QUALITY ASSURANCE
and
QUALITY CONTROL

BRIDGE STRUCTURES

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Quality Control and Quality Assurance

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August 20, 2010.

Introduction

This plan has been revised from the existing Quality Control and Quality Assurance plan used by Jewell Associates Engineers, Inc. to specifically address bridge projects for the Wisconsin Department of Transportation. This plan addresses the Bureau of Structures requirements as follows:

The QA/QC plan and procedures shall include as a minimum:

- Procedures to detect and correct bridge design errors before the design plans are made final.
- A means for verifying that the appropriate design calculations have been preformed, that the calculations are accurate, and that the capacity of the load-carrying members is adequate with regard to the expected service loads of the structure.
- A means for verifying the completeness, constructability and accuracy of the structure plans.
- Verification that independent checks, reviews and ratings were performed.

Definition of Staff Titles

Project Director - Senior Project Management or Principle with technical and construction experience in the type of project being supervising. For this plan, this person will be responsible for review of the structure selection, sizing and structure geometry prior to development of the Structure Survey Report and Preliminary Plans. The Project Engineer along with the Project Director will sign off on the preliminary selections.

Project Engineer - The Project Engineer will be responsible for the technical portions of the project including structure design, usual or unique loading conditions, geometry, preliminary and final plan development, specifications and quantities. This work shall be completed by the Project Engineer or under his direct supervision.

Checker - The checker will be assigned at the beginning of the project and shall be qualified to review and performs checks on design, plan preparation, specifications and quantities. The same checker will complete all checking for the the plan in review. Multiple checkers on the same plan will not be allowed.

General Comments for Checking Plans

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.

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.
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 internally by the Project Manager and by BOS for the Department.

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

The Checkers check the final plans against the Engineer's design and sketches to be sure all information is shown correctly. The Engineer prepares all sketches and notations not covered by standard drawings. 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.

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

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.

Avoid making minor revisions in details or dimensions that have very little effect on cost, appearance, or adequacy of the completed structure. Check grade and bridge seat elevations and all dimensions to the required tolerances. The Checkers make all corrections, revisions, and notations on a print of the plan and return it to the Plan Preparer. The Plan Preparer back checks all marks made by the checker before changing. Any disagreements are resolved with the project manager.

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.

Quality Control and Quality Assurance

This statement signed by the Project Director assures the Quality Assuance has taken place for the structure project indicated. Individual checklist for each specific work item are attached.

Project Work Plan	Reviewed and Approved	Greg Jewell P.E., R.L.S.
Flow Chart	Reviewed and Approved	Greg Jewell P.E., R.L.S.
SSR	Reviewed and Approved	Greg Jewell P.E., R.L.S.
Design Calculations	Reviewed and Approved	Greg Jewell P.E., R.L.S.
Preliminary Plan Checklist	Reviewed and Approved	Greg Jewell P.E., R.L.S.
Final Plan Checklist	Reviewed and Approved	Greg Jewell P.E., R.L.S.
Quantities Checklist	Reviewed and Approved	Greg Jewell P.E., R.L.S.

Quality Control and Quality Assurance

August 20, 2010
Prepared by:
Greg Jewell PE, RLS
Jewell Associates Engineers, Inc.

Project Work Plan

A Project Work Plan will be prepared by the Project Manager / Engineer for each project. This document will be used as a tool for management/communication throughout the project. The completed document will be shared with all team members and the client is appropiate.

The Project Manager shall prepare the document at the onset of the project and provide it to the Project Director for review and approval. The document shall be visited regularly thougout the length of the project to be sure the project is on track according to the plan. If a problem arises, either technical or financial, a Corrective Action Plan shall be developed by the Project Manager and approved by the Project Director. This becomes the updated Project Plan for use by all involved.

A minimum topics shall be included in the plan:

1. Background and Objectives
2. Scope of Services
3. Key Assumptions
4. Standards and Codes
5. Team Directory
6. Work Task and Budget Breakdown
7. Schedule
8. Deliverables
9. QA / QC Checklist
10. Billing Procedures
11. Monitoring and Control

For the discussion on Structure Quality and Control, the Project Manager preparing the Project Work Plan shall use the attached checklist as a guide for each projects.

