TENDER DOCUMENTS

SUBSECTION 6.61
BRIDGE JACKING

TABLE OF CONTENTS

PAGE

SUBSECTION 6.61 BRIDGE JACKING

6.61.1 GENERAL

6.61.1.1 This subsection sets out the requirements related to the bridge jacking work covered by this Contract.

6.61.1.2 Any specific requirements pertaining to the bridge jacking work covered by this Contract are set out on the drawings and in Section 4 *Special Technical Conditions*.

6.61.1.3 The requirements relating to the replacement of the bridge bearings are described in subsection 6.62 *Bridge Bearings*.

6.61.2 MEASUREMENT UNITS

6.61.2.1 The measurement units and respective symbols thereof used in this subsection are described as follows:

Measurement Unit	Designation	Symbol
length	millimeter	mm

6.61.3 REFERENCE STANDARDS

6.61.3.1 The **Contractor** shall perform all bridge jacking work in accordance with the requirements of the following standards and documents to which the provisions of this Contract are added:

6.61.3.1.1 (ACNOR(CSA)) Canadian Standards Association:

- CAN/CSA-A23.1/A23.2 *Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete*;
- CAN/CSA A23.3 *Design of Concrete Structures*;
- CAN/CSA G40.20/G40.21 *General Requirements for Rolled or Welded Structural Steel/Structural Steel*;
- CAN/CSA S6 *Canadian Highway Bridge Design Code*.

6.61.3.1.2 (ASTM) ASTM International:

- ASTM A123/A123M *Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products*.

6.61.3.1.3 (MTQ) Ministère des Transports du Québec:

- MTQ – *Cahier des charges et devis généraux* (CCDG).

6.61.4 MATERIALS

6.61.4.1 JACKING SYSTEM

6.61.4.1.1 The jacking of the spans shall be done using a jacking system.

6.61.4.1.2 Some of the jacking system components may be provided by the **Owner**. Where applicable, those components are indicated on the drawings.

6.61.4.2 TEMPORARY SUPPORTS

6.61.4.2.1 The shims, seats and saddles that make up the temporary supports shall be fabricated of galvanized steel.

6.61.4.2.2 The shims may be of various specific thicknesses or beveled in function of the **Contractor**'s jacking method and of the condition of the adjacent and underlying surfaces.

6.61.5 EQUIPMENT AND TOOLS

6.61.5.1 The capacity of the equipment and tools used, such as the hydraulic pumps, jacks and valves, shall be such that no more than 75% of their nominal capacity is used.

6.61.5.1.1 At least fourteen (14) days before the date on which the jacking work is scheduled, the **Contractor** shall provide the Engineer with the technical data sheets for the equipment and tools that the **Contractor** plans to use, such as the hydraulic pumps, jacks and valves, attesting that they have sufficient capacity to meet the requirement of paragraph 6.61.5.1.

6.61.5.1.2 The jacking shall be carried out with the assistance of a programmable logic controller (PLC) synchronized jacking system.

6.61.5.2 The hydraulic system shall be equipped with check valves to ensure uniform and constant pressure on each jack used for the jacking operation.

6.61.5.3 The jacking system's jacks shall be equipped with a lock nut that allows the mechanical locking of the load, which prevents the jack from collapsing in case of failure or breakage of the hydraulic system. The lock nut shall have sufficient capacity to support the total of the permanent loads plus the factored loads indicated on the drawings.

6.61.5.4 All jacks shall be connected to a common hydraulic system.

6.61.5.4.1 The hydraulic system shall be fitted with pressure gauges indicating the pressure of each jack thereto connected.

6.61.5.5 During the vertical movements of the deck, the jacking and the repositioning, a continuous readout instrument for the vertical movement shall be installed to allow the readings of the vertical movement of each span girder. This vertical movement cannot have a difference greater than 1.5 mm between two (2) girders or trusses.

6.61.5.5.1 The instruments to read the vertical movements of the girders shall allow readings that have a minimum accuracy of 0.1 mm.

6.61.6 DESIGN

6.61.6.1 Before starting the design, the **Contractor** shall perform on-site verifications of the space available for the positioning of the jacks and check the condition of deterioration of the structural components on which the jacks and temporary supports will rest, in order to ensure they are fit to sustain the loads imposed and the movements generated by the jacking.

6.61.6.1.1 The **Contractor** shall verify the presence of utilities under the bridge or in the bridge components to ensure that they will not be damaged during the jacking.

6.61.6.2 At least fourteen (14) days prior to the date on which the jacking work is scheduled, the **Contractor** shall submit to the Engineer, for review, the detailed method proposed to jack the bridge.

6.61.6.3 The **Contractor**'s design engineer who designs the jacking system shall be an engineer who is a member of the *Ordre des ingénieurs du Québec* (*OIQ*) and has more than ten (10) years of experience in structural work and other similar work. The **Contractor** shall replace any design engineer who, in the opinion of the Engineer, does not meet these requirements.

