4.10 Construction Drawings & Specifications

A set of construction drawings consists of the general arrangement drawings supplemented with detailed superstructure and substructure drawings and other fabrication, material, and construction specifications.

It may be appropriate in some cases for the Ministry Engineer to take on the CRP role, given that engineer's familiarity with the initial decisions for the project. However, the bridge engineer's time constraints may preclude this option. If the Ministry Engineer is not the CRP, have the Ministry Engineer review the construction drawings (a combined package of general arrangement and structural drawings, including erection loads) and the FS 137 Assurance of Field Reviews and approve them as meeting the ministry's design and construction requirements.

Shop drawings are prepared by material fabricators to detail, and in many cases, complete the structural design of bridge structure components. Ensure that these drawings are retained as part of the as-built documentation. The complete construction drawing set provides comprehensive details on the location, composition, arrangement, design parameters, and fabrication, materials, and construction specifications for the specific proposed structure.

On the construction drawings, clearly show all construction details and provide for installation in general conformance with the design intent.

4.10.1 General Bridge Arrangement Drawing Requirements

Ensure that general arrangement drawings clearly depict the proposed components and configuration of the bridge or major culvert in relation to the forest road, stream, and streambanks. Also, use these drawings during the agency referral process (see the Forest Service Bridge Design and Construction Manual).

Ensure that the contents for bridge and major culvert general arrangement drawings include:

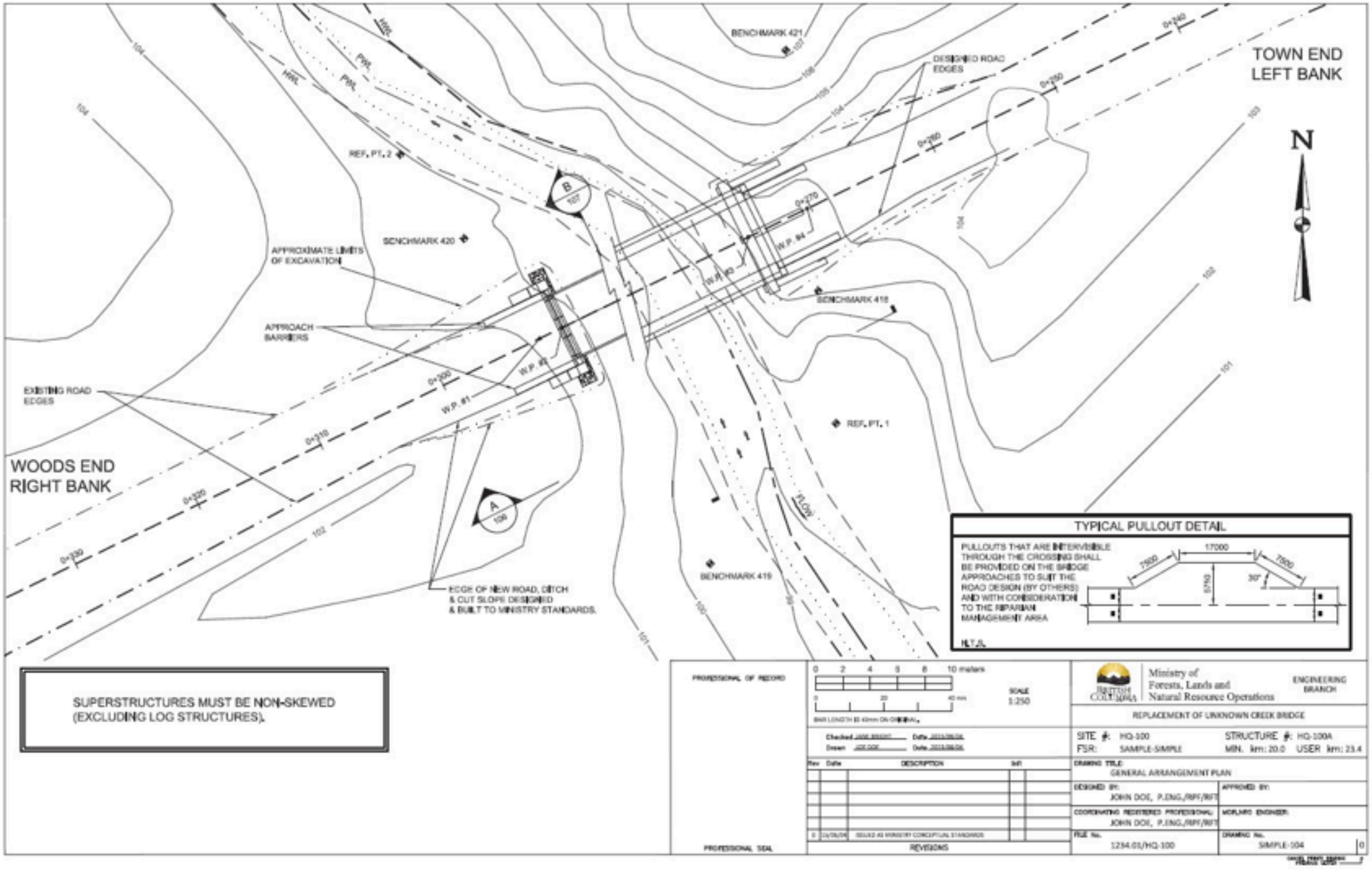
- site location key map;
- designer's name (and seal);
- name of the stream, road, and station (km) and adequate information to detail the location of the structure;
- design vehicle configuration for load and alignment;
- design code references, specifically those from the most recent version of the CAN/CSA

