Alberta Infrastructure and Transportation

Bridge Structures Design Criteria Version 6.0
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BRIDGE STRUCTURES DESIGN CRITERIA

1. DESIGN

Highway and Pedestrian Structures shall be designed in accordance with “CAN/CSA-S6-06 Canadian Highway Bridge Design Code” (CHBDC), and in accordance with other codes and standards, referred to in this “Bridge Structures Design Criteria” (BSDC), or with the prior written approval of the Department. Exceptions to CHBDC requirements are noted as follows and in the rest of this document:

a) Live load distribution factors used for girder design shall not be less than the empirical factors specified by CHBDC unless specifically agreed to in writing by the Bridge Engineering Section. If a bridge does not satisfy the criteria that allow the empirical factors to be used, the live load distribution factors used for girder design shall not be less than the empirical factors that would have been used if the bridge had met these criteria.

b) In Clause 5.7.1.3 of CHBDC, the width (B) of the bridge may be assumed to be reduced to a width that provides a value of B < 10. The number of design lanes (n) shall be reduced as required to be consistent with the assumed bridge width (B).

c) Notwithstanding Clause 1.4.2.5 of CHBDC, approval will not be given for the use of single load path structures. Slab and girder bridge structures shall have a minimum of four girder lines.

d) Piers with two columns or less are considered non-redundant. Piers with one column shall have a minimum cross-section area of 2.8 m^2. Piers with two columns shall have a minimum cross-section area of 2.8 m^2 for each column, or alternatively the columns shall be linked together with a strut extending from the top of the foundation to 1.4 m above the adjacent ground between the two columns.

e) Stay in place corrugated steel or other deck soffit formwork types are not allowed.

f) Deck and curb reinforcement required to develop the capacity of bridgerail post anchors, are site specific designs. Guidance for design of decks supporting bridgerail posts is available from AASHTO LRFD Bridge Design Specifications 2007 Appendix Section A13.4.3.

2. LOADINGS

a) Highway Bridges

CHBDC CL-800 plus Dynamic Load Allowance unless specified otherwise. Truck axle and wheel loads shall be proportioned from the CL-625 truck. No adjustments are required for the 9 kN/m uniformly distributed load for lane load.

b) Pedestrian Bridges

The minimum pedestrian bridge live load shall be in accordance with CHBDC Clause 3.8.9. For flexible structures, dynamic response and side sway, which could cause discomfort to pedestrians due to crowd loading, shall be considered.

c) Future Wearing Surface

Bridges designed with concrete to grade shall be checked for the effects of removing the top 25 mm of the deck and the subsequent placement of a 90 mm non-composite ACP wearing surface.

d) Fatigue

Unless otherwise approved, all new bridges shall be designed to comply with Class A Highway requirements (CHBDC Clause 1.4.2.2). This requirement shall apply to all bridge components for considerations of structural fatigue.

e) Vehicle collision load

The application of the collision load of 1400 kN as specified in Clause 3.15 of CHBDC, shall be limited to roadways with design speeds less than 80 km/hr. For roadways with design speed ≥ 80 km/hr, and bridge structural support within 10 m from edge of ultimate pavement, the vehicle collision load shall be increased to 1800 kN, assumed to act in any direction in a horizontal plane, and at a distance of 1200 mm above ground (Reference ASSHTO LRFD Bridge Design specifications).

f) Rating trucks

AIT rating truck configurations CS1, CS2 and CS3 shall be used with Section 14 for bridge evaluations. The NP live load factors shall be increased by 10% for short span bridges, for shears on spans less than 10 m and moments on spans less than 15m.

3. SPAN LENGTHS, SUB-STRUCTURE STATIONING & BEARING SETTING

a) Steel Girder and Cast-In-Place or Segmental Concrete Superstructures:

Span lengths established from preliminary engineering requirements shall be rounded up to the nearest whole metre. The span lengths shown on general layout drawings shall be measured at a fabrication temperature of +20˚ C, from centreline bearing to centreline bearing along the bottom flange for uniform depth girders, and along the top flange for tapered or haunched girders.

Ground stationing for locating the centreline bearing of sub-structure elements shall be adjusted to account for the following:

- length difference between gradeline profile and horizontal surveyed distances,
- length difference due to thermal change between +20˚ C and -5˚ C,
- longitudinal shift due to off-plumb tilting of bearing stiffeners or control sections set perpendicular to the top flange, when span lengths are measured along the top flange,
- differences between ground distances and other surveying systems.

For expansion bearings, a bearing temperature setting chart shall be provided for positioning bearing components according to the girder temperature at the time of setting the bearing.

For fixed bearings for continuous steel girder bridges, bearings are designed to be centred on girder bearing stiffeners. The size of voids for grouting anchor rods should have sufficient room to accommodate girder length changes at erection temperatures other than -5˚ C, in addition to normal construction tolerances. Supporting piers should be designed for any eccentricities that may arise.

The following standard note shall be incorporated on the general layout drawing: “GIRDER LENGTHS SHOWN ARE MEASURED ALONG BOTTOM (TOP) FLANGE AND ARE CORRECT AT +20˚ C. ABUTMENT AND PIER STATIONINGS ARE LOCATED SUCH THAT BEARINGS ARE CENTRED AT -5˚ C”.

b) Precast Concrete Girder Superstructures:

Length of precast concrete girders is to be shown on bridge general layout drawings together with pier diaphragm thicknesses between girder ends, and distance from abutment girder end to centreline abutment bearing. Precast girder lengths are set to meet preliminary engineering requirements and shall be rounded up to the nearest whole metre, and shall be measured along the bottom flange at a fabrication temperature of +20˚ C. The precast supplier shall make appropriate allowance for prestress shortening, shrinkage and creep up to the time of girder erection.

Ground stationing for locating the centreline bearing of sub-structure elements shall be adjusted to account for the following:

- length difference between gradeline profile and horizontal surveyed distances,
- length difference due to thermal change between +20˚ C and -5˚ C,
- differences between ground distances and other surveying systems.

Bridge bearings are to be centred on centreline bearing at -5˚ C. For expansion bearings, a bearing temperature setting chart shall be provided for positioning bearing components according to the girder temperature at the time of setting the bearing. Bearing design and setting chart shall make allowance for girder shortening due to post-tensioning and long term shrinkage and creep.

The following standard note shall be incorporated on the general layout drawing: "GIRDER LENGTHS SHOWN ARE MEASURED ALONG BOTTOM FLANGE AND ARE CORRECT AT +20˚ C. ABUTMENT AND PIER STATIONINGS ARE LOCATED SUCH THAT BEARINGS ARE CENTRED AT -5˚ C. PRECAST SUPPLIERS SHALL MAKE APPROPRIATE ALLOWANCE FOR PRESTRESS SHORTENING, SHRINKAGE & CREEP UP TO THE TIME OF GIRDER ERECTION".