6.61.6.4 The **Contractor** is responsible for the design of the jacking method, including verifying the capacity of the existing structural components, if they are used to transmit loads or to impose movements generated by the jacking system and the temporary supports.

6.61.6.4.1 The **Contractor** shall further consider the design of a transversal blocking system of the span during the deck jacking and support operations.

6.61.6.5 The **Contractor** shall consider, without however limiting itself to, the permanent load, traffic overloads, winds, dynamic effects, braking forces, expansion and any other load indicated on the drawings, the dimensions and current condition of the existing components, as well as the grading of the spans at the jacking point.

6.61.6.6 The **Contractor** shall also consider in the design of the jacking method the possibility that the surface on which the jacking system rests may not be horizontal.

6.61.6.7 The **Contractor** shall produce a detailed drawing of the spans jacking method, including the dimensions of and design notes on the following elements:

6.61.6.7.1 the jacking system;

6.61.6.7.2 the spans jacking equipment, including the jacks and pumps;

6.61.6.7.3 the load distribution plates;

6.61.6.7.4 the method of securing the temporary supports;

6.61.6.7.5 for each jack, the hydraulic pressure required to jack the intended load;

6.61.6.7.6 any other elements required to jack the bridge (spacers, grout and mortar).

6.61.6.8 The drawings of the jacking system components provided by the **Owner** are attached to the present specifications for information purposes. The **Contractor** shall check the actual dimensions of the various jacking system components before starting the work.

6.61.6.9 Where applicable, the **Contractor** shall check all welds of the jacking system welded parts by magnetic testing and ultrasonic inspection. The **Contractor** shall repair any defect found following these tests and inspections.

6.61.6.10 The detailed drawings of the jacking method submitted by the **Contractor** shall refer to the drawings of the jacking system components provided by the **Owner**, and the **Contractor**'s design engineer shall complete or amend them if he considers that it is necessary to do so.

6.61.6.11 The **Contractor** may propose jacking procedures and systems as an alternative to those provided and proposed by the **Owner**. The **Contractor** may, with the approval of the Engineer, modify in part the jacking system components. The **Contractor** may not claim any additional cost to the **Owner** for the design, manufacture, supply and use of such alternative or modified procedures and systems.

6.61.6.12 Where applicable, if temporary supports must be used for the purpose of the jacking operations and up to the loading of the bridge bearings, special attention shall be paid, during the design of these components, to the loads and movements imposed by the thermal expansion of the deck.

6.61.7 EXECUTION OF WORK

6.61.7.1 WORK PLANNING

6.61.7.1.1 At least fourteen (14) days prior to the start of the jacking work, the **Contractor** shall submit to the Engineer, for review, the drawings and design notes of the temporary structures and the technical data sheets for all elements used in the construction thereof, all in conformity with subsection 6.15 *Temporary Structures.*

6.61.7.1.2 The **Contractor** shall notify the Engineer at least fourteen (14) days prior to the start of the work.

6.61.7.1.3 The temporary structures shall allow a simultaneous continuous access to all jacking points in order to ensure effective coordination of the jacking operation and allow the Engineer to access any jacking point at any time.

6.61.7.1.4 The **Contractor** shall provide all the labour, temporary access devices and all equipment and specialized tools, as well as the jacking systems required for the jacking operation, other than the components provided by the **Owner**, if any.

6.61.7.1.5 The jacking of the spans shall be carried out under the responsibility and authority of the **Contractor**'s design engineer who shall:

6.61.7.1.5.1 check the condition of any equipment provided by the **Owner**, if any:

6.61.7.1.5.1.1 specific inspections of the condition of the jacking system components provided by the **Owner** are scheduled to be carried out by the **Owner** before the work is carried out by the **Contractor.** The **Contractor** may, upon request, consult the inspection reports;

6.61.7.1.5.1.2 notwithstanding the foregoing, the **Owner** disclaims all liability regarding the jacking system components and other elements provided. The **Contractor** is responsible for the jacking system and elements thereto provided and shall carry out, at its expense, such additional inspections thereof as it deems necessary prior to the start of jacking work;

6.61.7.1.5.1.3 the **Contractor** shall pre-assemble the jacking system on the ground before it is erected on the structure;

6.61.7.1.5.2 ensure that the fabrication and installation of any jacking system and of all elements used for jacking comply with the drawings and with the method proposed by the **Contractor** and reviewed by the Engineer;

6.61.7.1.5.3 establish, for each structural component to be jacked, a method of monitoring the level change between the top of the seat and the bearing point of the structural component to be jacked.

6.61.7.1.6 The jacking shall not begin until all the new parts and bridge bearings to be installed have been delivered to the worksite and the related steel or concrete work required for jacking is complete. The period during which the span is supported by the temporary supports shall be as short as possible.

6.61.7.1.7 The **Contractor**'s design engineer shall carry out an inspection of the jacking system, mandatorily in the presence of the Engineer, and shall provide the Engineer with a written statement of the conformity of the installation of the jacking system and of the other elements required for the span jacking.