The Project Manager shall identify the appropiate periods for Quality Assurance and Quality Control in the project plan.

No Plan will leave the office until the QA / QC Process has been completed.

Approvals, Distribution, and Work Flow

START

Consultant — Consultant Meet with Regional Office and/or local units of government to determine need.

Consultant — Project Work Plan is Prepared by Project Engineer and reviewed and approved by Project Director.

NO WORK TO PROCEED UNTIL PROJECT WORK PLAN IS APPROVED.

Consultant — Project Engineer creats a survey checklist and meets with Survey Crew Chief to review project needs.

Consultant — Topo map is created by survey staff, checked and verified. Signed off by surveyor in charge.

Consultant — Roadway geometry is created and reviewed and approved by Project Engineer.

Consultant — Prepare Structure Survey Report including recommendation of structure type and size. Prepared by Project Engineer and reviewed and prepared by Project Director.

NO WORK TO PROCEED UNTIL SSR IS REVIEWED AND APPROVED.

Sub Consultant — Geotechnical Consultant Make site investigation and prepare Site Investigation Report.

Consultant — Consultant Prepare Preliminary Plan documents including scour computations for spread footings and/or shallow pile foundations. Record scour critical code on preliminary plans. Refer to Chapter 8, Appendix 8-D.

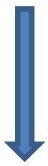
PLANS WILL NOT BE SENT UNTIL CHECKED AND APPROVED

Consultant — Forward preliminary plans to the Structures Design Section for review and processing with a copy to the Regional Office.

DEPARTMENT

Structures Design Section Record Bridge and project numbers.
Review hydraulics for Stream Crossings.
Review Preliminary Plan.
If a railroad is involved, send copies of preliminary plans to the Railroad.
If navigable waterway is crossed, a permit drawing to construct bridge is sent to Coast Guard. If Federal aid is involved preliminary plans are sent to Federal Highway Administration for approval.

DEPARTMENT



Return preliminary plans and comments from Structures Design Section and other appropriate agencies to Consultant with a copy to the Regional Office.

PROJECT DIRECTOR AND PROJECT ENGINEER REVIEW COMMENTS

DEPARTMENT

Forward Preliminary Plan and Hydraulic Data to DNR.

Consultant

Consultant Modify preliminary plan as required.

Consultant

Prepare and complete final design and plans for the specified structure.

Consultant

Write unusual special provisions.
Send copies of final plans and special provisions to the Structures Design Section.

FINAL PLANS WILL NOT BE SENT UNTIL CHECKED AND APPROVED

DEPARTMENT

Structures Design Section Review final plans.
If a railroad is involved, send copies of final plans to Rails & Harbors Section.

DEPARTMENT

Return comments to Consultant with copy to Regional Office.

Consultant

Modify final plans and specifications as required.

Consultant

Send final plan originals to Structures Design Section.

Consultant

Send applicable Structure Inventory Data form to Structures Design Section. These forms are available on DTID Network.

DEPARTMENT

Structures Design Section Review final plan originals.
Sign final originals.
Write standard Special Provisions and send plan originals to Bureau of Project Development.
Bureau of Project Development Prepare final approved bridge plans for pre - Development contract administration.

FINISH

Structure Survey Report

The Project Engineer shall consult with the Project Director for guidance and review of the selection and sizing of the proposed bridge structure. The follow criteria shall be the baseline for structure selection and sizing. The selected structure and sizing shall be approved by the Project Director.

The following criteria are used for the preparation of preliminary plans.

1. Selection of Structure Type. Refer to Chapter 17, Superstructure-General, for a discussion of structure types.

2. Span Arrangements. For stream crossings the desired minimum vertical clearance from high water to low steel is given in Chapter 8.0-Hydraulics. Span lengths for multiple span stream crossings are in most cases a matter of economics and the provision for an opening that adequately passes ice and debris. For structures over navigable streams, the vertical and horizontal clearance of the navigable span are determined by the U.S. Coast Guard after considering the interests of both highway and waterway transportation users.