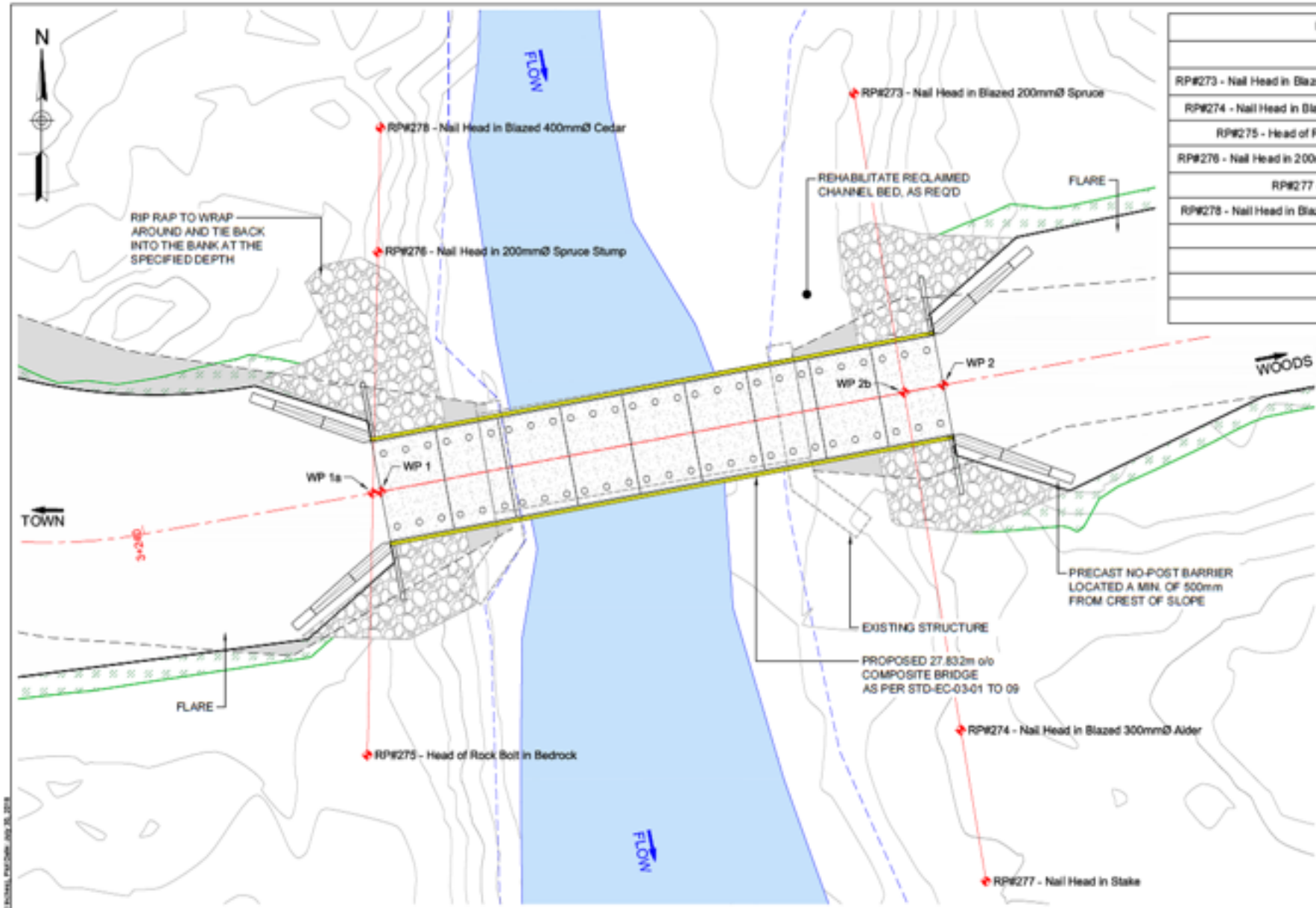
S6 – Canadian Highway Bridge Design Code and the Canadian Foundation Engineering Manual;

