

TENDER DOCUMENTS

SUBSECTION 6.14 TRAFFIC CONTROL AND TEMPORARY TRAFFIC CONTROL DEVICES

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SUBSECTION 6.14 TRAFFIC CONTROL AND TEMPORARY TRAFFIC CONTROL DEVICES

6.14.1 SCOPE

- 6.14.1.1 The present subsection specifies the requirements for traffic control and temporary traffic control devices for all interventions affecting traffic on the **Owner's** roadway infrastructures, including the Jacques-Cartier Bridge, Champlain Bridge, the federal portion of the Honoré-Mercier Bridge and their approaches, the Melocheville Tunnel and the Bonaventure Expressway.
- 6.14.1.2 The **Owner's** requirements with respect to traffic control and temporary signs are consistent with the *Ministère des Transports du Québec's* (MTQ) specifications on traffic control devices. Their aim is not to repeat these standards, but to define the **Owner's** particular traffic control requirements on its property, considering the significant amount of traffic travelling thereon. The objective of the **Owner's** requirements is to minimize the risk of accidents or incidents during work periods and to reduce inconveniences to users.
- 6.14.1.3 The present requirements for traffic control and signs take into consideration the special conditions met on the **Owner's** roadway network. The main changes to the minimum requirements of MTQ standards account first for the speed governing the design of traffic control devices. Rather than base the design on the posted speed limit, the actual speed used by drivers (higher in some places than the posted speed) has been used to increase safety at construction sites. This adjustment results in greater perception distances, stopping site distances and increased anticipation time and decision making opportunity for the drivers. Specifications for advance-warning signs have consequently been adjusted and taper lengths increased. Secondly, the distance between visual markers and beacons has been or could be reduced in some areas according to signalization plates and as directed by the Engineer to avoid traffic infiltration into work zones or protected zones during traffic congestion. Finally, the quantity of certain traffic control devices has been increased to account for actual speeds, and to address the reduced visibility caused by numerous heavy vehicles using the **Owner's** roadway network.
- 6.14.1.4 "Traffic Management and Control Plan" in the present section indicates all documents and works which are related to traffic control and traffic control devices that the **Contractor** shall provide and execute under the terms of the Contract.
- 6.14.1.5 "Global Traffic Management Plan" in the present section indicates the general measures defined by the Engineer to ensure co-ordination of the **Owner's** various construction sites. The **Contractor's** Traffic Management and Control Plan shall be compatible with the Global Traffic Management Plan.

6.14.1.6 “TCD” in the present section indicates the most recent version of the document entitled “Traffic Control Devices” Parts 1 and 2 of the “Normes Ouvrages routiers, Tome V” issued by the MTQ. Although the TCD apply to the present Contract, the present section describes a significant number of measures which are different and more restrictive than the TCD.

6.14.1.7 The following definitions of work durations, as prescribed by the TCD, apply to the Contract. However, temporary traffic control devices and recommended measures may differ significantly from those prescribed by the TCD for each work-duration category.

Brief Duration Work:

Work requiring less than fifteen (15) minutes to be performed.

Short Duration Work:

Work requiring less than twenty-four (24) hours to be performed.

Long Duration Work:

Work requiring more than twenty-four (24) hours to be performed.

Moving Operations:

Work involving a vehicle moving at a speed of at least 5 km/h and at most 20 km/h (slow-moving work) or of at least 20 km/h and at most 60 km/h (fast-moving work).

The expression “Contraflow lane” indicates any lane in which the direction of the traffic, when work is underway, is redirected in the opposite direction.

6.14.2 SPECIFIC STANDARDS AND REQUIREMENTS

6.14.2.1 The **Contractor** shall provide, design, set up and maintain all necessary temporary traffic control devices in order to properly guide vehicular, pedestrian and cyclist traffic at all times on the work site. Signs shall be designed first in conformity with the requirements of this subsection, including the **Owner’s** signalization plates attached to Section 4 *Special Technical Conditions*, and also in conformity with appropriate provisions of the TCD.

6.14.2.2 At all times the **Contractor** remains responsible for the temporary traffic control devices on its work site.

6.14.2.3 In the event of contradiction or discrepancy between TCD requirements and those prescribed in the present subsection, the most demanding requirements shall apply.

6.14.3 TEMPORARY TRAFFIC SIGNS PLANNING

6.14.3.1 TRAFFIC MANAGEMENT AND CONTROL PLAN

6.14.3.1.1 As the principal contractor, the **Contractor** is responsible for the safety of users traveling through the construction site as well as the health and safety of its employees and all workers on site; the **Contractor** shall therefore provide a detailed and complete traffic management and control plan for the duration of the Contract. This plan shall include drawings showing all details of traffic control devices planned for each traffic management scenario under consideration by the **Contractor** in the course of completing the works. The Traffic Management and Control Plan shall account for vehicular traffic and if applicable, pedestrian and bicycle traffic.