For most of the ordinary grade separation structures the requirements for horizontal clearance determine the span arrangements. Refer to Chapter 17.0-Superstructure-General for span length criteria.

3. Economics.

Economy is a primary consideration in determining the type of structure to be used. Refer to Chapter 5.0-Economics and Costs, for cost data.

At some stream crossings where the grade line permits considerable head room, investigate the economy of a concrete box culvert versus a bridge type structure. When economy is not a factor, the box culvert is the preferred type from the standpoint of maintenance costs, highway safety, flexibility for roadway construction, and provision of a facility without roadway width restrictions.

4. Aesthetics. Recognition of aesthetics as an integral part of a structure is essential if bridges are to be designed in harmony with adjacent land use and development. Refer to Chapter 4.0-Aesthetics.

The Structure type and sizing has been prepared by:

_____

The Structure type and sizing have been reviewed and approved by:

_____

Greg A. Jewell P.E., R.L.S.
Project Director

5. Hydraulic Consideration. Stream crossing structures are influenced by stream flow, drift, scour, channel conditions, ice, navigation, and conservation requirements. This information is submitted as part of the Structure Survey Report. Refer to Chapter 8 for Hydraulic considerations and Section 8.1.5 for Temporary Structure Criteria.

6. Geometrics of Design. The vertical and horizontal clearance roadway widths, design live loading, alignment, and other pertinent geometric requirements are given in Chapter 3.

7. Maintenance. All bridge types require structural maintenance during their service life. Maintenance of approaches, embankments, drainage, substructure, concrete deck, and minor facilities is the same for the various types of bridges. A minimum draining grade of 0.5% across the bridge is desirable to eliminate small ponds on the deck except for open railings where the cross slope is adequate.

Epoxy coated bar steel is required in all new decks and slabs.

Steel girders require periodic painting unless a type of weathering steel is used. Even this steel may require painting near the joints. It is more difficult to repaint steel girders that span busy highways.

Reinforced concrete box girders and voided slabs have a poor experience in Wisconsin. They should not be used on new structures.

Deck expansion joints have proved to be a source of maintenance problems. Bridges designed with a limited number of watertight expansion devices are recommended.

8. Construction. Occasionally a structure is proposed over an existing highway on which traffic must be maintained. If the roadway underneath carries high volumes of traffic, any obstruction such as falsework would be hazardous as well as placing undesirable vertical clearance restrictions on the traveled way. This is also true for structures over a railroad.

For structures over most high-volume roadways construction time, future maintenance requirements, and provision for future expansion of the roadway width, have considerable influence on the selection of the final product.

9. Foundations. Poor foundation conditions may influence the structure geometry. It may be more economical to use longer spans and fewer substructure units or a longer structure to avoid high approach fills.

10. Environmental Considerations. In addition to the criteria listed above all highway structures must blend with the existing site conditions in a manner that is not detrimental to environmental factors. Preservation of fish and wildlife, pollution of waters, and the effects on surrounding property are of primary concern in protecting the environment. The design of structures and the treatment of embankments must consider these factors.

11. Safety. Safety is a prime consideration for all aspects of the structure design and layout. Bridge railings are approved through actual vehicle crash testing.

The SSR shall have the following information included for submittal.

Completed SSR form DT1698 for appropriate structure being designed.
In addition the following information shall be supplied.

1. Small County Map on which the location of proposed structure is shown in red and highway relocation, if any, in green.
2. Plan and Profile Sheet on proposed reference line of highway showing the following:
    - (a) Ground line
    - (b) Finished grade line
    - (c) Profile grade line elevations at least every 100 feet for 1,000 feet each side of the structure
    - (d) Vertical curve control points
    - (e) Horizontal curve control points
    - (f) Curve data, including full SE and runoff distance
3. Contour Map of the site drawn to a scale of not less than 1" = 20 feet with one-foot contours and showing the following:
    - (a) Existing highway and structure
    - (b) Proposed highway alignment and R/W
    - (c) Station numbers
    - (d) North arrow
    - (e) Buildings
    - (f) Underground facilities
    - (g) Other features which influence the design
    - (h) Recommended channel change
    - (i) Direction of stream flow

CADD	PE	Checker

(j) Stations at end of existing structure

(k) Proposed structure and extent of riprap for consultant designed structures.

