical

F. Overtopping Flood OR (Overtopping N/A, for Floods > the 100 Year Flood)

1) Overtopping Frequency
2) Overtopping Elevation
3) Overtopping Discharge

5. Show traffic data. Give traffic count, data and highway for each highway on grade separation or interchange structure.

Utilities

In urban areas, public and private utilities generally have their facilities such as sewers, water cables, pipes, ducts, etc., underground, or at river crossings, in the streambed. If these facilities cannot be relocated, they may interfere with the most economical span arrangement. The preferred location of light poles is at the abutments or piers. Overhead power lines may cause construction problems or maintenance inspection problems. Verify if they exist and notify Utilities & Access Management Unit (Bureau of Tech. Services) to have them removed. It is the general policy to not place utilities on the structure. The Utilities & Access Management Unit approves all utility applications and determines whether utilities are placed on the structures or can be accommodated some other way. Refer all requests to them. Also see Chapter 18 of the FDM and Chapter 4 of "*WisDOT Guide to Utility Coordination*". Indicate with a check next to each item above upon review.

Sign and Date upon completion of the checking each of the above:

Technical Leader	Project Manager	QC Reviewer

Becher Hoppe QA/QC Guidelines & Checklist for:

Final Structure Plans Development

Drawing Size

1. Sheets are 11 inches wide from top to bottom and 17 inches long. A border line is provided on the sheet 1 inch from the left edge, and ¼ inch from other edges.

2. Title blocks are provided on the first sheet for a signature and other required information.

3. The following sheets contain the same information without provision for a signature.

Scale

All drawings insofar as possible are drawn to scale. Such details as reinforcing steel, steel plate thicknesses, etc. are not scaled. The scale is adequate to show all necessary details.

Line Thickness

1. Object lines are the widest line on the drawing.

2. Lines showing all or part of an existing structure or facility are shown by dashed lines of somewhat lighter weight.

3. Lines showing bar steel are lighter than object lines and are drawn continuous without any break.

4. Dimension and extension lines are lighter than bar steel lines but heavy enough to make a good reproduction.

Lettering and Dimensions

1. All lettering is upper case.

2. Lettering and dimensions are read from the bottom or right hand side and should be placed above the dimension lines.

3. Notes and dimension text are 0.12 inches high; view titles are 0.20 inches high (based on full size sheet, 22” x 34”).

4. Dimensions are given in feet and inches.

5. Elevations are given in decimal form to the nearest 0.01 of a foot. Always show two decimal places.

6. Although plan dimensions are very accurate, the contractor should use reasonable tolerances during construction of the project by building to the accuracy required.

7. Detail structural steel to the thickness of the material involved.

Notes

1. Show any notes to make the required details clear on the plans.

2. Do not include material that is part of the specifications.

Standard Insert Drawings

1. Standard detail sheets are available for railings and parapets, prestressed girders, bearings, expansion joints, and drains.

2. Fill in the dimensions and titles required and insert in the final plans.

3. Standard insert sheets can be found at: http://trust.dot.state.wi.us/extntgtwy/dtid_bos/extranet/structures/index.htm

Abbreviations

Abbreviations are to be used throughout the plans whenever possible. See Chapter 6.1.3.7 of the Bridge Manual for standard abbreviations.

Nomenclature and Definitions

Universally accepted nomenclature and approved definitions are to be used wherever possible.

Plan Sheets

The following information describes the order of plan sheets and the material required on each sheet.

1. Plan sheets are placed in order of construction generally as follows:

    a. General Plan
    b. Subsurface Exploration
    c. Abutments
    d. Piers
    e. Superstructure and Superstructure Details
    f. Railing and Parapet Details

2. Show all views looking up station.

General Plan (Sheet 1)

See the BOS web page, CADD Resource Files, for the latest sheet boarders to be used.

A. Plan View

1. Same requirements as specified for preliminary drawing, except do not show contours of groundline and as noted below.

    - Sufficient dimensions to layout structure in the field.
    - Describe the structure with a simple note such as: Four span continuous steel girder structure.
    - Station at end of deck on each end of bridge.

B. On Structure Replacements

    - Show existing structure in dashed-lines on Plan View.

C. Elevation View

1. Same requirements as specified for preliminary plan except:

    - Show elevation at bottom of all substructure units.
    - Give estimated pile lengths where used.

D. Cross-Section View

1. Same requirements as specified for preliminary plan except:

    - For railroad bridges show a railroad cross-section.
    - View of pier if the bridge has a pier (s), if not, view of abutment.

