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13.1**Scope**

Movable bridges shall not be used unless Approved.

13.6**Structural analysis and design****13.6.2****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.*

13.6.7**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.*

13.7**Mechanical system design****13.7.18****Bearings****13.7.18.4.3****Lubricated plain bearings**

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

13.7.18.4.4.2**Non-metallic bearings**

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.*

13.9**Electrical system design****13.9.2****General requirements for electrical installations**

Commentary: *Wires in rigid galvanized steel conduit is the preferred wiring method for bridges. Armoured cable with PVC jacket may be an acceptable alternative. External wiring to control panels and consoles shall be of type listed in CEC Standard (CAN/CSA 22.1), Table 19, for exposed wiring in wet locations. 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 (to reduce the problems of birds and their residue). The designer shall detail all wireways such that they do not impose a tripping hazard for the operator.*

13.9.11 Electrical control systems**13.9.11.1 Operating sequence and interlocking requirements**

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

13.9.11.2.3 Programmable logic controller (PLC)

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

Additional Requirements**Operation and Maintenance Handbook**

The designer should provide the Operation and Maintenance Handbook, not the Contractor. In addition to the relevant drawings to describe the work, 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;
- Calibration and set points of all devices; and
- A copy of the testing and commissioning records.

Spare Parts

The list of spare parts that the Contractor must 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.