6.14.3.1.2 The Traffic Management and Control Plan shall include:

6.14.3.1.2.1 Drawings of temporary signs for each of the various scenarios involving lane closures, traffic diversion or contraflow operations (vehicles, bicycles and pedestrians) such drawings indicating the new panels, devices and pavement markings to be added or removed as well as devices which shall be temporarily masked or removed, and minimal lane width requirements;

6.14.3.1.2.2 Traffic diversion drawings, including if applicable, indications for alternate roads and detours or proposed bypass routes to be identified to users;

6.14.3.1.2.3 The protocol (dates, schedules and sequence of operations) for lane closures and re-openings as well as implementation of traffic signs, markings and traffic control devices;

6.14.3.1.2.4 Restrictions (including, but not limited to, weight, speed, dimensions);

6.14.3.1.2.5 The users information program (including, but not limited to, communication plan, variable message signs);

6.14.3.1.2.6 The **Contractor's** measures to ensure effective management of the temporary traffic control devices.

6.14.3.1.3 The **Contractor's** Traffic Management and Control Plan shall be established jointly and in coordination with the **Owner** and shall be incorporated in the, Global Traffic Management Plan of the **Owner**. This plan shall be submitted to the Engineer at least fourteen (14) days prior to the start of the **Contractor's** work on site.

- 6.14.3.1.4 The **Contractor**'s temporary traffic control devices shall be designed and installed to provide users with the best possible guidance throughout the affected area. They shall clearly illustrate the best route to follow, and inform users well in advance of any potential dangers. They shall allow users to adapt their driving behavior to the variety of situations which they may confront and enable them to anticipate and respond appropriately.
- 6.14.3.1.5 To be completely effective, temporary traffic signs shall:
- 6.14.3.1.5.1 be bilingual (French and English) on all of the **Owner**'s property;
 - 6.14.3.1.5.2 be uniform, homogeneous and completely integrated with adjacent road signs;
 - 6.14.3.1.5.3 attract attention;
 - 6.14.3.1.5.4 be perfectly visible and legible at distances required by standards;
 - 6.14.3.1.5.5 be easily understandable;
 - 6.14.3.1.5.6 be adapted to the dangers and specific situations requiring signalization.
- 6.14.3.1.6 Implementation of construction site traffic control devices shall:
- 6.14.3.1.6.1 comply with the sign and traffic management requirements described in the present specifications in order to ensure the safety of users and workers;
 - 6.14.3.1.6.2 be executed according to well-defined procedures agreed upon by all parties involved, more specifically the Engineer and the **Contractor**.
- 6.14.3.2 PREPARATION OF TEMPORARY TRAFFIC CONTROL DRAWINGS
- 6.14.3.2.1 The drawings for temporary road signs shall be designed to:
- 6.14.3.2.1.1 indicate all dangers;
 - 6.14.3.2.1.2 ensure the safety of users in the lanes affected by the works as well as those on lanes adjacent to the work;
 - 6.14.3.2.1.3 ensure the safety of workers during execution of the works;
 - 6.14.3.2.1.4 provide users with all relevant signals and information;
 - 6.14.3.2.1.5 account for local peculiarities (including, but not limited to, geometry and actual vehicle speed).

- 6.14.3.2.2 For every necessary configuration, submitted drawings shall contain, but not limited to, the following information:
- 6.14.3.2.2.1 A diagram showing the geometry and profile of the structure affected and also the detour route;
 - 6.14.3.2.2.2 Identification of the planned work zone;
 - 6.14.3.2.2.3 Implementation (position, distances, alignment) and symbols for traffic signs and other proposed devices;
 - 6.14.3.2.2.4 Sequential grouping of devices according to the order in which they will be implemented and removed;
 - 6.14.3.2.2.5 All necessary explanatory notes required for a thorough understanding of the proposed implementation;
 - 6.14.3.2.2.6 If applicable, an operational timetable for each suggested configuration;
 - 6.14.3.2.2.7 A suitable legend that complies with the **Owner's** standards.
- 6.14.3.2.3 The **Contractor's** drawings for temporary traffic control devices shall be designed and prepared by an engineer specialized in traffic management who is a member of the Ordre des ingénieurs du Québec and has at least five (5) years of relevant experience. All drawings (and specifications if required) shall be sealed and signed by this engineer.
- 6.14.3.2.4 The **Contractor** shall submit to the Engineer the drawings relating to temporary signs that the **Contractor** intends to install on and in the vicinity of the construction site. The Engineer will examine the drawings and provide comments within seven (7) days. The **Contractor** shall correct the drawings in light of the comments. No traffic sign installation may be carried out by the **Contractor** before written authorization is issued by the Engineer.
- 6.14.3.2.5 The **Contractor's** drawings of the temporary signs shall be to a minimum scale of at least 1:1000. The drawings showing signs for contraflow lanes or for specific situations not described in these specifications or in TCD, however, shall be to a minimum scale of 1:500.
- 6.14.3.2.6 The **Contractor** shall place construction traffic signs so that the delineation of the work zone and tapers do not begin in a horizontal curve or a vertical curve, such as the apex of a bridge.
- 6.14.3.2.7 Tapers shall begin on a straight segment where the visibility is at least two hundred (200) meters in all directions.

6.14.3.2.8 To assist the **Contractor** in preparing its signage drawings, the **Owner** may, on request, provide plan templates to be used for that purpose.

6.14.3.3 AUTHORIZED LANE CLOSURES

6.14.3.3.1 Unless noted otherwise in Section 4 *Special Technical Conditions* of the present specifications, on the **Owner's** property, lane closures are only permitted according to the *Table(s) of lanes to be maintained opened* attached to Section 4 *Special Technical Conditions* of the present specifications. For purposes of application of these tables, the following legal holidays shall be considered as Saturdays or Sundays: Victoria Day, Saint-Jean-Baptiste Day, Canada Day, Labour Day and Thanksgiving Day. Moreover, no lane closures are permitted in the afternoon of the preceding day of a civic holiday or a long week-end. These schedules shall be complied with at all times, and no exceptions will be tolerated.