E. Grade Line

1. Same requirements as specified for preliminary plan.

F. Design and Traffic Data

1. Same requirements as specified for preliminary plan plus show Design Specifications as: AASHTO LRFD Spec. 2007.

G. Hydraulic Information, if Applicable

H. Foundations

1. Give soil/rock bearing capacity or pile capacity.

    - Example for General Plan sheet: Abutments to be supported on HP 10 x 42 steel piling with a required driving resistance of 180 tons * per pile as determined by the Modified Gates Dynamic Equation. Estimated 50’ long.

* The factored axial resistance of piles in compression used for design is the required driving resistance multiplied by a resistance factor of 0.5 using modified Gates to determine driven pile capacity.

2. Repeat the note above on each substructure sheet, except the asterisk (*) and subsequent explanation of factored design resistance need not appear on individual substructure sheets.

3. See Table 11.3-5 for typical maximum driving resistance values.

I. Estimated Quantities

1. Enter bid items and quantities as they appear, and in the order in which they appear in the "Schedule of Bid Items" of the Standard Specifications.

2. Put items not provided for at the bottom of the list.

3. Enter quantities for each part of the structure, (superstructure, each abutment, each pier) under a separate column with a grand total.

4. Quantities are to be bid under items for the Structure Type and not by the "B" or "C" numbers. For example, concrete for a multi-cell box culvert exceeding a total length of 20 feet is to be bid under item Concrete Masonry Culverts. As another example, a bridge having a length less than 20 feet would be given a "C" number; however, the concrete bid item is Concrete Masonry Bridges.

5. For incidental items to be furnished for which there is no bid item, and compensation is not covered by the Standard Specifications or Special Provisions, note on the plans the most closely related bid item that is to include the cost in the price bid per unit of item. As an example, the cost of concrete inserts is to be included in the price bid per cubic yard of concrete masonry.

J. General Notes

1. A standard list of notes is given in 6.3.2.1.1 and 6.3.2.1.2. Use the notes in this table that apply to the structure drawn on the plans.

K. List of Drawings

1. Each sheet is numbered sequentially beginning with 1 for the first sheet. Give the sheet number and title of sheet.

L. Bench Marks

1. Give the location, description and elevation of the nearest bench mark.

M. Title Block

1. Fill in all data for the Title Block except the signature. The title of this sheet is "General Plan".

2. Use the line below the structure number to describe the type of crossing. (Example: STH 15 SB over Fox River). For Design Specification, use AASHTO and year. If LRFD specs are used, use AASHTO LRFD and year.

N. Professional Seal

1. All final bridge plans prepared by Consultants or Governmental Agencies shall be professionally sealed, signed, and dated on the general plan sheet. This is not required for WisDOT prepared plans, as they are covered elsewhere.

Plan notes for New Bridge Construction

1. Drawings shall not be scaled. Bar Steel Reinforcement shall be embedded 2” clear unless otherwise shown or noted.

2. All field connections shall be made with 3/4” diameter friction type high-tensile strength bolts unless shown or noted otherwise.

3. Slab falsework shall be supported on piles or the substructure unless an alternate method is approved by the Engineer.

4. The first or first two digits of the bar mark signifies the bar size.

5. The slope of the fill in front of the abutments shall be covered with heavy riprap and geotextile fabric Type ‘HR’ to the extent shown on sheet 1 and in the abutment details.

6. The slope of the fill in front of the abutments shall be covered with slope paving material to the extent shown on sheet 1 and in the abutment details.

7. The stream bed in front of the abutment shall be covered with riprap as shown on this sheet and in the abutment details.

8. The existing stream bed shall be used as the upper limits of excavation at the piers.

9. The existing ground line shall be used as the upper limits of excavation at the piers.

10. The finished graded section shall be the upper limits of excavation for structures.

11. The upper limits of excavation for structures for the abutments shall be the bottom of slope protection.

12. Within the length of the box all spaces excavated and not occupied by the new structure shall be backfilled with Structure Backfill to the elevation and section existing prior to excavation within the length of the culvert.

13. At the backface of abutment all volume which cannot be placed before abutment construction and is not occupied by the new structure shall be backfilled with structure backfill.

14. Concrete inserts to be furnished by the utility company and placed by the contractor. Cost of placing inserts shall be included in the bid price for concrete masonry.

15. Prestressed Girder Bridges - The haunch concrete quantity is based on the average haunch shown on the Prestressed Girder Details sheet, which is the maximum haunch quantity for which the Contractor will be paid.

Plan Notes for Bridge Rehabilitation

1. Dimensions shown are based on the original structure plans.

2. All concrete removal not covered with a concrete overlay shall be defined by a 1 inch deep saw cut.

3. Utilize existing bar steel reinforcement where shown and extend 24 bar diameters into new work, unless specified otherwise.