4. GEOMETRY

a) Control line designations shall be selected from the following list and be used consistently throughout the same set of drawings: Centreline NBL Hwy XX, Centreline N-W RAMP, Centreline RDWY, Centreline CROWN, Centreline BRG ABUT #X, Centreline ABUT #X (for integral abutments), Centreline PIER #X.

b) The desirable longitudinal grade for proper bridge deck drainage shall be a minimum of 1%. The minimum longitudinal grade may be reduced to 0.5% with documented supporting reasons and written approval from the department. Reduced grades should be avoided because standing puddles of water between deck drains may result, and may require coring of retro-fit drains through the deck. It is recognized that grade line constraints for grade separation structures may required crest curves that result in portions of the bridge deck having a grade of less than 1 %. However, every effort should be made to at least locate the top of the crest towards one end of the structure.

c) Bridge structure supports, including abutments, piers, retaining walls and sign structure columns, shall not be located within the underpassing roadway's clear recovery zone and shall allow all required sight distances to be met. The minimum vertical clearance of overpassing bridges shall be as specified in Fig. H 7.7a of the Roadside Design Guide. Clear zone requirements, calculated critical vertical clearances with their critical locations for current construction as well as the ultimate stage construction shall be shown on the General Layout for all grade separation structures.

d) The minimum vertical clearance for overhead sign structures shall be the greater of 6 m or 300 mm higher than the lowest grade separation structure in the vicinity.

e) Top of bridge headslope fill width shall be out-to-out bridge end width plus 2 m. Taper rate from headslope fill width to approach roadway fill width shall be 30:1 or flatter. Corner transitions between headslope and sideslope shall use an elliptical curve at the toe of the slope. A design tool is available at the AIT Bridge Planning Tools FTP site.

f) Skew angles are to be given to the nearest minute; i.e., 12˚ 41' L.H.F. not 12˚ 40' 35" L.H.F.

g) Roadway crown slope - 2%, except on super-elevated roadways.

h) Top of sidewalk and median - 2% towards roadway.

i) Top of abutment seat, pier cap, curb and barrier wash slope – 3%.

j) "Top of Centreline Finished Crown" stations and elevations are to be shown for each end of the structure. Top of Centreline Finished Crown is defined as the point where the headslope line intersects the finished centreline roadway profile. Station is given to the nearest decimetre and elevation to the nearest centimetre.

k) Design high water elevation, high ice elevation, low water elevation (with date of survey), design general and local scour elevations shall be shown on the General Layout for all river structures

l) Substructure elements are to be numbered in the direction of increasing chainage; i.e., ABUTMENT #1 or PIER #1 occurs at the lower chainage location and the numbering increases from there.

m) All dimensions, including stationing and elevations shall be ground dimensions. For more information on ground and grid coordinates refer to the AIT Design Bulletin No. 34/2006.

5. GIRDER DEFLECTION & CAMBER

a) Steel Girders:

Welded steel girders shall be cambered for 100% of dead load deflection and roadway gradeline profile. Camber data shall be shown on a camber diagram, at 10th span points, centreline of supports, and centreline of field splices, along with net camber values for individual girder segments between splices. For spans longer than 50 m, data shall be presented at 20th span points. Data shall include girder DL, deck DL, SIDL (including curb/barrier + wearing surface), and vertical grade.

Notwithstanding CHBDC Clause 10.7.4.1 welded steel girders spanning less than 25 m shall be cambered to compensate for dead load deflection and highway grade profile.

Camber variations for steel girders are normally minor in nature and should be easily accommodated by adjusting deck formwork elevation and thickness of the deck haunch on top of the girders.

b) Precast Girders:

Forms for DBC type girders are adjustable to allow a sag to be built into the girder to account for camber resulting from prestressing/post-tensioning. The required form sag is to be presented on the drawings. Forms for NU type girders do not allow for form sag. However, theoretical calculated cambers based on best estimates shall be shown on the engineering drawings. Camber data shall be provided at various construction stages, such as at transfer, erection, deck pour, post-tensioning, SIDL, gradeline profile, shrinkage and creep, etc.

Camber for precast girders can vary substantially from estimated values due to variations in concrete properties, storage conditions, and shrinkage and creep. Proper detailing of stirrup projections, girder end/bearings, and selection of deck haunch thickness are required.

c) Cast-in-Place Superstructures:

Data must be presented on drawings to allow setting of form elevations. The deflection data used in the determination of the form elevations should be presented.

d) Standard note for camber correction:

The following standard note shall be shown on the deck drawing and shall apply to the nominal deck haunch thickness and the outside of curb/fascia dimensions:

"THESE DIMENSIONS WILL VARY DUE TO VARIATIONS IN GIRDER CAMBER. THE CONTRACTOR SHALL DETERMINE THE ADJUSTMENTS REQUIRED AND SUBMIT THEM TO THE CONSULTANT FOR APPROVAL."

6. MATERIALS

a) Concrete:

Standard weight aggregates.

Normal Portland cement (Type GU) or Sulphate Resistant (Type HS) unless noted otherwise on drawings.

Classes and strengths:

DESCRIPTION	CLASS	f'c @ 28 days
1) Precast girders		50 to 70 MPa
2) Precast MSE wall panels		50 MPa
3) Abutments	C	35 Mpa
4) Piers	C	35 Mpa
5) Cast-in-place decks, abutment roof slabs, approach slabs, diaphragms, blockouts and tops of abutment backwalls.	HPC	45 Mpa
6) Cast-in-place curbs & barriers	HPC	45 Mpa
7) Grout Keys (14 mm max. aggregates)	HPC	45 Mpa
8) Piles	Pile	25 Mpa
9) Concrete drain trough	B	25 Mpa
10) Concrete slope protection	B	25 MPa

b) Reinforcing Steel:

In accordance with the current version of C.S.A. Standard G30.18M "Billet Steel for Concrete Reinforcement" - Grade 400.