6.14.3.3.2 In addition to the requirements mentioned in paragraph 6.14.3.3.1, for work which will be carried out on the roadway infrastructures comprising of two lanes or more in a direction and for which the posted speed is higher than 50 km/h, or if specified in Section 4 *Special Technical Conditions* of these specifications, or if so required by the CSST, the **Contractor** must conform to the following particular elements:

6.14.3.3.2.1 In the presence of workers not protected by a rigid barrier in a traffic lane, the **Contractor** must also close the adjacent lane in addition to the required lane in order to increase the level of safety of the people working on the structure, unless a special authorisation is given out by the Engineer.

6.14.3.3.2.1.1 In spite of what precedes, installation and removal procedures of the road signal devices may be carried out by closing only one lane.

6.14.3.3.2.1.2 These double or single lane closings are allowed only according to the *Table(s) of lanes to be maintained opened* attached to Section 4 *Special Technical Conditions* of these present specifications.

6.14.3.3.2.1.3 During double lane closings, the amount of reduction in the Contract price, as described in Article 6.14.9 *Traffic Hindrance Minimization System*, apply to each lane closed. In such a case, the reduction in the Contract price shall be \$100 / hour / lane x 2 lanes.

6.14.3.3.3 All work to install and remove signalization including the evacuation of workers shall be completed and all lanes opened to traffic per the schedules specified in the *Table(s) of lanes to be maintained opened* attached to Section 4 *Special Technical Conditions*. No extensions of these hours will be granted.

6.14.3.3.4 Any closure ahead of the prescribed time, any delay in reopening lanes, any unauthorized closure, and any closure resulting from deficient work not complying with the Contract requirements will result in the application of subsection 5.35.5 “*Damages arising from closure of vehicular traffic lanes*” of the present specifications.

6.14.3.3.5 All lane closures are subject to prior authorization by the Engineer according to the **Owner’s** procedure. The **Contractor** shall transmit its closure request to the Engineer within the delays specified in the “Request for Specific Interventions” Form attached to Section 4 *Special Technical Conditions*.

6.14.3.4 ROAD TRAFFIC MANAGEMENT

6.14.3.4.1 The **Contractor** shall perform all works covered by the Contract in such a way so as not to interfere with traffic, except when authorized by the Engineer in exceptional circumstances, necessary due to the nature of the works.

6.14.3.4.2 The **Contractor** shall always comply with the Engineer’s instructions regarding the prompt reopening of a lane when the situation requires it, even during off peak hours. The **Contractor** may not request compensation for the cost of travel by its work teams from one area of the worksite to another.

6.14.3.4.3 The **Contractor** shall provide and maintain a sufficient number of road signs, barriers, signals lights, signal arrows, concrete site guardrails and any other material required to direct and control road traffic.

6.14.3.4.4 With respect to all detours and alternate routes, the **Contractor** shall obtain, at its expense, all permits required from the relevant authorities.

6.14.3.4.5 The **Contractor** shall protect roadway traffic against all damages which may result from its work and shall assign flagmen if required (including, in particular, when trucks are entering and exiting the worksite).

6.14.3.4.6 In the event of an accident or incident on or in the vicinity of the construction site, the **Contractor** shall immediately contact the Cartier-Champlain Sûreté du Québec station at 450 442-1036 and inform the dispatcher of the situation on the site and shall also inform the Engineer.

6.14.3.5 SIGNALIZATION CREW

6.14.3.5.1 The workers in charge of temporary signs and traffic control shall be at least eighteen (18) years old, shall have attended the course “*Supervision et surveillance de la signalisation de travaux de chantiers routiers*” (STC-102) given by the Association québécoise du transport et des routes (AQTR) pertaining to traffic management and safety during road works, and shall hold a valid AQTR certificate for the duration of the works.

6.14.3.6 IMPACT ATTENUATOR EQUIPPED VEHICLE

- 6.14.3.6.1 During lane closure and reopening operations or for the setting up of a contraflow lane, the **Contractor** shall always equip the upstream vehicle with an impact attenuator. This vehicle shall also be used for brief duration work, moving operations or work near open traffic lanes.
- 6.14.3.6.2 The impact attenuator shall be connected to the back of the vehicle, TMA type, in compliance with the National Cooperative Highway Research Program (NCHRP) Report 350 – *Recommended Procedures for the Safety Performance Evaluation of Highway Features* and shall be designed for a minimum speed of at least 100 km/h, (level TL-3).
- 6.14.3.6.3 Every truck equipped with an impact attenuator shall have a total loaded mass (including the attenuator) in compliance with the manufacturer's specifications for the model used, have a flashing luminous signal arrow, revolving lights and type III reflective striping on the sides and back in conformity to the MTQ's standard 14101 "*Pellicules rétro réfléchissantes*".

6.14.3.7 ACCOMPANYING WORK VEHICLE

- 6.14.3.7.1 The **Contractor** shall, for the entire duration of any closure of one or more lanes, provide, operate and maintain an accompanying work vehicle which will do the following:
 - 6.14.3.7.1.1 Continuously travel in the traffic lanes at the legal speed limit when contraflow lanes are in use;
 - 6.14.3.7.1.2 Make a minimum of one run every hour in all other cases.
- 6.14.3.7.2 Tasks of the accompanying work vehicle operator:
 - 6.14.3.7.2.1 To contact the Sûreté du Québec and arrange for the towing off the work site of any stopped vehicle requiring such assistance;
 - 6.14.3.7.2.2 To reinstall and/or replace any faulty sign or other traffic control device;
 - 6.14.3.7.2.3 To remove any obstacle or debris of any kind and to forward to the **Contractor's** superintendent all information concerning any moved or inoperative devices which could block or impair correct operation of traffic lanes.
 - 6.14.3.7.2.4 Facilitate vehicle exiting and entering the work area.