4. Concrete expansion bolts and inserts to be furnished and placed by the contractor under the bid price for concrete masonry.

5. At "Curb Repair" expose existing reinforcement a minimum of 1 1/2” clear.

6. Existing floor drains to remain in place. Remove top of deck in drain area as directed by the Field Engineer to allow placing and sloping of 1 1/2” concrete overlay.

7. Expansion joint assembly, including anchor studs and hardware shall be paid for in the lump sum price bid as "Expansion Device B-_____" or “Expansion Device Modular B- _____”.

8. Clean and fill existing longitudinal and transverse cracks with penetrating epoxy as directed by the Field Engineer.

9. Variations to the new grade line over 1/4” must be submitted by the Field Engineer to the Structures Design Section for review.

10. The contractor shall supply a new name plate in accordance with Section 502.3.11 of the Standard Specifications and the standard detail drawings. Name plate to show original construction year.

Subsurface Exploration

This sheet is initiated by the Geotechnical Engineer. The following information is required on the sheet. Bridge details are not drawn by the Geotechnical Engineer.

A. Plan View

1. Show a plan layout of structure with survey lines, reference lines, pier and abutment locations and location of borings and probings plotted to scale.

2. On box culvert structure plans, show three profile lines of the existing ground elevations (along the centerline and outer walls of the box). Scale the information for these lines from the site contour map that is a part of the structure survey report.

B. Elevation

1. Show a centerline profile of existing ground elevation.

2. Show only substructure units at proper elevation w/no elevations shown. Also show the pile lengths.

3. Show the kind of material, its located depth, and the blow count of the split spoon sampler for each boring.

4. Give the blow count at about 5 foot intervals or where there is a significant change in material.

Abutments

1. Use as many sheets as necessary to show details clearly.

2. Show all bar steel required using standard notations; solid lines lengthwise and solid dots in cross section.
3. Give dimensions for a skewed abutment to a reference line which passes through the intersection for the longitudinal structural reference line and centerline of bearing of the abutment.
4. Give the dimension, from centerline of bearing to backface of abutment along the longitudinal reference line and the offset distance if on a skew. Show the skew angle.
5. If there is piling, show a complete footing layout giving piling dimensions tied to the reference line. Number all the piles. Give the type of piling, length and required driving resistance.
6. Show a welded field splice for cast-in place concrete or steel H piles.
7. Bridge seats for steel bearings and laminated elastomeric bearings are level within the limits of the bearing plate. Slope the bearing area utilizing non-laminated elastomeric bearings if the slope of the bottom of girder exceeds 1%. Slope the bridge seat between bearings 1” from front face of backwall to front face of abutment. Give all beam seat elevations.

A. Plan View

1. Place a keyed construction joint near the center of the abutment if the length of the body wall exceeds 50 feet. Make the keyway as large as feasible and extend the horizontal bar steel through the joint.

2. Dimension wings in a direction parallel and perpendicular to the wing centerline.

3. Dimension angle between wing and body if that angle is different from the skew angle of the abutment.

B. Elevation

1. Give beam seat, wing (front face and wing tip), and footing elevations to the nearest .01 of a foot.
2. Give vertical dimension of wing.
3. Wing Elevation
4. Body Section

    a. Place an optional keyed construction joint in the parapet at the bridge seat elevation if there is a parapet.

5. Wing Sections
6. Bar Steel Listing and Detail
7. Use the following views where necessary:
    a. Pile Plan & Splice Detail
    b. View Showing Limits of Excavation and Backfill
    c. Special Details for Utilities

d. Drainage Details

Piers

1. Use as many sheets as necessary to show all details clearly. One sheet may show several piers if only the height, elevations and other minor details are different.
2. Give dimensions for a skewed pier to a reference line which passes through the intersection of the longitudinal structural reference line and the pier centerline. Show the skew angle.

3. Dimension the centerline spacing of superstructure girders.

A. Plan View

1. Show dimensions, footings, cap steps, beam spacings and skew angle.

B. Elevation

1. Show dimensions and elevations.
2. Show lengths of all columns for clarity.
3. Give the elevation of the bottom of footings and beam seats.
4. Refer to abutments for detailing bridge seats.
5. Dimension all bar steel and stirrups.

C. Footing Plan

1. Show dimensions for pile spacing, pile numbers and reinforcing steel in footing.

D. Bar Steel Listing and Details

E. Pile Splice Detail (If different from abutment only).

F. Cross Section thru Column and Pier Cap

1. Detail anchor bolts between reinforcing bars to provide clearance. Long steel bridges may require more clearance. This allows an erection tolerance for the structural steel so that the bar steel is not pierced by the anchor bolts if the bearing is shifted.