- expected life of the structure in place (temporary or permanent);
- design high-water elevation for bridges and design discharge;
- clearances between the design high-water level and soffit (low point of underside of superstructure) of bridges;
- details of debris passage or management strategies, if required;
- road approaches and grades, including width requirements (e.g., allowance for vehicle side tracking) and side slopes, to a sufficient distance back from the bridge to show potential problems, or to the end of the first cut or fill;
- dimensioning and labeling of component parts (to be confirmed with the shop drawings);
- connection requirements for component elements;
- drawings scales;
- relevant site plan and profile data (for suggested contents, see Site Data & Survey Requirements for Bridges & Major Culverts; sample general arrangement drawings are shown following in Figure 4-1 and Figure 4-2);
- location (vertical and horizontal) of proposed structure relative to field reference points;
- deck elevations at bridge ends;
- possible ford or temporary bridge crossing locations;
- road and bridge or culvert signs;
- approach barriers, if required;
- rip rap extents;
- limit of construction for contract purposes;
- special provisions related to the unique nature of the site and crossing, including specific instructions to bidders related to process or results, as appropriate;
- special instructions relating to material erection, installation standards, requirements, or methods as deemed necessary.

Figure 4-1 Sample of General Arrangement and Layout (simple creek crossing) (PDF, 6.03 MB)

Figure 4-2 Sample of General Arrangement and Layout (complex creek crossing) (PDF, 2.2 MB)





LOCATION TABLE (LOCAL COORDINATES)			
DESCRIPTION	EASTING (X)	NORTHING (Y)	ELEVATION (Z)
RP#273 - Nail Head in Blazed 200mmØ Spruce	685776.983	5519786.057	10.061
RP#274 - Nail Head in Blazed 300mmØ Alder	685782.172	5519755.141	11.143
RP#275 - Head of Rock Bolt in Bedrock	685753.321	5519753.930	12.208
RP#276 - Nail Head in 200mmØ Spruce Stump	685753.830	5519778.355	11.623
RP#277 - Nail Head in Stake	685783.404	5519747.798	11.654
RP#278 - Nail Head in Blazed 400mmØ Cedar	685753.956	5519784.400	10.349
WP 1	685753.980	5519766.720	12.741
WP 1a	685753.586	5519766.645	12.741
WP 2	685781.325	5519771.899	12.741
WP 2b	685779.420	5519771.538	12.741

LAYOUT SCHEDULE			
RP#273 TO WP 1	30.052 m	RP#275 TO WP 1a	12.718 m
RP#274 TO WP 1	30.478 m	RP#276 TO WP 1a	11.712 m
RP#275 TO WP 1	12.806 m	RP#278 TO WP 1a	17.758 m
RP#276 TO WP 1	11.636 m	RP#273 TO WP 2a	14.722 m
RP#273 TO WP 2	14.809 m	RP#274 TO WP 2a	16.626 m
RP#274 TO WP 2	16.779 m	RP#277 TO WP 2a	24.072 m
RP#275 TO WP 2	33.273 m	WP 1 TO WP 1a	0.401 m
RP#276 TO WP 2	28.244 m	WP 2 TO WP 2a	1.939 m
WP 1 TO WP 2	27.832 m	WP 1a TO WP 2a	26.293 m