- 6.14.3.7.3 The accompanying work vehicle shall have the following characteristics:
- 6.14.3.7.3.1 Be a pickup;
 - 6.14.3.7.3.2 Have a total loaded weight of at least 2,700 kg;
 - 6.14.3.7.3.3 Have insurance coverage in conformity with the requirements of Section 11 – *Insurance Conditions* of the Contract.
- 6.14.3.7.4 Every accompanying work vehicle shall contain or be equipped with the following:
- 6.14.3.7.4.1 One (1) shovel;
 - 6.14.3.7.4.2 One (1) broom brush;
 - 6.14.3.7.4.3 One (1) first aid kit;
 - 6.14.3.7.4.4 One (1) A-B-C class fire extinguisher having a minimal size of five (5) kg;
 - 6.14.3.7.4.5 Twenty-four (24) safety flares;
 - 6.14.3.7.4.6 Three (3) bags of twenty (20) kg of absorbent;
 - 6.14.3.7.4.7 Three (3) bags of twenty (20) kg of abrasive;
 - 6.14.3.7.4.8 Three (3) bags of twenty (20) kg of cold patch asphalt;
 - 6.14.3.7.4.9 One (1) cellular telephone;
 - 6.14.3.7.4.10 360° Emergency rotating light and a signal arrow that complies with TCD standards;
 - 6.14.3.7.4.11 Be equipped with a wide type III reflective yellow stripe conforming to the most recent version of standard 14101 *Pellicules rétroréfléchissantes* contained in Chapter 14 “*Matériaux divers*” of the MTQ “*Normes – Ouvrages routiers – Tome VII – Matériaux*”, on each side and on the back of the vehicle.
 - 6.14.3.7.4.12 Have an identification “*Patrouille*” in the back (with reflective material).
- 6.14.3.7.5 Upon written request from the Engineer, the **Contractor** shall provide all missing or replacement equipment within twenty-four (24) hours.

6.14.3.8 WORK ZONE SIGNALIZATION

6.14.3.8.1 Signalization requirements

6.14.3.8.1.1 The **Contractor** shall use a signal arrow for each lane partially or completely closed to traffic. The signal arrows shall be installed to close a lane even though the open lane/close lane indicator lights indicate that one or more lanes are closed. The signal arrow shall meet the requirements of these specifications and of the TCD standards. Its use shall be in compliance with these documents during all stages of performance of the work and in all situations encountered.

6.14.3.8.2 Visual markers

6.14.3.8.2.1 Unless otherwise indicated, the only authorized visual markers are direction chevrons T-RV-1 and the non-metallic T-RV-2 construction markers or T-RV-7 or equivalents approved by the Engineer. The use of cones is forbidden.

6.14.3.8.2.2 The visual markers shall meet the TCD requirements.

6.14.3.8.2.3 The space between visual markers (variable E defined in Chapter 4 *Roadwork Signing* of the TCD) shall be at most ten (10) meters. The spacing in the tapers shall be at most five (5) meters.

6.14.3.8.2.4 In tapers, the direction chevrons shall be spaced at ten (10) meters maximum for 75 meters tapers, or to a maximum of twenty (20) meters for 150 meters tapers.

6.14.3.8.2.5 The **Contractor** shall use, as visual markers, the T-RV-1 direction chevron signs in the tapers which are used to reduce the number of available lanes.

6.14.3.8.2.6 In the deviation zone, the **Contractor** shall install direction chevron signs at ten (10) meters intervals in curves. The height of the chevron, measured from the road surface to the lower edge, shall be 1200 mm.

6.14.3.8.2.7 For all encountered situations, sign spacing (variable B, defined in Chapter 4 *Roadwork Signing* of the TCD) and visual markers spacing shall be as shown on the **Owner's** signalization plates attached to Section 4 *Special Technical Conditions*.

- 6.14.3.8.2.8 As a general guide, Table 1 summarizes the spacing shown on the signing plates for posted speeds of fifty (50) km/h and seventy (70) km/h.

Table 1: Owner’s requirements for sign spacing

	Posted Speed	
	50 km/h	70 km/h
D (Lane width)	3.65 m	3.65 m
L (Taper length)	75 m	150 m
E (Visual marker spacing - Lanes)	10 m	10 m
E (Visual marker spacing – Tapers)	5 m	5 m
E _b (Spacing of chevrons in 75m tapers)	10 m	10 m
E _b (Spacing of chevrons in 150m tapers)	20 m	20 m
E _c (Spacing of visual markers for contraflow lane)	10 m	10 m
B (Sign spacing)	75 m	125 m

- 6.14.3.8.2.9 When lanes closures are in effect, acceleration and deceleration lanes shall be provided. These shall have a length at least twice that of the taper length (variable L). Tapers shall be laid out in conformity with TCD (variable L) specifications, but their length shall be as shown in the signalization plates attached to Section 4 *Special Technical Conditions*.

6.14.3.8.3 Roadwork signing

- 6.14.3.8.3.1 The roadwork signing shall have an orange background with a fluorescent type VII reflective film conforming to TCD requirements.