Superstructure

Use as many sheets as are necessary to show all details clearly. Standard insert sheets are available to show many standard details. The title, project number, and a few basic dimensions are added to these standard sheets.

All Structures

1. Show the cross-section of roadway, plan view and related details, elevation of typical girder or girders, details of girders, and other details not shown on standard insert sheets.
2. All drawings are to be fully dimensioned and show such sections and views as needed to detail the superstructure completely.

Girder Bridges

1. Show the total dead load deflections, including composite dead load (without future wearing surface) acting on the composite section, at tenth points of each span.

2. Distribute the composite dead load evenly to all girders and provide one deflection value for a typical interior girder. Chapter 17 – Superstructure-General illustrates three load cases for exterior girder design with raised sidewalks, cases that provide a conservative envelope to ensure adequate girder capacity. However, the above composite dead load distribution should be used for deflection purposes.

3. For prestressed concrete girders, the dead load deflection reported does not include the weight of the girder. See Chapter 24 – Steel Girder Structures for camber and blocking, top of steel elevation and deflection reporting criteria.

4. A separate deflection value for interior and exterior girders may be provided if the difference, accounting for load transfer between girders, warrants multiple values. A weighted distribution of composite dead load could be used for deflection purposes only. For example, an extremely large composite load over the exterior girder could be distributed as 40-30-30 percent to the exterior and first two interior girders respectively. Use good engineering judgment to determine whether to provide separate deflection values for individual girder lines. In general, this is not necessary.

Slab Bridges

1. Provide camber values at the tenth points of all spans. The camber is based on 3 times the deflection of the slab, only.

2. For multi-span bridges, the deflection calculations are based on a continuous span structure since the falsework supports the bridge until the concrete slab has cured.

3. Deflection and camber values are to be reported to the nearest 0.1 inch.
4. For girder structures, provide finished grade top of deck elevations for each girder line at the tenth points of all spans. Show the top of deck elevations at the

outside edge of deck at tenth points. If staged construction, include tenth point elevations along the construction joint.

5. For slab structures, provide the finished grade elevations at the centerline and/or crown and edge of slab at tenth points.

6. Decks of uniform thickness are used on all girders. Variations in thickness are achieved by haunching the deck over each girder. Haunches are formed off the top of the top flange. See the standards for details. In general the minimum haunch depth along the edge of girder is to be 1 1/4” although 2” is recommended to allow for construction tolerances. Haunch depth is the distance from the bottom of the concrete deck to the top of the top flange.
7. Provide a paving notch at each end of all structures for rigid approach pavements.See standard for details.

8. If the structure contains conduit for a deck lighting system, place the conduit in the concrete parapet. Place expansion devices on conduit which passes through structure expansion joints.

9. Show the bar steel reinforcement in the slab, curb, and sidewalk with the transverse spacing and all bars labeled. Show the direction and amount of roadway crown.

10. On bridges with a median curb and left turn lane, water may be trapped at the curb due to the grade slope and crown slope. If this is the case, make the cross slope flat to minimize the problem. Existing pavers cannot adjust to a variable crown line.

11. On structures with modular joints consider cover plates for the back of parapets when aesthetics are a consideration.

Steel Structures

1. Show the diaphragm connections on steel girders. Show the spacing of rail posts on the plan view.

2. Show a steel framing plan for all steel girders. Show the spacing of diaphragms.

3. On the elevation view of steel girders show dimension, material required, field and shop splice locations, stiffener spacing, shear connector spacing, and any other information necessary to construct the girder. In additional views show the field splice details and any other detail that is necessary.
4. Show the size and location of all weld types with the proper symbols except for butt welds. Requirements for butt welds are covered by A.W.S. Specifications.

5. See Chapter 24 – Steel Girder Structures for camber and blocking, top of steel

elevation and deflection reporting criteria.

6. Existing flange and web sizes should be shown to facilitate the sizing of bolts on Rehabilitation Plans.

Railing and Parapet Details

1. Standard drawings are maintained by the Structures Development Section showing railing and parapet details.

2. Add the details and dimensions to these drawings that are unique to the structure being detailed.
3. Compute the length along the slope of grade line rather than the horizontal dimension.

Miscellaneous Information

Bill of Bars

1. Show a complete bill of bar steel reinforcement for each unit of the structure. Place this bill on the sheet to which the bars pertain. If the abutments or piers are similar, only one bar list is needed for each type of unit.