Grade 400 W steel shall be used if the bars are to be welded. Welded bars are to be denoted with the suffix 'W' on the bar list drawing.

c) Prestressing Strand:

In accordance with ASTM Standard A-416 (fpu = 1860 MPa). Design shall be based on use of low relaxation strand.

d) Structural Steel:

1) Girders and all materials welded to girders.	CSA G40.21-Grade 350AT CAT 3 or ASTM A709 Grade 345 Type B with Charpy value of 27 J @ -30˚ C
2) Ungalvanized bearing and bracing materials bolted to girders.	CSA G40.21M-Grade 350A or ASTM A709 Grade 345 Type B
3) Galvanized bearing materials not welded to girders.	CSA G40.21M-Grade 300W
4) Miscellaneous steel including deck joints	CSA G40.21M-Grade 300W
5) Structural bolts	22 mm diameter A325M - Type 3 weathering steel

e) Anchor rods:

1) Anchor rods for bearings in contact with black steel.	Stainless steel AISI Standard Type 316
2) Anchor rods for bearings in contact with galvanized steel.	Galvanized anchor bolts CSA G40.21M Grade 300 W or ASTM A307
3) High strength anchor rods, e.g. bridgerail posts anchors	ASTM A193 GRADE B7 (Fy = 725 MPa, Fu = 860 MPa). Note galvanizing of high strength material requires special procedure, see Drawing S1642-00.

7. CLEAR COVER TO REINFORCING STEEL AND POST-TENSIONING DUCTS

a) The following minimum clear cover for reinforcing steel shall be specified on drawings. These are minimum requirements for inspection and checking during construction:

Reinforcing steel in concrete subject to normal exposure	50 mm
Reinforcing steel in concrete cast in contact with soil (no form)	75 mm
Reinforcing steel adjacent to front face of curb, median or barrier	100 mm
Reinforcing steel in cast-in-place decks with waterproofing and overlay system.	
Top layer	50 mm
Bottom layer	40 mm
Reinforcing steel in cast-in-place decks without waterproofing and overlay system	
Top layer	75 mm
Bottom layer	40 mm

b) Post-tensioning ducts in pre-cast concrete girders with 28 day concrete strength not less than 65 Mpa shall conform to the following:

The inside duct diameter shall not exceed 50% of the web thickness
The inside duct area shall be ≥ 250% of the strand area
The minimum cover to post-tensioning ducts shall be 45 mm (±5 mm)

8. REINFORCING STEEL DETAILS

a) Bar Lists

- Complete rebar details are to be shown on the 'Bar List' drawing.
- All reinforcing steel bar marks are to be as per AIT Drafting Standards.
- Bar marks should not be duplicated on a project unless the bars are identical.
- Incremented bars should each have their own bar mark.
- Mass for individual bar types is to be calculated and shown to the nearest kilogram.
- Mass for epoxy coated and plain bars is to be shown on the bar list along with an overall total for each bridge component; i.e. abutments, piers, deck, etc.
- Separate totals for plain bars and epoxy coated bars, as well as a combined total, are to be given for each list appearing on the bar list drawing. Separate totals for plain and epoxy bars for substructure and superstructure, are to be shown in the Quantity Summary on the Information Sheet drawing, but not in the quantity estimate tables for the individual bridge components.
- Rebar fabrication is generally done from the details shown on the 'Bar List' drawing. Therefore it is extremely important that the bar list details be correct.

b) Epoxy coated reinforcing steel shall be used for the following locations:

- Both layers of steel in cast-in-place decks.
- Both layers of steel in abutment roof slabs.
- Stirrups projecting from precast girders into deck slab.
- Bars in curbs (abutments and superstructure).
- Bars within 150 mm of the top of abutment backwalls.
- Dowel bars that connect approach slab to abutment corbel.
- Reinforcing steel in approach slabs.

c) Bar bends and bar laps for lap splices are to be as specified in CHBDC for epoxy coated bars. Minimum hooks are to be specified on the bar lists where the standard hooks will not fit due to member dimensions.

d) Epoxy coated bars are to be denoted with the suffix 'C' on the bar list drawing.

e) The minimum size of reinforcing bars (excluding welded wire mesh) in all bridge elements except drain troughs shall be 15M.

9. SUB-STRUCTURE & FOUNDATIONS

a) For river crossings, it is required that the piers are founded on driven piles or drilled caissons rather than spread footings.

b) Abutments on top of MSE walls shall be supported on piles, not spread footings.

c) For substructure elements founded on driven steel H-piles, it is preferred that HP 310 piles be used.

d) The following design pile load information for abutment and/or pier piles are to be shown in the General Notes on the Information Sheet:

- SLS permanent loads only
- SLS extreme loads (combination #   )
- ULS permanent loads only
- ULS extreme loads (combination #   )

For driven piles, the SLS extreme load shall be used in the Bearing Formula in Section 3 of the Specification for Bridge Construction, unless site specific conditions require otherwise.

e) Outline of foundations and estimated pile tip elevations are to be shown relative to test holes on the geotechnical information sheet.

f) Steel piles designed to be exposed shall be hot-dip galvanized to a minimum of one metre below grade or stream bed. All damaged galvanizing shall be zinc metallized.

g) The following features shall be used to prevent staining of sub-structure concrete:

- The exterior edge of the bottom flange of exterior steel girders shall have a 19 x19 x 8000 mm long rubber strip (AMERICAN BILTRITE CMPD#Ab-263 OR APPROVED EQUIVALENT) centred over the pier and attached with SC200 epoxy.
- Exterior steel girders shall have the same rubber strip attached all around the bottom flange 300 mm in front of the abutment seat.
- Where steel girders are cast into integral abutments, the same rubber strip shall be field applied all around the bottom flange of all girders immediately in front of the concrete abutment face.
- End of pier cap cantilevers shall have cast in stainless steel drip sheets across the full underside width of the pier cap.

h) Piers within the clear zone shall be protected by one of the following options:

- Protective guardrail including the weak post W-beam (TL3) or strong post W-beam (TL3), or Modified thriebeam (TL4).
- Thriebeam bull-nose (TL3).
- High tension cable systems (TL3 or TL4).
- Concrete barriers (TL4 or TL5).
- Proprietary cushion systems.
- Sand barrels.

Refer to the Roadside Design Guide for selection, details, deflection allowance for flexible systems, and zone of intrusion considerations for rigid barriers.

i) Ends of pier caps and pier shafts facing on coming traffic shall be either circular or chamfered (minimum 300 x 300 mm).

10. RETAINING WALL STRUCTURES

a) The location and layout of retaining walls shall meet the requirements of Section H7.6 of the Roadside Design Guide.

b) Top of retaining walls shall be smooth and have no steps or abrupt change in height.

c) Retaining walls with traffic running parallel to the top of the wall shall have rigid bridge barriers meeting the requirements of CHBDC Section 12. Footing slabs for barriers on top of MSE walls shall be buried below the pavement and be protected by waterproofing membrane and protection board.

d) The height of MSE retaining walls shall be limited to 6 m for highway interchange and overpass structures, and 8 m for railway underpasses, unless approved in writing by the Department

e) MSE walls shall be designed to the more severe requirements of CHBDC and AASHTO LRFD Bridge Design Specifications.

f) Design life of all MSE components shall be 100 years.

g) MSE wall panels shall be supported by compacted backfill without voids on the non-exposed side.

h) Proper drainage, with drainage swale on top and weeping tile behind the bottom of the wall, is essential.

i) Dry cast concrete block facing shall not be used for MSE walls.

j) The consultant shall provide a geotechnical report on global stability, stamped and sealed by a profession engineer registered in Alberta.