4. Typical Roadway Cross Section of proposed approaches showing the following:

(a) Dimensions

(b) Slopes

(c) Type and width of surfacing or pavement

(d) Sidewalk, curb and gutter

(e) Subgrade and pavement thickness

(f) Clear zone width.

5. Stream Cross Section at upstream and downstream face of existing bridge and at one bridge length upstream and downstream. Surface water elevations at 1500 feet upstream and downstream of existing bridge.

6. Original Photographs of:

(a) Existing structure

(b) Upstream and downstream structures

(c) Buildings within 100 feet of the proposed structure

(d) Unobstructed panoramic view looking upstream and downstream from proposed structure

(e) Air photo mosaics if available

7. Proposed Location Map showing structure location and number, one per structure when there are multiple structures on the project.

8. Attach a copy of the regulatory flood plain map (FEMA map) depicting the site.

9. For consultant designed structures - Hydraulic Report which may contain the following:

(a) USGS quadrangle sheet showing proposed location, highway alignment and reach of river

(b) All available flood history, high water marks with date of occurrence, nature of flooding, damages and scour information

(c) Factors affecting water stages

(d) Navigation Clearance, for guidance in making report, see Chapter 8 of Bridge Design Manual

(e) Discussion of alternatives considered, factors influencing selection

10. Attach a copy of DNR initial concurrence letter.

GENERAL PLAN

Drawing Size

		CADD	PE	Checker
1	Sheets are 11 inches wide from top to bottom and 17 inches long.			
2	Verify the latest approved DOT boarder is being used.			
3	Verify title sheet information is correct on first drawing sheet.			
4	Dimensions along the reference line except for structures on a curve in which case they are along a tangent to the curve. Sufficient dimensions to layout structure in the field.			
5	Stations are required at centerline of piers, centerline of bearing at abutments, and end of deck or slab.			
6	Stations at intersection with reference line of roadway underneath for grade separation structures.			
7	Direction of stationing increase for highway or railroad beneath a structure.			
8	Detail the extent of slope paving or riprap.			
9	Direction of stream flow and name if a stream crossing.			
10	Highway number and direction and number of traffic lanes.			
11	Horizontal clearance dimensions, pavement, shoulder, sidewalk, and structure roadway widths.			
12	Median width if dual highway.			
13	Skew angles and angles of intersection with other highways, streets or railroads.			
14	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.			
15	Location of and vertical clearance at point of critical vertical clearance if highway or railroad separation. (For both roadway directions on divided highways).			
16	If floor drains are proposed the type, approximate spacing, and whether downspouts are to be used.			
17	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.			
18	Indicate which wingwalls have beam guard rail attached if any and wing lengths.			
19	Structure numbers on plan.			
20	North Arrow.			
21	Excavation protection for railroads.			
22	Location of deck lighting or utilities if any.			
23	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.			
24	Bench Mark Cap Location			
25	Locations of surface drains on approach pavement.			
26	Tangent Offsets between reference line and tangent line along CL substructure unit.			
27	Describe the structure with a simple note such as: Four span continuous steel girder structure.			
28	Station at end of deck on each end of bridge.			
29	On Structure Replacements-Show existing structure in dashed-lines on Plan View.			

Review of Quality Control by Project Director
Stating Checklist Items Conform to Project Plan. Date: _____

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:

		CADD	PE	PM
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/length 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.			

Review of Quality Control by Project Director
Stating Checklist Items Conform to Project Plan. Date: _____

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:

	CADD	PE	PM
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.			