WP 1 & 2 ARE ℄ AT TOP OF BRIDGE DECK AND END OF BRIDGE
WP 1a & 2a ARE REFERENCE TO CENTER OF BRIDGE
(ALL DISTANCES ARE HORIZONTAL)

EXTENT OF RIP RAP	
TOWN (RIGHT) BANK - UPSTREAM SIDE	7.6 m
TOWN (RIGHT) BANK - DOWNSTREAM SIDE	8.8 m
WOODS (LEFT) BANK - UPSTREAM SIDE	8.0 m
WOODS (LEFT) BANK - DOWNSTREAM SIDE	7.5 m
IN FRONT OF BALLAST WALL	3.0 m

MEASURED FROM WORKING POINTS.
(ALL DISTANCES ARE HORIZONTAL)

NOTE: THIS SAMPLE DWG. PROVIDES ONE EXAMPLE OF A TYPICAL BRIDGE DWG. WITH TYPICAL NOTES. A PROFESSIONAL OF RECORD (POR) MUST DEVELOP SPECIFIC NOTES AND DWGS. APPROPRIATE FOR A PARTICULAR SITE AND MUST ENSURE ALL MINISTRY AND PROFESSIONAL STANDARDS ARE MET

Existing Edge of Road
Present Water on Date of Survey
High Water Observed in Field
Toe of Design Fill
Top of Design Cut
Design Edge of Road
Design Centerline of Road
Area to be Filled
Area to be Cut

PROPOSED STRUCTURE PLAN VIEW
1:200

0 2 1:200 10m

ORIGINAL SIGNED & SEALED

BRITISH COLUMBIA
MINISTRY OF FORESTS, LANDS, NATURAL RESOURCE OPERATIONS & RURAL DEVELOPMENT
SOUTHERN ENGINEERING GROUP

SITE #: RM-1234 LOCATION: SAMPLE FSR 3.24km
STRUCTURE #: RM-1234A CROSSING: SAMPLE CREEK

REV #	DATE	DESCRIPTION	POR
0	7/10/2018	ISSUED FOR CONSTRUCTION	VH

DRAWING TITLE: PROPOSED STRUCTURE PLAN VIEW

PROFESSIONAL OF RECORD (POR):	CHECKED BY:
VICTOR HEDMAN P.ENG	DREW DOUGHTY P.ENG
RJNRORD	RJNRORD
DESIGN BY: SHEA WEBER	DRAWING NUMBER: 11250-55-RM-1234-06
RJNRORD	

4.10.2 Bridge Superstructure Drawing Requirements

Detail the following elements on bridge superstructure drawings:

- design code references, specifically those from the latest version of the CAN/CSA S6 – Canadian Highway Bridge Design Code and the Canadian Foundation Engineering Manual;
- individual member shapes, dimensions and connection details;
- materials specifications and CSA references, including but not limited to:
    - steel grades, impact category, finish;
    - timber species, grades, preservative treatment;
    - concrete strength, slump, and air entrainment;
    - bearing materials and connections;
    - superstructure elements, configuration, and connections;
    - dimensions and sizes of components;
    - girder or stringer arrangements and connections;
    - span lengths;
    - bridge and road width;
    - curb and rail configuration, connections, and component elements;
    - bridge label with structure number, date of manufacture, and load rating; and
    - field fabrication details.

Note that the superstructure drawings are normally supplemented by shop drawings prepared by the fabricator.

4.10.3 Bridge Substructure Drawing Requirements

Ensure that the following information on foundation requirements is detailed on the bridge substructure drawings:

- abutment elements, configuration, and connections;
- dimensions and sizes of components;
- critical elevations of substructure components;
- scour protection: dimensions, composition, extent of placement, design slope, design high water, and other considerations;
- piers;
- location and sizes of piles or posts;
- pile-driving specifications, minimum expected pile penetrations, set criteria, and required service level capacities;
- field welding requirements;

- bracing and sheathing configurations; and
- foundation requirements, material types and depth, and compaction level.