11. BRIDGE BEARINGS

a) Bearing types in common use for beam and slab bridges are: a) steel reinforced elastomeric bearing pads with or without stainless steel and teflon sliding surfaces, b) fixed steel plate rocker bearings, c) proprietary pot bearings. Continuous plain neoprene sheets are used for standard SL and SCC/SLC bridges. Steel roller nests, pinned rockers and tall expansion rockers can be found in older structures but have not been used for some time due to costly machining and stress relieving.

b) Shear transfer mechanisms - Reinforced concrete shear keys with galvanized steel face plates, or steel keeper angles or brackets have proven to be more cost effective than anchor rod assemblies at each bearing. Wherever practical, independent shear transfer mechanisms should be considered for transferring horizontal forces into the sub-structure. The designer should consider the following:
- simplify bearing design to transfer gravity loads and rotations only,
- improve bearing service life by removing components subject to wear and tear,
- independent guides located between girders are more accessible for repair and maintenance.
- cantilevering anchor rods with long projections are very inefficient in resisting shear and cantilever moments.

c) Steel reinforced elastomeric bearings are the most preferred bearing type due to their long record of maintenance free performance and should be used whenever possible. The following standard features shall be incorporated:
- A self-rocking pintel welded under base plate shall be used to ensure uniform contact between neoprene bearing pad and the girder bottom flange at erection. No extra construction tolerance is required when using the self-rocking pintel.
- All bearings shall be grouted in prior to casting deck concrete. Bearings pads shall be designed for all rotations that take place after the bearings are grouted.
- Elastomeric material shall meet the requirements of AASHTO Grade 5 for cold temperature performance.
- For expansion bearings, the elastomeric cover for the uppermost steel shim shall not be greater than 2 mm. Unfilled 1 mm thick Teflon sheet is bonded to top of elastomeric pad. Stainless steel sliding surface shall conform to AISI 304, No. 8 mirror finish.
- The design coefficient of friction shall be taken from CHBDC Table 11.4 for unfilled PTFE and un-lubricated flat sheet.
- Elastomeric pads shall be restrained from walking out by means of 6 mm high corner keeper bars welded to the top of the base plate. The 6 mm height is to limit girder raising/jacking for future removal and replacement of bearing pads.

- Elastomeric bearing pads on skewed bridges are usually orientated perpendicular to the longitudinal girder axis. When the direction of rotation is uncertain, such as for severe skews or for bridges with stiff concrete diaphragms, round pads should be considered.
- Field welding adjacent to elastomeric pads shall be performed with care to avoid damage to the elastomer. The temperature of the steel adjacent to the elastomer should be kept below 120ºC. The distance between the weld and the elastomer should be at least 40 mm.

d) Fixed steel plate rocker bearings may be appropriate for long span steel girder bridges, or where the loads will exceed the practical range of reinforced elastomeric bearing pads. However, when bridges have movements in the transverse as well as longitudinal direction due to curve, skew or width of bridge, this type of bearing may not be suitable. The curved surface of the rocker plate and the top central 250 mm width of the base plate shall be machined to ANSI 250.

The bearings are installed level on shim stacks, and shall be grouted prior to casting deck concrete. No tapered shoe plate is used with these bearings because of the large rotational capacity.

e) Pot bearings shall be used only where reinforced elastomeric pads are too large and become difficult to manufacture. Pot bearings require precision fabrication and accurate installation to avoid performance problems. The fabrication of pot bearings are to be in accordance with Section 6, "Structural Steel" of the current Specifications for Bridge Construction and the Ontario Provincial Standard Specifications OPSS 1203. A sample Special Provision and an approved list of suppliers are available from the Bridge Engineering Section upon request.

Pot bearings are normally installed on a level base plate on shim stacks, and grouted in prior to casting deck concrete. The bearings shall be designed for all rotations that take place after grouting, plus a fabrication and construction tolerance allowance of 0.01 radian. Total rotational capacity is normally limited to 0.02 radians for pot bearings, and increasing rotational capacity beyond that is expensive.

f) Tapered sole plate - Bearings shall be set level by using tapered sole plates to correct for effects of roadway grade and girder cambers at the time of erection. For prestressed girders, the taper shall be based on the estimated girder camber at erection.

For long bridges with finger plate expansion joints, the sliding plane of the abutment expansion bearings shall be set on grade slope for proper functioning of finger joints. Effects of longitudinal forces generated by inclined sliding bearings on the structure shall be investigated. Bearings shall be grouted prior to pouring deck concrete.

g) Bearing finishing and attachment –

- Base plates shall be hot-dip galvanized or metallised.

- For steel girders, sole plates or rocker plates shall be black steel when shop welded to girder bottom flange. Sole plates or rocker plates can also be hot-dip galvanized and bolted to the girder bottom flange.
- For precast girders, sole plates shall be hot-dip-galvanized or metallised, and field welded to galvanized shoe plates cast into the girders. All galvanizing damaged by field welding shall be repaired by metallizing.
- Attachment by welding shall be in the longitudinal direction along the edge of the girder. Transverse welding requires underhand welding and shall not be permitted. Transverse ends shall be sealed with an approved caulking material.
- Pot bearing components are normally metallised after welding and machining, and are attached to galvanized plates by bolting.
- Anchor rods in contact with galvanized steel shall be hot-dip galvanized. Anchor rods in contact with black steel shall be stainless steel.
- Attachments for elastomeric pads and pot bearings shall be designed such that the bearing components can be removed and replaced.

h) Bearing contact face preparation –
- Steel plates in contact shall be machined to ANSI 1000. Contact surfaces with neoprene pad and grout or c.i.p. concrete do not require machining. Where required, machining shall be performed prior to hot-dip galvanizing. Where the galvanizing process may cause distortion, metallizing shall be used instead.
- Galvanized surfaces shall be isolated from black steel by painting with two coats of epoxy mastic paint.

i) Expansion bearings shall provide an excess travel capacity in each direction of at least 25% of the theoretical thermal movement, but not less than 25 mm, beyond theoretical travel. Allowance is to be made for additional movement if such is indicated by foundation conditions. Stainless steel plate shall be wider than the elastomeric pad by at least 10 mm on each side.

j) An 80mm nominal thickness grout pad shall be provided under bearing base plates. The grout should sit in a grout pocket recessed 40 mm into the top of the sub-structure. The grout pocket shall be 75 mm larger than the base plate around the perimeter.

k) Uplift bearings shall not be used.

l) Shim plates used for shim stacks shall be hot-dip galvanized.

m) Bearings shall be detailed to be replaceable. The following assumptions can be made for a typical bearing replacement procedure:
- All girder lines are simultaneously jacked to avoid damage to deck, diaphragms and deck joint components.
- After raising the structure adequately, jacks are shimmed around the piston or locked to prevent catastrophe in case of hydraulic failure.

