

13.1	Scope	2
13.5	General design requirements	2
13.5.9	Aligning and Locking	2
13.5.11	New devices	2
13.5.12	Access for Routine Maintenance	2
13.5.13	Durability	2
13.6	Moveable bridge components	2
13.6.2	Swing bridge components	2
13.6.2.3	Main pinions	2
13.6.2.3.2	Pinion-bearing supports	3
13.6.3	Bascule bridge components	3
13.6.3.2	Locking devices	3
13.6.5	Vertical lift bridge components	3
13.6.5.3	Counterweight guides	3
13.6.5.3.2	Clearances	3
13.7	Structural analysis and design	3
13.7.3	Wind loads	3
13.7.3.4	Vertical wind, normal to the floor plan area	3
13.7.6	Hydraulic cylinder connections	3
13.8	Mechanical system design	4
13.8.6	Wedges	4
13.8.7	Brakes	4
13.8.7.1	General	4
13.8.7.1.3	Holding	4
13.8.8	Frictional resistance	4
13.8.8.1	Machinery	4
13.8.9	Torque	4
13.8.9.1	Torque at prime mover for main machinery	4
13.8.9.4	Torque at prime mover for locks and wedges	4
13.8.13	Bearing pressures (moving surfaces)	4
13.8.13.2	Determination of bearing pressures	4
13.8.17	Machinery fabrication and installation	5
13.8.17.4	Plain bearings	5
13.8.17.4.3	Bushings	5
13.8.19	Power equipment	5
13.8.19.2	Brakes	5
13.8.19.2.1	General	5
13.10	Electrical system design	5
13.10.3	General requirements for electrical installation	5
13.10.4	Working drawings	5
13.10.4.1	General	5
13.10.8	Motor temperature, insulation, and service factor	5
13.10.21	Programmable logic controllers	6
13.10.26	Circuit breakers and Fuses	6
13.10.39	Electrical wires and cables	6
13.10.42	Raceways, metal conduits, conduit fittings, and boxes	6
13.10.42.7	Wireways and cable trays	6
13.10.50	Spare parts	6
13.11	Construction	6
13.12	Training and start-up assistance	7
13.13	Operating and maintenance manual	7

13.1

Scope

Commentary: *Movable bridges shall not be used unless Approved.*

Section 13 Movable bridges of the S6-06 does not address the following items in detail:

- *Technical material advances such as UHMW polyethylene bearings and Teflon spherical plain bearings;*
- *Hydraulic drives;*
- *PLC control systems.*

All these technologies may be acceptable, depending on the particular situation. Any variances from Section 13 requires consent of the Ministry.

13.5

General design requirements

13.5.9

Aligning and Locking

Commentary: *CCTV systems are suggested to assist the operator in monitoring mechanisms not visible from the operator's cabin.*

13.5.11

New devices

Delete the second sentence and replace with the following:

If any such devices, materials, or techniques are proposed for use by the designer, they shall be in accordance with good commercial practice, shall have a background of successful application for similar usage, and shall be consented to by the Ministry.

13.5.12

Access for Routine Maintenance

Commentary: *The installation of elevators in tower-drive vertical lift bridges shall be considered for heights greater than 15 metres. This is to allow movement of maintenance materials to the hoisting equipment easily and effectively.*

13.5.13

Durability

Commentary: *The maintenance and inspection manual shall be prepared by the designer.*

13.6

Moveable bridge components

13.6.2

Swing bridge components

13.6.2.3

Main pinions

13.6.2.3.2 Pinion-bearing supports

Delete and replace with the following:

The brackets and connections that support the main pinion bearings are critical to the bridge operation and shall be designed for at least twice the maximum design torque in the pinion.

Commentary: *The maximum torque may occur under braking or acceleration.*

13.6.3 Bascule bridge components**13.6.3.2 Locking devices**

Commentary: *The current code requires locking devices on the toe end of each girder. Depending on the design this may contribute to an overly complex mechanical installation. Locking devices on the toe ends of each outside girder is an acceptable alternative.*

13.6.5 Vertical lift bridge components**13.6.5.3 Counterweight guides****13.6.5.3.2 Clearances**

Commentary: *The requirement for shims is to ensure the clearances can be correctly set. In addition the guide shoe mounting design shall facilitate easy adjustment and replacement in the future.*

13.7 Structural analysis and design**13.7.3 Wind loads****13.7.3.4 Vertical wind, normal to the floor plan area**

Commentary: *Note that for unequal arm swing bridges, the surface area shall be the floor plan area of the larger arm.*

13.7.6 Hydraulic cylinder connections

Commentary: *The design philosophy is that the hydraulic cylinder is supposed to be the weakest link, not the structural attachments to the bridge.*

13.8 Mechanical system design**13.8.6 Wedges**

Commentary: Unless separate supports are provided, the end-lift machinery of swing bridges shall also be capable of supporting the span under the specified loading. Systems which might creep under vibration or load shall not be used.