6.61.7.1.8 The jacking system shall be tested at a test pressure, without jacking the structure, in order to detect any leakage or pressure loss in the hydraulic circuit. The test pressure shall be about 90% of the jacking pressure.

6.61.7.1.9 Prior to each jacking operation or reinstallation of the spans, the **Contractor** shall hold a coordination meeting, mandatorily in the presence of the Engineer and of the **Contractor**'s design engineer, to ensure that all the employees and other stakeholders involved in the operation understand the jacking method.

6.61.7.1.10 Throughout the jacking operations, the **Contractor**'s design engineer shall ensure that the jacking method is applied safely and that there are no on-site improvisations that could compromise the integrity of the bridge.

6.61.7.1.11 The jacking and reinstallation of the span shall be supervised by the **Contractor**'s design engineer, who shall be on site throughout the operations of jacking and reinstallation of the spans.

6.61.7.1.12 The jacking operations shall be instrumented. The **Contractor** shall keep records of the operations carried out and measurements taken such as, but without being limited to, the pace, pressure and load.

6.61.7.1.13 The recorded data report of the jacking operations shall be submitted to the Engineer within seven (7) days of completion of said operations.

6.61.7.1.14 Failure by the **Contractor** to meet the requirements of paragraphs 6.61.7.1.7 to 6.61.7.1.13 will result in the application of Article 5.35.12 *Damages for Failure to comply with Requirements related to Jacking Operations* of Section 5 *Standard Administrative Conditions*.

6.61.7.2 JACKING OPERATION

6.61.7.2.1 Unless otherwise indicated on the drawings, the jacking shall be carried out evenly in maximum increments of 1.5 mm, and the jacking height shall be checked for each structural component jacked (girders and trusses) before continuing with the next increment. Furthermore, the bridge structural components such as the joints, concrete barriers, guard rails and steel structures located near the jacking point shall be inspected on a continuous basis in order to ensure that no damage is caused by excessive stress.

6.61.7.2.2 In case a jack breaks, steel temporary support elements shall be installed at the appropriate locations to support the loads safely. Their position shall not interfere with the intended position of the new bridge bearings or that of the new components to be installed. Neither shall the supports interfere with the work to be carried out during the period extending between the jacking and reinstallation of the spans.

6.61.7.2.3 Throughout the jacking operation, all jacks shall be connected to the hydraulic system in order to keep the pressure the same on each one of them.

6.61.7.2.3.1 All girders of a span that rest on a pier shall be jacked simultaneously; the jacking height difference between the various girders shall be less than 1.5 mm.

6.61.7.2.4 The hydraulic pressures shall be monitored continuously in order to ensure that the pressure levels for the jacking set by the **Contractor**'s design engineer are not exceeded.

6.61.7.2.5 During the jacking operation, the **Contractor** shall ensure that none of the jacking system's solicited components crack and become deformed. If cracking or deformation occurs, the work shall be stopped immediately. The **Contractor** shall notify the Engineer thereof immediately, and the affected components shall be repaired and reinforced as directed by the **Contractor**'s design engineer, subject to authorized from the Engineer.

6.61.7.2.6 Throughout the work period and especially during the jacking operation, the **Contractor** shall carry out, seven (7) days a week, at least one (1) daily "hands-on" inspection to ensure that none of the structure's solicited components and none of the temporary securing and support systems crack or become deformed. If cracking or deformation occurs, the work shall be stopped immediately. The **Contractor** shall notify the Engineer thereof immediately, and the affected components shall be repaired as directed by the Engineer. The **Contractor** shall submit to the Engineer a report covering its inspections and audits when the jacking work is completed.

6.61.7.2.7 The height of the temporary supports shall be adjusted by adding spacers as each component is jacked. The thickness of the spacers shall be such that the distance between the top of the temporary support and the bottom of the component jacked is always less than 1.5 mm.

6.61.7.2.8 When the jacking has reached the height indicated on the drawings, the temporary supports shall be secured before the load is removed from the jack in order to prevent any possible movement (lateral movement and torsion). The method for securing the supports shall be approved by the **Contractor**'s design engineer.

6.61.7.2.8.1 For non-continuous span bridges, if no height is indicated on the drawings, the maximum jacking height shall be 10 mm more than the final level of the bridge.

6.61.7.2.8.2 For continuous span bridges, if no height is indicated on the drawings, the maximum jacking height shall be 3 mm more than the final level of the bridge.

6.61.7.2.9 Existing bridge bearings may not be replaced and new components may not be installed before the **Contractor**'s design engineer has received written authorization from the Engineer.

6.61.7.2.10 The repositioning of the jacked components shall be carried out using the same method as that used for jacking.

6.61.7.2.11 The temporary support and jacking system shall not be dismantled until the Engineer has accepted the work and his written authorization has been received.

6.61.7.2.12 At the end of the work, the **Contractor** shall return to the **Owner**, at a location determined by the Engineer, all jacking system components and other elements used to jack the spans that have been provided by the **Owner**.

END OF SUBSECTION