- Bearings are pulled and replaced one at a time with overhead traffic being directed away from the bearing being removed and replaced.
- At abutments, jacking will usually take place in front of the bearing and the bearing being pulled out sideways.
- For girders with a single pier bearing, the jacks will be placed in pairs in both front and rear of the pier bearing. Bearings will be pulled out sideways.
- For precast concrete girders with double bearings, the pier diaphragm should be designed for girder jacking.
- Locations for future jacking shall be shown on drawings and shall be based on estimated jack and distribution plate sizes.

12. INTERMEDIATE DIAPHRAGMS

a) Intermediate diaphragms are required in bridge structures with girder and slab superstructures unless their omission is agreed to in writing by the Bridge Engineering Section. Intermediate diaphragms in bridge structures with steel girder and slab superstructures shall have a maximum spacing of 8.0 m. Intermediate diaphragms in bridge structures with precast concrete girder and slab superstructures shall have a maximum spacing of 13.0 m

b) Intermediate diaphragms for steel or precast girders 1200 mm deep or shallower, can be channel or W shape of at least 1/3 and preferably 1/2 the girder depth. For girders deeper than 1200 mm, X or K bracing with top and bottom horizontals shall be provided. Cross frame type diaphragms should preferably be designed and detailed such that they can be erected as a single unit rather than multiple pieces.

c) Intermediate diaphragms and girders shall be designed for construction loads during deck concrete placement in accordance with CHBDC Clause 3.16 and other code requirements. Specifically, diaphragms, exterior steel and precast girders carrying deck overhangs shall be checked to ensure sufficient strength and stability to handle concentrated loads from deck finishing machines, work bridges, fog misting equipment, and loads from temporary walkways outside the edge of the deck slab. Loads assumed for such design shall be based on realistic estimates for each bridge and shall be shown on contract drawings. Diaphragms provided shall become part of the permanent structure and be left in place for possible future maintenance, i.e. widening, rehabilitation, etc. It should be noted that not only are diaphragms costly, unnecessarily stiff diaphragms will attract undesirable forces from live loads.

d) Where long vertical slotted holes are required in diaphragm connector or gusset plates to accommodate differential camber between adjacent girders, the slotted holes shall meet requirements of CHBDC Clause 10.18.4.2(c) for plate washers and reduced capacity.

13. NU GIRDER BRIDGES

a) NU girder bridges shall be designed to meet the following AIT requirements:

b) Except for integral abutment designs, abutment diaphragms should be steel to provide open access for inspection and maintenance of bearings and abutment deck joints.

c) Pier diaphragm should be a continuous c.i.p. concrete diaphragm, and could be either pinned, fully monolithic with the pier shaft, or permit free expansion. Positive moment connection at piers shall be developed by either one or a combination of grouted unstressed tendons, bent-up strands or cast in hooked rebar. Minimum separation between girders ends shall be 150 mm with grouted tendons only, and 300 mm with bent strands or hooked rebar. For pier diaphragms with a pinned or expansion connection to the pier top, girders ends should be supported on double reinforced elastomeric pads. Live load reaction on each bearing is to be taken as equal to the maximum girder live load end shear. For pier diaphragms connected monolithically to the pier top, girder ends can be supported on plain elastomeric pads for erection loads only. Temporary bracing to ensure stability of girder ends erected on top of piers is the contractor’s responsibility.

d) Intermediate diaphragms are normally steel, and the first set of intermediate diaphragm adjacent to a pier shall be no more than 3 m from the centreline pier. Concrete intermediate diaphragms could be considered provided there is sufficient bracing to ensure girder stability immediately after girder erection.

e) Minimum age for girders before erection shall be 30 days. Since age of girders at erection varies, girder design and detailing should duly consider effects of differential camber between girders, such as in haunch height variations and diaphragm connectors. Girder design should normally be based on a nominal girder depth assuming the minimum haunch height.

f) Stirrup projections from the top of the precast girder into the deck shall be epoxy coated steel and shall meet all code requirements for lap splicing with vertical stirrups, and anchorage requirements for developing full composite action. All stirrups shall have 135º hooks around longitudinal bars. When projection of stirrups are less than 40 mm above the underside of the bottom mat of deck bars, additional hat shape extension bars shall be provided to tie the slab and the girder haunch. Longitudinal deck bars shall be detailed with a space of 300 mm directly over the girder webs.

g) Horizontal interface shear design for composite action shall satisfy requirements from CHBDC or AASHTO LRFD Bridge Design Specifications 2007, whichever is more stringent. This will require the longitudinal distribution of shear forces be taken conservatively as the ULS shear envelope.

h) Additional vertical stirrups and closed ties for the bottom flange for crack control at pretensioned girder ends shall be provided in accordance with CHBDC Clause 8.16.3.2. Closed ties shall also be provided in the rest of the girder at a spacing of 300 mm. Closed ties are normally fabricated in two pieces with full tension lap splices. The top of the ties can be left open in the midspan region where there is conflict with post-tensioning cables.

i) For conventional abutments, abutment girder ends shall be thickened and designed as part of the abutment diaphragm for transfer of lateral forces.

j) All girder ends shall have cast in shoe plates. Shoe plate design shall be optimized for the different requirements for exterior and interior supports. See CHBDC Clause 8.9.3.14.
k) Girders shall be erected on permanent bearings whenever possible to eliminate the need for temporary bearings. Bearings shall be grouted prior to deck pour.
l) Where practical, four bonded strands shall be incorporated in the top flange to assist in controlling stresses due to transportation and deck construction.
m) Galvanized Richmond Type EC2 inserts shall be used for connecting diaphragms in exterior girders.
n) Longitudinal lapping of welded wire mesh reinforcement is not required.