2. Give each bar or group of bars a different mark if they vary in size, length, or location in a unit. Each bar list is to show the mark, number of bars, length, location and detail for each bar. Give bar lengths to the nearest 1” and segment lengths of bent bars to the nearest 1/2”.

3. Show all bar bends and hooks in detail.

4. Identify all bars with a letter indicating the unit in which the bar is placed - A for abutment, P for pier, S for superstructure. Where units are multiple, each unit should have a different letter.

5. Use a one or two digit number to sequentially number the bars in a unit. P1008 indicates bar number 08 is a size number 10 bar located in a Pier.

6. Use a Bar Series Table where a number of bars the same size and spacing vary in length is a uniform progression. Use only one mark for all these bars and put the average length in the table.

7. Refer to the Standard drawings in Chapter 9.0 for more information on reinforcing bars such as minimum bend diameter, splice lengths, bar supports, etc.

8. When a bridge is constructed in stages, show the bar quantities for each stage. This helps the contractor with storage and retrieval during construction.

Box Culverts

Detail plans for box culverts are to be fully dimensioned and have sectional drawings needed to detail the structure completely. The following items are to be shown when necessary:

A. Plan View
B. Longitudinal section
C. Section thru box
D. Wing elevations
E. Section thru wings
F. Section thru cutoff wall
G. Vertical construction joint
H. Bar steel clearance details
I. Header details
J. North point, Bench mark, Quantities
K. Bill of bars, Bar details
L. General notes, List of drawings, Rip rap layout
M. Inlet nose detail on multiple cell boxes
N. Corner details

1. Bid items are excavation, concrete masonry, bar steel and rip rap. Non bid items are membrane waterproofing, filler and expansion bolts.

2. In lieu of showing a contour map, show profile grade lines as described for Subsurface Exploration sheet.

3. See the standard details for box culverts for the requirements on vertical construction joints, apron and cutoff walls, longitudinal construction joints, and optional construction joints.

4. Show name plate location on plan view and on wing detail.

Miscellaneous Structures

Detail plans for other structures such as retaining walls, sign bridges, pedestrian bridges, and erosion control structures are to be detailed with the same requirements as previously mentioned.

Standard Drawings

Standard drawings are maintained and furnished by the Structures Development Section. These drawings show the common types of details required on the contract plans.

Insert Sheets

These sheets are maintained by the Structures Development Section and are used in the contract plans to show standard details.

Change Orders and Maintenance Work

These plans are drawn on full size sheets.

Bench Marks

1. Bench mark caps are shown on all bridges and larger culverts.
2. Locate the caps on a horizontal surface flush with the concrete.
3. Show the location in close proximity to the Name Plate.

Checking Plans

1. Upon completion of the design and drafting of plans for a structure, the final plans are usually checked by one person. Dividing plans checking between two or more Checkers for any one structure leads to errors many times.

2. The plans are checked for compliance with the approved preliminary drawing, design, sufficiency and accuracy of details, dimensions, elevations, and quantities. Generally the information shown on the preliminary plan is to be used on the final plans.

3. Revisions may be made to footing sizes and elevations, pile lengths, dimensions, girder spacing, column shapes, and other details not determined at the preliminary stage. Any major changes from the preliminary plan are to be approved by the Chief Bridge Design Engineer.

4. Give special attention to unique details and unusual construction problems. Take nothing for granted on the plans.

5. The Checkers check the final plans against the Engineer's design and sketches to be sure all information is shown correctly.

6. The Engineer prepares all sketches and notations not covered by standard drawings.

7. A good Checker checks what is shown and noted on the plan and also checks to see if any essential details, dimensions, or notation have been omitted.

8. Check the final plan Bid Items for conformity with those scheduled in the WisDOT Standard Specifications for Highway and Structure Construction.

9. The Checker makes an independent Bill of Bars list to be sure the detailer has not omitted any bars when checking the quantity of bar steel.

10. Avoid making minor revisions in details or dimensions that have very little effect on cost, appearance, or adequacy of the completed structure.

11. Check grade and bridge seat elevations and all dimensions to the required tolerances.

12. The Checkers make all corrections, revisions, and notations on a print of the plan and return it to the Plan Preparer.

13. The Plan Preparer back checks all marks made by the checker before changing

14. Any disagreements are resolved with the supervisor. Common complaints received from field people are dimension errors, small details crowded on a drawing, lettering is too small, and reinforcing bar length or quantity errors

15. Indicate with a check next to each item above upon review.

16. Sign and Date upon completion of the checking each of the above:

Technical Leader	Project Manager	QC Reviewer