13.8.7 Brakes**13.8.7.1 General****13.8.7.1.3 Holding**

Commentary: The braking requirements of this clause are also applicable for hydraulically driven bridges.

13.8.8 Frictional resistance**13.8.8.1 Machinery**

Commentary: Self-lubricated bearing materials may be appropriate for some applications. For proprietary bearing materials the coefficients of friction shall be as advised by the suppliers.

13.8.9 Torque**13.8.9.1 Torque at prime mover for main machinery**

Commentary: For hydraulic cylinder actuated spans the bridge torque will need to be converted into an equivalent cylinder force.

13.8.9.4 Torque at prime mover for locks and wedges

Commentary: For hydraulic cylinder operated span lock and wedge machinery, the sum of all resistances to be overcome shall be reduced to a single equivalent force in the cylinder.

13.8.13 Bearing pressures (moving surfaces)**13.8.13.2 Determination of bearing pressures**

Commentary: Where alternate bearing materials are considered, the maximum bearing pressures shall be in accordance with the supplier's recommendations.

13.8.17 Machinery fabrication and installation

13.8.17.4 Plain bearings

13.8.17.4.3 Bushings

Delete the first sentence and replace with the following:

Bearings shall have bronze bushings unless otherwise consented to by the Ministry.

Commentary: *Self-lubricated non bronze bushings may be appropriate for some applications; however, their use is subject to consent by the Ministry.*

13.8.19 Power equipment

13.8.19.2 Brakes

13.8.19.2.1 General

Commentary: *Brakes shall be arranged for hand release regardless of power source.*

13.10 Electrical system design

13.10.3 General requirements for electrical installation

Commentary: *This section includes a number of instructions aimed at the Contractor. The designer shall review the instructions and ensure the relevant instructions to the Contractor are incorporated into the Contract Documents prepared by the designer on behalf of the Ministry.*

13.10.4 Working drawings

13.10.4.1 General

Commentary: *This section includes a number of instructions aimed at the Contractor. The designer shall review the instructions and ensure the relevant instructions to the Contractor are incorporated into the Contract Documents prepared by the designer on behalf of the Ministry.*

13.10.8 Motor temperature, insulation, and service factor

Commentary: *AC motors should have Class F insulation in accordance with CSA or NEMA standards.*

13.10.21 Programmable logic controllers

Delete the last paragraph and replace with the following:

The PLC shall be provided with a communication card installed to allow remote communication monitoring by the Ministry at its Provincial Control Centre.

13.10.26 Circuit breakers and Fuses

Commentary: *Electronic Circuit Breakers with programmable trip settings are acceptable types of circuit breakers.*

13.10.39 Electrical wires and cables

Commentary: *The code prefers wire in conduit. Armoured cables with PVC jacketing may be an acceptable alternative. Therefore external wiring to control panels and consoles shall be wire types as listed in CEC Standard, Table 19, for exposed wiring in wet locations.*

13.10.42 Raceways, metal conduits, conduit fittings, and boxes**13.10.42.7 Wireways and cable trays**

Delete the third sentence in the second paragraph and replace with the following:

Wireways and trays shall not be used outside the operator's house except with armoured cables. Tray and fittings shall be stainless steel complete with cover. The designer shall detail all wireways such that they do not impose a tripping hazard for the operator.

Commentary: *The use of corrosion resistant material and lids is to reduce the problems with birds and their residue.*

13.10.50 Spare parts

Commentary: *The listing of spare parts specified for the Contractor to provide shall be included in the Contract Documents prepared by the designer on behalf of the Ministry. The list should be reviewed to include PLC and UPS spare parts.*

13.11 Construction

Commentary: *This section includes instructions to the Contractor which need to be reviewed and appropriately transferred to the Contract Documents prepared by the designer on behalf of the Ministry.*

13.12 Training and start-up assistance

Commentary: *This section includes instructions to the Contractor which need to be reviewed and appropriately transferred to the Contract Documents prepared by the designer on behalf of the Ministry.*

13.13 Operating and maintenance manual

Commentary: *The designer should provide the Operation and Maintenance Handbook, not the Contractor. In addition to the drawings specified in this clause and Clause 13.10.4, the handbook shall also include:*

- *A regular schedule of inspection, and lubrication;*
- *A schedule of operating or testing the bridge. The test operations should occur at regular intervals and should include emergency operating conditions;*
- *A hardcopy and softcopy of the software program, clearly listing all safety interlocks used in the PLC controls of the movable bridge;*
- *Calibration and set points of all devices; and*
- *A copy of the testing and commissioning records.*