14. STEEL GIRDER BRIDGES

Welded steel plate girder bridges shall be designed to meet the following AIT requirements:

a) Vertical stiffeners and girder ends shall normally be square to girder flanges. Abutment detailing dimensions shall account for effects of girder end tilt.
b) All bearing stiffeners (including jacking stiffeners) shall be "fit to bear bottom" and "fit only top", and then fillet welded to both top and bottom flanges. For long bridges with large expansion movements, the use of double bearing stiffeners shall be considered.
c) Location of jacking stiffeners shall be based on estimated jack sizes required for bearing replacement, plus sufficient clearance to the edge of the abutment seat or pier cap.
d) Diaphragm connector plates and intermediate stiffeners at stress reversal locations shall be welded to both top and bottom flanges. Corner cope of plates shall normally be 50 x 50 mm, and can be reduced to 25 x 25 mm when extra weld is required at narrow girder flanges.
e) Intermediate stiffeners other than stress reversal shall be welded to the compression flange only, and cut short of the tension flange with web gap meeting the requirement of CHBDC Clause 10.10.6.4.
f) Corners of stiffener plates projecting past the outside edge of flange plates shall be coped 45º.
g) No intersecting welds are allowed. Horizontal stiffeners on the same side of the web as vertical stiffeners shall be terminated 6 mm from intersecting vertical stiffeners
h) All weld ends shall terminate 15 mm from edge or end of plates.
i) Stiffened plate girder webs shall in no case have intermediate transverse stiffeners spaced at greater than 1.5 h.
j) Gusset plates for attachment of horizontal bracing shall be bolted and not welded to girders.

15. DECKS, CURBS & CONCRETE BARRIERS

a) Deck slabs for beam and slab bridges shall be designed with the empirical method in accordance with CHBDC Clause 8.18.4 except that Clause 8.18.4.1 (b) be amended to limit girder spacing to slab depth ratio to 15.0. Use of this method requires composite action between the slab and girder over the entire girder length. The use of any other design method must be specifically agreed to in writing by the Bridge Engineering Section.

b) Cast-in-place deck slabs for beam and slab bridges shall normally be 225 mm thick. This will permit a maximum girder spacing of 3375 mm.

c) Cast-in-place deck slabs for standard SCC/ SLC composite bridges shall have a nominal thickness of 150 mm (minimum thickness of 125 mm) under waterproofing membrane and ACP. An additional cover of 25 mm is provided for exposed concrete to grade.

d) Concrete curbs and barriers shall have crack control joints above the deck level at a maximum spacing of 3 m (centred between bridgerail posts where applicable). Longitudinal reinforcing in curbs and barriers above the top of the deck shall be discontinuous at the control joints. Control joints shall be caulked prior to application of deck waterproofing membrane.

e) Concrete paving lips along the edge of ACP are difficult to cast and finish. They also prevent good compaction of the asphalt, and are therefore not allowed.

16. SIDEWALK & RAISED CONCRETE MEDIAN

a) The portion of the structural deck slab under sidewalks and raised concrete medians shall be protected by a waterproofing membrane. A top slab is poured after the membrane is applied to the structural slab. The top slab shall have transverse tooled joints at a spacing matching adjacent curb/barrier control joints. The sidewalk shall have a curb projecting 100 mm above the finished top of the sidewalk along the outside edge. The sidewalk shall normally be higher than the adjacent road surface, and drain through slots in the traffic separation barrier onto the roadway surface.

b) For raised concrete medians, barrier curbs (150 mm high near vertical face) are not suitable for posted speeds greater than 60 km/h, and mountable curbs (100 mm high with 1 on 3 slope) should be used. For more detailed guidance, refer to Section H4.3 and H11.3 of the Roadside Design Guide.

c) Warrants for provision of sidewalks and pathways are provided in Section H9.2 of the Roadside Design Guide.

17. DECK PROTECTION AND WEARING SURFACE

a) The standard deck protection and wearing surface system has a total thickness of 90 mm consisting of a nominal 5 mm thick rubberized asphalt waterproofing membrane, plus 3 mm protective board, plus two 40 mm lifts of asphaltic concrete pavement. This rubberized asphalt waterproofing membrane is to be used for all bridge unless otherwise approved by the department. Examples of bridges likely to receive approval would include small spot improvement structures such as SLC composite bridges scheduled to be built in the late season when availability of asphalt may become a problem, or local road bridges that will not receive de-icing agents in the foreseeable future.

b) Asphalt Wearing Surface - Type H2 is used basically on Primary Highway bridges and/or high traffic volume highways or local roads. Asphalt Wearing Surface - Type M1 is used on low traffic volume highways or local roads when an asphalt overlay is applied.

18. DECK JOINTS

a) Steel girder bridges < 60 m and concrete girders bridges < 80 m, measured end to end including length of approach slabs, should normally be integral abutment bridges with no deck joints. These limits are based on considerations on the width of the pavement crack that may occur due to thermal length changes in the superstructure. These limits will not apply to gravel roads. For more details on integral abutment design, see Appendix A – Integral Abutments.

b) For conventional design, new structures shall be fully continuous from end to end with deck joints at abutments only. The following standard deck joints shall be used:

Standard dwg	Joint type	Movement range
S-1493	Multi-cell strip seal	115 – 60 = 55 mm
S-1448	Cover plated V-seal	150 – 60 = 110 mm
S-1638, S-1639, S-1640	Finger plate joint	> 100 mm
S-1626	Multi-cell strip seal for skew = 20º to 45º	55 mm square to joint

c) In Alberta, experience has shown that abutment seats often move forward over time until the abutment joint gap is completely closed, making it impossible to extract and replace the joint seal element. Therefore AIT standard deck joint incorporates stop movement bars to maintain a minimum joint gap of 60 mm to facilitate seal replacement. Designers should note that this is often larger than the minimum gap indicated on manufacturer’s brochures, which provides gap width suitable for first installation only. For strip seal type deck joints with skew angles within the range of 20º to 45º, snow plow guard plates shall be installed in accordance with Drawing S-1626 to prevent snow plow blades from catching the edge of the joint extrusion. Welded snow plow guard plates can break due to fatigue and shall not be located directly under wheel paths.

d) Only approved strip seal joints listed on the Standard Drawings shall be used.

e) Fingers plates and cover plates are fixed to the deck side to allow jacking and raising of the superstructure. They need to be properly recessed in accordance with the Standard Drawings to avoid damage from snow plows. Neoprene drip sheets and stainless steel collector drains are to be provided with finger plate type joints to intercept water passing through the joint.

f) Modular seal deck joint systems shall not to be used.

g) Deck joints on steel girder superstructures are to be erected by bolting to the girders on the deck side. Bolted connections are to utilize slotted holes to provide adjustment in vertical, lateral, and longitudinal directions. Other adjustable supports are required on the abutment side.

h) Deck joints on concrete superstructure or abutments are to be erected on adjustable supports by projecting dowels with threaded couplers for elevation adjustment.