Review of Quality Control by Project Director
Stating Checklist Items Conform to Project Plan. Date: _____

Other Requirements

	CADD	PE	PM
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:			

Ultimate Stresses for Materials:
- Concrete Superstructure
- Concrete Substructure
- Bar Steel Reinforcement
- Structural Steel
- Prestressed Concrete
- Prestressing Steel

Foundations
- Soil Bearing Pressure
- Pile Type and Capacity (see bridge manual 6.3.2.1)

Ratings- Live Load:
Design Loading: HL-93
Inventory Rating Factor: RF = X.XX
Operating Rating Factor: RF = X.XX
Wisconsin Standard Permit Vehicle (Wis-SPV)
(See bridge manual Chapter 45 – Bridge Rating (45.8.2) for additional information)

Hydraulic Data
Base Flood
- 100 Year Discharge
- Stream Velocity
- 100 Year Highwater Elevation
- Q2 & Q2 Elevation (Based on new structure opening)
- Waterway Area
- Drainage Area
- Scour Critical

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

- Overtopping Frequency
- Overtopping Elevation
- Overtopping Discharge

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

6 Approved Abbreviations- see bridge manual Table 6.3-1

7 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. Alsc see Chapter 18 of the FDM and Chapter 4 of "WisDOT Guide to Utility Coordination".

Review of Quality Control by Project Director
Stating Checklist Items Conform to Project Plan. Date: _____

Specifications and Standards

The following Specifictions shall be used for Wisconsin Department of Transportation Bridge Designs

American Association of State Highway and Transportation Officials (AASHTO) LRFD Design Specifications
American Society for Testing and Materials (ASTM)
American Welding Society (AWS)
Wisconsin Department of Transportation Standards
Wisconsin Department of Transportation Bridge Manul
Division of Transportation Systems Development Standard Specifications for Highway and Structure Construction

For Railway Structures the following specification shall be refererenced.

American Railway Engineering Maintenance-of-Way Association (AREMA) Manual for Railway Engineering

The following items will be checked by project engineer familiar with bridge design practices and references:

Items		Designer	Checker
1. Bridge Geometry			
2. Specifications noted in Calculations.			
3. Loading Conditions match conditions.			
4. Future Loading Conditions.			
5. Distribution of Loads	Live		
	Dead		
6. Check of computations			
7. Check of output to plans developed.			
8. Foundation Design matches soil report			
9. Special Conditions (Not standard drawing) have calculations for changes.			

FINAL PLAN

GENERAL PLAN

CADD	PE	CHECKER

Same requirements as specified for preliminary plan except:

1 Verify the latest approved DOT boarder is being used.
2 Verify title sheet information is correct on first drawing sheet.

Elevation View

CADD	PE	CHECKER

Same requirements as specified for preliminary plan except:

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

Cross-Section View

CADD	PE	CHECKER

Same requirements as specified for preliminary plan except:

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

Grade Line

CADD	PE	CHECKER

Same requirements as specified for preliminary plan.

Design and Traffic Data

CADD	PE	CHECKER

Same requirements as specified for preliminary plan plus

1 Show Design Specifications as: AASHTO LRFD Spec. 2007.
2 Hydraulic Information, if Applicable
3 Foundations
   a. Give soil/rock bearing capacity or pile capacity.
   b. *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.
   c. 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.
   d. See Table 11.3-5 for typical maximum driving resistance values

Estimated Quantities

CADD	PE	CHECKER

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. Put items not provided for at the bottom of the list. Enter quantities for each part of the structure, (superstructure, each abutment, each pier) under a separate column with a grand total.
2 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.

3 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.

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.

CADD	PE	CHECKER

List of Drawings

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

CADD	PE	CHECKER

Bench Marks

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

CADD	PE	CHECKER

Title Block

1 Fill in all data for the Title Block except the signature. The title of this sheet is "General Plan". Use the line below the structure number to describe the type of crossing. (Example: STH 15 SB over Fox River). For Design Spec. use AASHTO and year. If LRFD specs. are used, use AASHTO LRFD and year.

CADD	PE	CHECKER

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.

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

2 Elevation
- a Show a centerline profile of existing ground elevation.
- b Show only substructure units at proper elevation w/no elevations shown. Also show the pile lengths.
- c Show the kind of material, its located depth, and the blow count of the split spoon sampler for each boring. Give the blow count at about 5 foot intervals or where there is a significant change in material.

CADD	PE	CHECKER

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.
5 Show the skew angle.
6 If there is piling, show a complete footing layout giving piling dimensions tied to the reference line.