- 6.14.3.8.3.2 The use of pictograms shall be favoured to lettering. The pictograms shall conform to the prescriptions of Appendix B of Chapter 4 of the TCD entitled “*Roadwork Signing*”.

- 6.14.3.8.3.3 The signing lettering on the panels shall be bilingual (French and English) and appear on two (2) different panels in accordance to TCD requirements.

- 6.14.3.8.3.4 When required, the **Contractor** shall provide appropriate signing for motorcyclists, cyclists and pedestrians.

6.14.3.9 INSTALLATION OF TEMPORARY TRAFFIC CONTROL DEVICES

- 6.14.3.9.1 Traffic control devices used for securing work zones shall be:

- 6.14.3.9.1.1 Installed before work begins, starting from the furthest distance and proceeding towards the work zone;

- 6.14.3.9.1.2 Installed in sufficient number according to their location and in conformity with the **Owner's** signalization plates, TCD standards and the **Contractor's** temporary traffic signalization drawings and shall be sealed and signed by an engineer member of the "Ordre des ingénieurs du Québec";
- 6.14.3.9.1.3 In good working order (e.g. reflectivity, brightness);
- 6.14.3.9.1.4 Visible at the expected visibility distance range or at least twice the visibility stopping distance.
- 6.14.3.10 During the installation and removal of the temporary traffic control devices, the **Contractor** shall comply with occupational health and safety requirements and respect the safety requirements of the **Owner**. The signalization crew shall be protected by a vehicle equipped with an impact attenuator placed upstream of traffic per the requirements stipulated in subsection 6.14.3.6 *Impact Attenuator Equipped Vehicle*.
- 6.14.3.10.1 The **Contractor** shall also supply, install, clean and maintain all signs, concrete site guardrails and appropriate visual markers in conformity with occupational health and safety requirements and to the satisfaction of the Engineer.
- 6.14.3.10.2 During the installation of the traffic advance signing, the **Contractor** shall arrange for their installation outside of the traffic lanes. For the signs installed on the bridges, the **Contractor** shall place them on the guard rails or on fixed adjacent elements outside the traffic lanes. The fasteners and supports shall withstand the force of the wind and the turbulence created by the passage of the trucks. The type of fasteners used shall be submitted to the Engineer for review.
- 6.14.3.10.3 Traffic signs, barriers, guard rails, traffic lights, signal arrows and the flagmen shall be installed and maintained by the **Contractor** for the entire duration of work to ensure public and personnel safety and to secure the work zone to the satisfaction of the Engineer and in conformity with occupational health and safety requirements.
- 6.14.3.10.4 The **Contractor** shall provide, for and in the vicinity of its work zone, a sequence of operations covering the installation of temporary traffic control devices as well as safety measures and indicators that ensure users' safety.
- 6.14.3.10.5 The **Contractor** shall protect motorists, pedestrians and cyclists from all damages that may result from the **Contractor's** work.
- 6.14.3.10.6 The **Contractor** shall stabilize traffic signs using only weights made for this purpose. At least two weights shall be used to keep each device in place.

6.14.3.10.7 All the traffic control measures and devices described in the **Contractor's** Traffic Management and Control Plan shall be completely put in place before any construction work may begin.

6.14.3.11 MAINTENANCE OF TEMPORARY TRAFFIC CONTROL DEVICES

6.14.3.11.1 The **Contractor** shall take all necessary measures to replace or reinstall any removed, displaced, or damaged traffic control device within a period of at most thirty (30) minutes after being notified by the *Sûreté du Québec*, the Engineer, an employee of the **Owner** or any other person. Should the **Contractor** fail to conform to these requirements or fail to be reached by the **Owner** within this delay, corrective measures will be taken by the **Owner**, the Engineer or the *Sûreté du Québec* at the **Contractor's** expense; costs incurred by the **Owner** for corrective measures will be deducted from the amounts payable to the **Contractor** under this Contract.

6.14.3.11.2 The **Contractor** shall clean, repair and if necessary replace devices in order to maintain their visibility and reflectivity.

6.14.3.12 SIGN MASKING DURING WORK

6.14.3.12.1 Permanent signs installed adjacent to or above a traffic lane which, for the duration or part of the duration of the roadwork are not useful or give messages contradictory to the temporary traffic signalization, shall be removed or masked using materials which are totally opaque during both day and night.

6.14.3.12.2 Temporary signs adjacent to or above a traffic lane installed previously for the duration or part of the duration of roadwork that contradict planned signals for the current phase of roadwork shall be removed or masked using materials which are totally opaque during both day and night.

6.14.3.13 REMOVAL OF TEMPORARY SIGNS

6.14.3.13.1 Temporary signs shall be removed in the opposite order of their installation or according to specific sequences described in the Traffic Management and Control Plan. The **Contractor** shall thoroughly clean closed lanes before reopening them to traffic.

6.14.3.13.2 The signalization crew shall be protected by an impact attenuator vehicle placed on the upstream side of traffic.

6.14.3.13.3 It is prohibited to leave any temporary traffic control device, including traffic signs and other devices, on traffic lanes or shoulders outside of working hours. Indications on temporary traffic control devices moved to authorized locations shall not be visible from the traffic lanes.