The above requirements also apply to portable bridge superstructures.

4.10.4 Log Bridge Superstructure on Log Crib Drawing Requirements

Since log stringer and crib materials are variable in nature and finished dimensions are not uniform, log bridge drawings are somewhat schematic. Ensure that the drawings address layout of the structure and its elements, required component sizing, and connection details.

Ensure that the following are indicated on the log bridge superstructure and log crib drawings:

- schematic layout indicating width and span;
- reference source for stringer and needle beam sizing;
- minimum stringer, curb, and needle beam dimensions;
- stringer, curb, needle beam, and crib logs specifications, including species, quality characteristics of acceptable logs, and seasoning;
- stringer-to-cap bearing details, including shim types and stringer and cap- bearing width and surface preparation;
- dap details at log connections;
- needle beam locations and connection details, if applicable;
- space to add stringer, curb, and needle beam sizes as part of the as-built record;
- deck layout, indicating tie sizes and spacing, plank thickness, and connections;
- other materials specifications, including sawn timber, hardware, and shims;
- excavated depth relative to scour line for mudsill or bottom bearing log;
- general layout and arrangement of front, wing wall, deadman, and tieback logs, and their connections to each other and to the bearing log or cap;
- description of crib fill material;
- layout and description of in-stream protection, if applicable; and
- rip rap protection layout and specifications (as required).

4.10.5 Major Culvert Drawing Requirements

Ensure that drawings and notes for major culverts portray and describe the following:

- site plan (see Site Data & Survey Requirements for Bridges & Major Culverts)
- location of the culvert, such as a key map;
- design vehicle load;
- fill height, depth of cover, and maximum and minimum cover requirements;

- design slopes of fill and rip rap;
- culvert invert elevations at the inlet and outlet;
- culvert specifications and dimensions: opening dimensions, length, corrugation profile, gauge, material type, and inlet bevel specifications;
- site preparation requirements;
- embedment requirements, including a description of the substrate and any rock used to anchor the bed material in the pipe;
- foundation details;
- backfill and installation specifications;
- installation camber;
- culvert gradient;
- seepage barrier details if required;
- special attachments or modifications;
- inlet requirements (rip rap layout, stilling basin, etc.);
- outlet requirements (rip rap layout, stilling basin, backwater weir for fish passage);
- rip rap specifications, including dimensions and configuration;
- design high-water elevation and design discharge, inlet or outlet control;
- connection details for pipe sections; and
- any existing improvements and resource values in the vicinity of the culvert that would influence or be influenced by the structure.

Combine any of the above requirements may where appropriate. For example, drawings for a log stringer bridge on timber piles may include the details from Log Bridge Superstructure on Log Crib Drawing Requirements, plus those from Bridge Substructure Drawing Requirements.

Include any additional requirements for a fish stream culvert, as specified in the Fish-Stream Crossing Guidebook (PDF, 4.2MB).

4.10.6 Portable Bridge Superstructures

Where portable bridge superstructures or other structural components are used for any FS bridge project (including those bridges built under Road Permit (BCTS) and designated in that permit to be an FS bridge to be used for harvesting after completion of the Timber Sale License), the components **must** have been designed or structurally analyzed by a professional engineer, to demonstrate adequacy for the intended use.

Record the ministry portable bridge superstructure number or, if there is no current superstructure number, contact the ministry engineer so that one can be assigned.

Once the components have been reviewed and approved by a professional engineer, re-use the components at new sites without specific professional engineer review of the superstructure, provided that:

- a qualified inspector has inspected the bridge at the new site before any use and does not detect any damage or deterioration of the structure; see Chapter 6 Engineered Structured Inspections - Types of Inspections;
- the design loads to be carried are equal to or lower than the original design loads for the superstructure;
- the bridge is suitable and has been specifically designed or analyzed for the new site, and signed and sealed design drawings and specifications have been prepared; and
- the superstructure has been fabricated and constructed in compliance with the appropriate legislation.