CADD	PE	CHECKER

7 Number all the piles.
8 Give the type of piling, length and required driving resistance.
9 Show a welded field splice for cast in place concrete or steel H piles.
10 Bridge seats for steel bearings and laminated elastomeric bearings are level within the limits of the bearing plate.
11 Slope the bearing area utilizing non-laminated elastomeric bearings if the slope of the bottom of girder exceeds 1%.
12 Slope the bridge seat between bearings 1" from front face of backwall to front face of abutment.
13 Give all beam seat elevations.
14 Bar Steel Listing and Detail
15 Pile Plan & Splice Detail
16 View Showing Limits of Excavation and Backfill
17 Special Details for Utilities
18 Drainage Details

Plan View

CADD	PE	CHECKER

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.

Elevation

CADD	PE	CHECKER

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.

Wing Elevation
Wing Sections
Body Section

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

Piers

CADD	PE	CHECKER

1 Use as many sheets as necessary to show all details clearly.
2 One sheet may show several piers if only the height, elevations and other minor details are different.
3 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.
4 Show the skew angle.
5 Dimension the centerline spacing of superstructure girders.
6 Bar Steel Listing and Details
7 Pile Splice Detail (If different from abutment only)
8 Cross Section thru Column and Pier Cap
9 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.

Plan View

CADD	PE	CHECKER

1 Show dimensions
2 Show footings
3 Show cap steps
4 Show beam spacings
5 Show skew angle

Elevation

CADD	PE	CHECKER

1 Show dimensions
2 Show elevations
3 Show lengths of all columns for clarity
4 Give the elevation of the bottom of footings and beam seats

		CADD	PE	CHECKER
5	Refer to abutments for detailing bridge seats			
6	Dimension all bar steel and stirrups			

Footing Plan

		CADD	PE	CHECKER
1	Show dimensions for pile spacing			
2	Show pile numbers			
3	Show reinforcing steel in footing			

Superstructure

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

All Structures

		CADD	PE	CHECKER
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. All drawings are to be fully dimensioned and show such sections and views as needed to detail the superstructure completely.			
2	For girder bridges: Show the total dead load deflections, including composite dead load (without future wearing surface loads) acting on the composite section, at tenth points of each span.			
3	For standard bridges without raised sidewalks, the parapet/railing and median weights should be distributed equally to all girders and one deflection value given for all girders. Raised sidewalk weights, along with corresponding parapet/railing weights, should be applied to the supporting girders, only, and separate deflection values given for interior and exterior girders. When raised sidewalks are utilized, median weight should be distributed to interior girders. See Chapter 17 –			
4	Superstructure – General for proper dead load distribution. For prestressed concrete girders, the dead load deflection reported does not include the weight of the girder.			
5	See Chapter 24 – Steel Girder Structures for camber and blocking, top of steel elevation and deflection reporting criteria.			
6	For slab bridges:			
	Provide camber values at the tenth points of all spans. The camber is based on 3 times the deflection of the slab, only. 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. Deflection and camber values are to be reported to the nearest 0.1 inch.			
8	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. For slab structures, provide the finished grade elevations at the centerline and/or crown and edge of slab at tenth points.			
9	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.			
10	Provide a paving notch at each end of all structures for rigid approach pavements. See standard for details.			
11	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.			
12	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.			
13	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.			
14	On structures with modular joints consider cover plates for the back of parapets when aesthetics are a consideration.			

Steel Structures

		CADD	PE	CHECKER
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.

Box Culverts

CADD	PE	CHECKER

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:

1 Plan View
2 Longitudinal section
3 Section thru box
4 Wing elevations
5 Section thru wings
6 Section thru cutoff wall
7 Vertical construction joint
8 Bar steel clearance details
9 Header details
10 North point, Bench mark, Quantities
11 Bill of bars, Bar details
12 General notes, List of drawings, Rip rap layout
13 Inlet nose detail on multiple cell boxes
14 Corner details
15 Show name plate location on plan view and on wing detail.

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.

Utilities

CADD	PE	CHECKER

Coordination with any utilities show on the preliminary plans and verify conflict or accomadations have been made.

Bench Marks

CADD	PE	CHECKER

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.