6.14.3.13.4 No removed signalization device shall be left on the **Owner's** road network including road shoulders.

6.14.3.14 ENTRIES AND EXITS FROM THE WORK ZONE

6.14.3.14.1 Vehicles accessing the work zone shall be equipped with a revolving flashing light, failing which they shall be followed by at least one accompanying work vehicle.

6.14.3.14.2 Vehicles exiting the work zone shall do so downstream of this zone and in the extension of the lane closed for construction. An accompanying work vehicle, as defined in the present subsection, shall be used to slow down or stop traffic in order to ease the merging of the vehicle into an open traffic lane.

6.14.3.14.3 Movement of vehicles exiting and entering the work zone shall be coordinated with flagmen and the accompanying work vehicle operations and shall account for construction site configuration, drivers' visibility and the Traffic Management and Control Plan of the **Contractor**. A description of tasks and co-ordination mechanisms and detailed signalization drawings, shall be used for each situation. Accompanying work vehicles shall be equipped with specific signals to inform road users of slowdowns, or bypass manoeuvres.

6.14.3.15 USE OF T-20 "CONSTRUCTION AHEAD" PANEL

6.14.3.15.1 One (1) T-20 panel shall be installed one (1) kilometre upstream of the work zone in accordance with the TCD long-term work. T-20 panels shall be installed at the intervals specific in the drawings for the structure on which work is being done.

6.14.3.15.2 For work on the Champlain Bridge, the **Contractor** shall install T-20 panels every kilometers and on each of the access ramps leading to and/or exiting from the bridge within a three (3) kilometers radius from the construction site. All highway lanes leading to the bridge within this radius shall have one or several T-20 panels posted on them.

6.14.3.15.3 For work on the Jacques-Cartier Bridge, T-20 panels shall be installed at each of the major intersections leading to the bridge within a five hundred (500) meters radius from the work site.

6.14.3.15.4 For work on the Honoré-Mercier Bridge, T-20 panels shall be installed at every kilometer and on each access ramp leading to and/or exiting from the bridge over a distance of two (2) kilometers from the work site.

6.14.3.15.5 For work in the Melocheville Tunnel, T-20 panels shall be installed on each major intersection leading to the tunnel within a radius of one (1) kilometer from the tunnel's entry point.

6.14.3.15.6 For work on Highway 15, Bonaventure Expressway and “S” and “T” lanes, the **Contractor** shall install T-20 panels at every kilometer as well as on each of the access ramps leading to or exiting from these highways or lanes within a radius of three (3) kilometers from the work site. All expressway and bridge lanes leading to these highways or lanes in this radius shall be equipped with one or more T-20 panels. T-20 panels shall also be installed at each major intersection leading to the Bonaventure Expressway from downtown Montreal within a radius of five hundred (500) meters around the work site.

6.14.3.16 SPECIAL REQUIREMENTS FOR BRIEF DURATION WORKS AND MOVING OPERATIONS

6.14.3.16.1 For brief duration work and moving operations, the **Contractor** shall position an impact attenuator vehicle upstream of the work site.

6.14.4 SPECIFIC REQUIREMENTS FOR CONTRAFLOW TRAFFIC SIGNS

6.14.4.1 GENERAL

6.14.4.1.1 The **Contractor** shall make sure that the signalization work for the contraflow traffic complies with the TCD requirements and the characteristics on the signalization plates attached to Section 4 *Special Technical Conditions* for the various deviation scenarios.

6.14.4.1.2 The **Contractor** shall note that lane number three (3) of the Jacques-Cartier Bridge (center lane) has no predominant traffic flow direction since it is reversible and equipped with a lane control system showing actual lane operation. Consequently, when the **Contractor** is working in either lane 1 (right lane towards the South Shore) or lane 5 (right lane towards Montreal) of the Jacques-Cartier Bridge, or in lanes 1 and 5 at the same time using lane 3 for traffic in one of the two direction, special traffic control devices are not required for the centre lane.

6.14.4.1.3 For work requiring contraflow lane operations, the **Contractor** shall submit to the Engineer for examination, the sequence for traffic control device installation and removal. The signalization plates attached to Section 4 *Special Technical Conditions* indicate minimal requirements for signalization and contraflow traffic implementation. The **Contractor** remains responsible for temporary traffic control devices in place on its construction site at all times.

6.14.4.2 IMPACT ATTENUATOR INSTALLED AT THE END OF THE DISPLACED RIGID BARRIER FOR CONTRAFLOW TRAFFIC:

6.14.4.2.1 The **Contractor** shall install impact attenuators at the end of central rigid barriers which are displaced to allow contraflow traffic (refer to signalization plates attached to Section 4 *Special Technical Conditions* for additional information).

- 6.14.4.2.2 The impact attenuator shall be a frontal retained device meeting NCHRP Report 350 – *Recommended Procedures for the Safety Performance Evaluation of Highway Features* standard and be designed for speeds of at least 70 km/h (TC-2 level).
- 6.14.4.2.3 The impact attenuator shall be on the MTQ approved products list. The impact attenuator shall be of temporary use, easy to install, easy to move and easy to remove.
- 6.14.4.3 ADDITIONAL SIGNALIZATION REQUIREMENTS
- 6.14.4.3.1 T-D-80 “Two-Way Traffic Ahead” signs indicating that there are two adjacent lanes with traffic moving in opposite directions, and P-140-1 “No Passing” signs shall be installed every two hundred fifty (250) meters in zones consisting of adjacent lanes of opposing traffic.
- 6.14.4.3.2 The **Owner’s** general requirements concerning the use of visual markers are presented in Table 1 “*Owner’s Requirements for Sign Spacing*”.
- 6.14.4.3.3 When contraflow lanes are used outside the work area over distances longer than one (1) kilometer, and when temporary sign modifications are required for safety purposes, the distance between visual markers shall be five metres (5 m) over a distance of five hundred metres (500 m) before and after the detour and twenty-five metres (25 m) in the detour in accordance with section 4.4, *Delineators*, Chapter 4 *Roadwork Signing*, TCD, Part I.