19. BRIDGE BARRIERS

a) AIT standard bridgerail and approach end transitions for new construction or deck replacement shall be selected from the table below:

Drawing No.	Title	Application/ Transition Type
S-1642-00	PL-2 (TL-4) Double Tube Type Bridgerail – Bridgerail Details (Sheet 1 of 2)	Preferred bridgerail for most applications.
S-1643-00	PL-2 (TL-4) Double Tube Type Bridgerail – Approach Rail Transition Details (Sheet 2 of 2)	14 m long Thrie Beam Approach Rail Transition PL-2 (TL-4) and Strong Post Approach Rail (TL-3).
S-1648-00	PL-2 (TL-4) Thrie Beam on Curb Bridgerail – Bridgerail Details (Sheet 1 of 2)	Bridgerail for use on short bridges < 20 m long.
S-1649-00	PL-2 (TL-4) Thrie Beam on Curb Bridgerail – Approach Rail Transition Details (Sheet 2 of 2)	14.3 m long Thrie Beam Approach Rail Transition PL-2 (TL-4) c/w transition curb and Strong Post Approach Rail (TL-3).
S-1650-00	PL-2 (TL-4) Single Slope Concrete Bridge Barrier – Barrier Details (Sheet 1 of 2)	Bridgerail for use in urban areas where aesthetics is important.
S-1651-00	PL-2 (TL-4) Single Slope Concrete Bridge Barrier – Approach Rail Transition Details (Sheet 2 of 2)	14 m long Thrie Beam Approach Rail Transition PL-2 (TL-4) and Strong Post Approach Rail (TL-3).
S-1652-00	PL-1 (TL-2) Thrie Beam Bridgerail	Bridgerail for use on local roads. 5.7 m long Thrie Beam Approach Rail Transition PL-1 (TL-2).
S-1653-00	PL-1 (TL-2) Low Height Thrie Beam Bridgerail	Bridgerail for use on local roads with clear roadway < 9 m. 5.7 m long Thrie Beam Approach Rail Transition PL-1 (TL-2).
S-1681-07	PL-3 (TL-4) Bridgerail to Modified Thrie Beam Transition Details	8.2 m long Modified Thrie Beam Approach Rail Transition PL-2 (TL-4).
S-1700-06	PL-2 (TL-4) Combination Barrier – Bridgerail Details (Sheet 1 of 6)	Bridgerail for use on urban bridges with 4.2 m widened outside lane for cyclists.
S-1701-06	PL-2 (TL-4) Combination Barrier – Barrier End Details (Sheet 2 of 6)	Connects to single slope concrete road barrier.
S-1702-06	PL-3 (TL-5) Double Tube Type Bridgerail – Bridgerail Details (Sheet 3 of 6)	Bridgerail for use when high AADT with heavy truck volumes and/or high structure requires a PL-3 (TL-5) bridgerail.
S-1703-06	PL-3 (TL-5) Double Tube Type Bridgerail – Barrier End Details (Sheet 4 of 6)	N/A
S-1704-06	PL-3 (TL-5) Double Tube Type Bridgerail – Concrete Barrier Details (Sheet 5 of 6)	N/A
S-1705-06	PL-3 (TL-5) Double Tube Type Bridgerail – Approach Rail Transition Details (Sheet 6 of 6)	14 m long Thrie-Beam Approach Rail Transition PL-2 (TL-4) and Strong Post Approach Rail (TL-3).

The PL1 thriebeam bridgerail has no curb and provides an economical solution for use with SL standard bridges on local roads.

b) When a vehicular bridge contains a sidewalk, a traffic separation barrier is normally provided. CHBDC Clause 12.4.3.3 requires traffic separation barriers to have a smooth surface with no snag points and a minimum height of 0.60 m measured from the surface of the sidewalk. Such traffic barrier is normally a standard single slope concrete barrier without the top ledge (Dwg. S-1650-00). Note that this is a traffic barrier to prevent vehicle encroachment onto the sidewalk and not a pedestrian barrier.

c) For highways with lower AADT/design speed, the run-out length of approach guardrail shall be in accordance with Table H3.12 of the Roadside Design Guide.

d) Other crash-tested bridge barrier systems may be appropriate for special site conditions, but shall not be used without written approval from the department.

e) Pedestrian/Cyclist railing:

The standard 1150 mm Vertical Bar Type Handrail as shown on Dwg. No. S-1401 is designed for use at the outside of sidewalks with a traffic separation railing on the road side. The handrail shall be mounted on a concrete curb projecting 100 mm above the sidewalk for a total handrail height of 1250 mm. For urban ring road projects, the standard 1150 mm high handrail design shall be modified to1300 mm for a total rail height of 1400 mm. This shall be achieved by extending the height of the vertical bar panels and the posts.

For situations where there is an intersection close to the end of the bridge and enhanced vehicle visibility is required, the standard handrail shall be modified as shown on Dwg. No. S-1426 - Standard 1150 mm Staggered Vertical Bar Type Handrail. Orientation of the staggered bars must be described on the engineering drawings to suit the site situation.

f) Bridgerail layout:

- All dimensions for bridgerail layouts are to be given on centreline of bridgerail anchor bolts.
- Bridgerail expansion joints shall be provided at all deck joint locations. For long bridges, additional expansion joints shall be provided at a maximum spacing of 45 m.
- Standard bridgerail drawings show a standard bridgerail expansion joint with a gap of 100 mm, and a large expansion joint with a gap of 200 mm. Considering that most bridge abutments tend to move inwards over the life of the bridge, a large expansion joint should be selected when there is potential for the bridgerail joint to jam up before the deck joint closes.
- Steel bridgerailing for bridges with curve radii of 600 m or less shall be fabricated curved.

20. OBSTACLES BEHIND BRIDGE BARRIERS

The presence of obstacles, such as signs, lamp posts, sign structure support columns, piers of adjacent bridges, etc., on top of or close behind bridge barriers can potentially cause snagging of errant vehicles or cause debris to fall on the roadway below. The mounting of such hazards are to be avoided whenever practical. However, when it becomes unavoidable, the following set-back requirements or protective measures shall apply:

Applicable roadside barrier standard	Set-back or other treatment
TL 2	305 mm minimum
TL 3	610 mm minimum
TL 4	For lamp posts and sign structure columns, provide PL2 combination barrier (Standard Dwg. S-1700 & S-1701 with a height of 1400 mm). If a PL3 bridgerail is required by code, a PL3 barrier with a minimum height of 1370 shall be provided. A set-back of 610 mm is required behind the top rail. For piers of adjacent bridges, 3000 mm minimum set-back is required.

Attachments shall be mounted close to centreline of piers to avoid excessive vibration from traffic. Base plates and anchors shall be grouted and sealed with penetrating sealer.