6.14.5 TEMPORARY PAVEMENT MARKINGS

- 6.14.5.1 The **Contractor** shall design, supply, install, maintain and remove temporary pavement markings on the roadway as required in order to better direct traffic at all times.
- 6.14.5.2 Before the start of the marking work, the **Contractor** shall provide drawings of the lane markings, bearing an engineer signature and seal, for all traffic configurations planned for control of traffic. The lane marking drawings shall comply with the TCD requirements.
- 6.14.5.3 When temporary pavement marking is necessary, existing markings shall be removed and replaced by the marking required to suit the work. Upon completion of the work, the temporary marking shall be removed and replaced with the appropriate permanent markings before reopening lanes to traffic. Removal of the temporary marking (alkyd paint) shall be done using sandblasting or steel shot. The use of abrasive rollers or black opaque paint is prohibited.

- 6.14.5.4 The **Contractor** shall make sure that the surface of lanes open to traffic is appropriately marked; if the use of paint is impossible, the **Contractor** shall install temporary reflective lane delineators for a period not exceeding fifteen (15) days.
- 6.14.5.5 Until the final marking is painted in place, the **Contractor** shall ensure that temporary pavement markings are adequate at all times. The use of reflective lane delineators shall be considered to be a temporary measure.
- 6.14.5.6 When used, reflective lane delineators shall be installed every three (3) meters for continuous lines, intermittent lane lines, nosings and approaches in the vicinity of obstacles, and every two (2) meters for double yellow lines. For double lines, delineators shall be installed in pairs in order to take the shape of double lines. The delineator's colour shall comply with the TCD standards.
- 6.14.5.7 Temporary delineators shall be replaced by temporary or permanent markings (according to specifications) as soon as possible.
- 6.14.5.8 When the work deals with the replacement of sections of a concrete bridge deck or approaches of a concrete based roadway, the temporary pavement markings shall be done on a black background in order to emphasize the marking.

6.14.6 BRIDGE LANE CONTROL SYSTEM

- 6.14.6.1 The Jacques-Cartier and Champlain Bridges are equipped with lane control systems. These systems, operated by the *Sûreté du Québec*, offer relatively limited display possibilities.
- 6.14.6.2 Table 2 "Jacques-Cartier Bridge System Characteristics" and Table 3 "Champlain Bridge System Characteristics" set out the system characteristics of the Jacques-Cartier Bridge and Champlain Bridge.

Table 2: Jacques-Cartier Bridge System Characteristics

Lanes	Possible displays*	
	Toward Montreal	Toward the South Shore
1 (upstream)	Closed	Open or Closed
2	Closed	Open or Closed
3	Open or Closed	Open or Closed
4	Open or Closed	Closed
5 (downstream)	Open or Closed	Closed

*Uniform indication over the entire length of the lane.

Table 3: Champlain Bridge System Characteristics

Lanes	Possible displays*	
	Toward Montreal	Toward the South Shore
1 (upstream)	None	Open or Closed
2	None	Open or Closed
3	Open or Closed	Open or Closed
4	Open or Closed	Open or Closed

5	Open or Closed	None
6 (downstream)	Open or Closed	None

6.14.6.3 While developing its Traffic Management and Control Plan, the **Contractor** shall take these lane control systems into consideration. The **Contractor** shall also consult the **Owner** and the *Sûreté du Québec* for operational details. The Traffic Management and Control Plan shall be developed and implemented in perfect co-ordination with these lane control systems.

6.14.7 INFORMATION SIGNS

6.14.7.1 PERIPHERAL SIGNS

6.14.7.1.1 The **Owner** may enter into contracts with other contractors for the planning, implementation and maintenance of all peripheral signs required for any number of projects, including proposed alternate signs during lane closures. Management of these contracts falls under the Engineer's responsibility.

6.14.7.1.2 When preparing its Traffic Management and Control Plan, the **Contractor** shall ensure that its plan integrates perfectly into the **Owner's** Global Traffic Management Plan. In this regard, the **Contractor** shall co-operate with the Engineer, consultants and other contractors whose services are retained by the **Owner**, the MTQ, concerned municipalities and any other parties involved in traffic management in the Greater Montreal area.

6.14.7.1.3 The **Contractor** shall coordinate, operate, integrate and modify, if required, its temporary signing, in order to ensure an effective interface with the peripheral signing and to make it compatible with other contractors signing. The **Contractor** may be required to supply and operate mobile variable message signs (VMS) so as to manage lane closure and opening operations more effectively.

6.14.7.2 COMPLEMENTARY TRAFFIC CONTROL DEVICES

6.14.7.2.1 Letters and numbers displayed on complementary traffic control devices shall meet the "*Metric Edition Standard Alphabets for Highway Signs and Pavement Markings*" requirements as published by the U.S. Department of Transport and approved by the Transport Association of Canada.