21. BRIDGE DRAINAGE

a) Concrete drain troughs are commonly placed at abutment corner locations at the low end where the roadway grade carries water off of the bridge.

b) Deck drains are normally provided on river crossings to eliminate water on the bridge deck as quickly as possible.

c) Bridge decks with waterproofing membranes are to have provisions made along the gutter lines to allow for the drainage of water that penetrates the asphaltic wearing surface.

22. APPROACH SLABS

Approach slabs for conventional abutments with back wall and deck joint shall be in accordance with the provisions of CHBDC Clause 1.8.2 except as noted:

a) Class HPC concrete.

b) 175 mm minimum thickness.

c) Minimum 3600 mm long measured parallel to centreline of roadway.

d) Longitudinal reinforcing: 15M bars @ 175 (placed parallel to centreline of roadway).

g) Transverse reinforcing: 15M bars @ 350 (placed parallel to abutment backwall).

For approach slab requirements for integral abutments, see Appendix A

23. UTILITY ACCOMMODATION

a) A single 100mm or 75 mm ø Rigid PVC duct with pull wires is normally placed in each curb.

b) Additional conduits, weatherproof boxes, and anchor bolts for light poles will likely be required in situations where lighting is to be provided on the structure or on the adjacent approaches. Conduit sizes and locations of boxes and light fixtures will, in most instances, be provided by the utility company.

c) Notwithstanding the above, it is the opinion of Alberta Infrastructure & Transportation (AIT) that in the long term utilities that are attached to the exterior of a bridge will invariably become a problem when major maintenance of the structure is required. It is AIT's strong preference that whenever practical, utility lines are not to be attached to a bridge, and that alternative means of crossing an obstruction be actively pursued by Utility Companies. However, if other options are not reasonably available, and a Company still wishes to pursue a request to attach a line to a structure, the following conditions must be met:

- Complete details of the proposed attachment must be submitted to AIT for review and written approval prior to the commencement of the installation under consideration.

- All costs associated with the installation, maintenance, and operation of a utility are the responsibility of the utility owner.

- At the discretion of AIT, moving or removal of the utility, including all associated costs shall be borne by the owner of the utility line. Typically a 'request for removal' will (or may) be issued to facilitate major maintenance, rehabilitation, replacement, closure, or removal of a bridge.

- In the event that a utility line is no longer required the owner of the utility line shall advise AIT, arrange for the line to be removed, and when applicable for the structure to be restored to condition commensurate with that prior to the installation of the line. Any restoration work that may be required shall be completed to the satisfaction of AIT and all costs associated with the work shall be borne by the owner of the utility line.

24. QUANTITIES

a) Bridge Contracts are tendered on a unit price basis for most bid items. The following items, with their indicated units, are among the most commonly used:

Piling (Type and size) – supply	-	m
Piling (Type and size) – drive	-	m
Piling (Type and size) – set up	-	pile
Concrete – Type	-	m^3
Reinforcing steel - plain	-	kg
Reinforcing steel – epoxy coated	-	kg
Concrete Slope Protection	-	m^2
Rock Rip-Rap – Class	-	m^3
Bridgerail	-	m
Handrail	-	m
Bridge Deck Waterproofing	-	m^2
Wearing Surface – Two course hot-mix ACP (Type)	-	lump sum or tonne
Wearing Surface – Hot-mix ACP	-	lump sum or tonne

Piling, concrete, and rip-rap require a separate quantity for each size or type used.

b) Quantities, with the exception of slope protection and rip-rap, are to be calculated and shown to the nearest whole unit. Slope protection and rip-rap quantities are to be calculated and shown to the nearest 10 units.

c) Individual quantity estimate tables are to be shown on the applicable drawings for the abutments, piers, and deck and are to be summarized on the quantity estimate table shown on the 'Information Sheet'.

d) Quantities done by other than the site contractor are to be so identified on the quantity estimate tables.

e) Structural steel mass for steel girder superstructures shall be calculated and the mass, in tonnes, shown in the 'General Notes' area on the girder drawings. Mass includes girders, diaphragms, stiffeners, and splice plates but does not normally include deck joints, bearings, and bolts.

25. STANDARD DETAILS & ENGINEERING DRAFTING GUIDELINES

a) The use of standard drawings and details are encouraged wherever possible.

b) Drafting standards and standard details shall be in accordance with Section 2 – Guidelines for Bridge Projects of the "Engineering Drafting guidelines for Highway and Bridge Projects" http://www.trans.gov.ab.ca/Construction/DoingBusiness.asp

26. ORGANIZATION OF DRAWING SET

a) Preferred drawing order for bridge type structures is as follows:

b) General Layout.

c) Information Sheet/Sheets.

d) Abutments.

e) Pier/Piers.

f) Bearings.

g) Girders.

h) Deck.

i) Deck Joints.

j) Other (If used).

k) Bar List.

l) Standard Drawings.

m) Other types of structures (culverts, etc.) should follow the same basic order with drawings added and/or deleted as necessary.

n) Bridge Engineering Section drawing numbers are to be used in all cases. Numbers will be established when exact number of drawings in set is known.

o) Index listing all drawings included in the drawing set is to be shown on the first sheet of the set. The index is normally orientated from the bottom up; i.e., sheet No. 1 shown at the bottom and successive sheets listed upward from there.

p) Consultants who are not familiar with AIT bridge design drawings are encouraged to obtain recently completed drawing sets for their guidance.

27. OVERHEAD SIGN STRUCTURES

Overhead sign structures, including bridge or cantilevered types, shall be designed to the requirements of "AASHTO Standard Specifications for Structural Supports for Highway Signs, Luminaires and Traffic Signals" Fatigue Category I. These structures are procured by a design/build process, inclusive of sign panels, structural framing and foundations, in accordance with AIT Specifications for Bridge Construction Section 24. Consequently, the consultant's responsibilities differ from those of the conventional procurement process.

Consultant responsibilities are summarized as follows:

- Each overhead sign structure is treated as a small bridge, and tracked by a bridge file number for design, construction and BIM inspections. This structure classification is used for all sign support structures where the sign panel area is larger than 3 m^2 and the sign is partially hanging over the traffic lanes or road shoulder.
- The consultant shall determine placement, clearance requirements, need for barrier protection, and type of structure (bridge or cantilevered) in accordance with guidance provided in Section H8.4 of the Roadside Design Guide, and prepare a general layout drawing for each individual sign structure in accordance with standard drawing S-1721-07.
- The consultant shall review the design notes and shop drawings submitted by the contractor to ensure all requirements of Section 24 of the Specifications for Bridge Construction are met. This review is for conformance of specification requirements only and is not a design check.
- At the end of the construction, the consultant shall update the general layouts to reflect as-built conditions and forward all shop drawings for department records.

28. Appendix A - INTEGRAL ABUTMENTS

29. Appendix B - ABC STRUCTURES DESIGN GUIDE