6.14.7.2.2 These complementary traffic control devices shall have an orange background with a type III or IV fluorescent reflecting film. The signs shall be of rectangular shape and shall comply with TCD specifications. Letters shall be at least 150 mm high and of the C, D and E series. Shop drawings shall be submitted for review to the Engineer before fabrication. Sign messages shall be bilingual (French and English) and the characters of the same height for both languages.

6.14.8 MOBILE VARIABLE MESSAGE SIGNS (VMS)

6.14.8.1 SCOPE

6.14.8.1.1 This section deals with the supply and operation of mobile variable message signs (VMS) when required. These signs are used foremost to transmit to users and motorists information relating to lane closure schedules, to open traffic lanes in each direction, to road conditions, potential dangers and the distance until the work zone.

6.14.8.2 STANDARDS AND SPECIFIC REQUIREMENTS

6.14.8.2.1 Mobile VMS shall be placed in such a way as to allow them to be moved upon request from the Engineer. They shall remain operational for the entire duration of the works.

6.14.8.2.2 Logistics pertaining to the operation of these VMS shall be included in the **Contractor's** Traffic Management and Control Plan.

6.14.8.2.3 When signs are installed on the **Owner's** property, messages shall be bilingual (French-English) and the characters of the same height for both languages.

6.14.8.2.4 Each variable message sign shall be of a matrix type allowing a display of at least three (3) lines of twelve (12) characters each. Lettering shall have a minimum height of 300 mm. The matrix shall be at least 27 x 72 pixels. The base of the VMS shall be at least 3.0 m wide by 1.2 m high. The VMS shall display a sequence of clear and visible messages. Every VMS shall be numbered according to their identification.

6.14.8.2.5 The VMS shall be installed on a trailer which provides stability and safety. The VMS shall be mounted on a hydraulic mast, allowing it to be raised once installed. In order to improve the message visibility, the VMS installation shall allow it to be oriented without the trailer being moved.

6.14.8.2.6 The panel shall provide a luminous intensity which adapts automatically to ambient light, allowing the messages to always be perfectly readable at a distance of two hundred fifty meters (250 m).

6.14.8.2.7 The VMS shall have the following operational characteristics:

- 6.14.8.2.7.1 The VMS shall not require any external connection for its energy supply. It shall be of the stand-alone type and be powered by a diesel generator or by one or more solar panels, whichever is best suited to construction site characteristics. Furthermore, the VMS shall be able to run twenty-four (24) hours a day. When using solar panels, the **Contractor** shall take into account obstructions (shade) created by surrounding structures.
- 6.14.8.2.7.2 For the solar powered panels, the **Contractor** shall make sure that they operate adequately in bad weather or on a cloudy day. The **Contractor** shall remedy all defective power supply, at its own expenses.
- 6.14.8.2.7.3 For VMS powered by a diesel generator, the **Contractor** shall take into account the impact of noise created locally by the use of such generators.
- 6.14.8.2.7.4 The VMS shall be able to store displayed messages in its memory. It shall also be programmable using an IBM-compatible computer. The VMS programming language shall be NTCIP. The VMS shall be programmable on-site and via cellular communication.
- 6.14.8.2.7.5 Each VMS shall be equipped with a cellular communication device, and cellular communication expenses for every VMS shall be paid by the **Contractor**.
- 6.14.8.2.7.6 The **Contractor** shall supply the software for communications between the computer and the VMS.
- 6.14.8.2.7.7 In case of a breakdown, the VMS shall automatically display a general message selected by the **Owner** to ensure road users' safety.
- 6.14.8.2.8 The **Owner** uses six (6) large permanent variable message signs to display information to users. The **Contractor** may not use these signs for its own purposes or for signal needs. The **Contractor** should plan, obtain and operate its own VMS.
- 6.14.8.2.9 The **Contractor** shall provide the **Owner** with all assistance required for modifying or controlling the displayed messages at all times. The **Contractor** shall make sure that the **Owner** has full control of the messages.
- 6.14.8.2.10 The **Contractor** shall clear the VMS of snow after each snowfall and shall also make sure that the messages are visible by the users.

6.14.9 TRAFFIC HINDRANCE MINIMIZATION SYSTEM

- 6.14.9.1 Subject to any restrictions as may be applicable in Section 4 *Special Technical Conditions* of the specifications, the **Contractor** shall in the course of performing the work stipulated in the Contract, close one or more traffic lanes pursuant to *the Table(s) of lanes to be maintained opened* attached to Section 4 *Special Technical Conditions* of the present specifications.
- 6.14.9.2 Even if such closures are allowed under this Contract, they are still disruptive to traffic flow during the periods specified and therefore affect the level of service provided to users. In an effort to minimize the impact on users, the **Owner** hereby implements a system to minimize lane closures.
- 6.14.9.3 In addition, the parties agree that the Contract price shall be reduced when the **Contractor** performs lane closures. For each lane closed within the periods authorized in the *Table(s) of lanes to be maintained opened* attached to Section 4 *Special Technical Conditions*, the Contract price shall be reduced of an amount of one hundred dollars (\$100) per hour, before taxes. The Traffic Hindrance Minimization System shall apply to all types of work (such as Moving Operations, Brief Duration Work, Short Duration Work and Long Duration Work) which require lane closures.
- 6.14.9.4 The number of hours during which lanes are closed under the Traffic Hindrance Minimization System shall be compiled jointly by the **Contractor** and the Engineer. When lanes are controlled by a lane control system, each lane closure time is started when the red light comes on and stopped when the green signal returns. When lanes are not controlled by a lane control system, the hours during which the lanes are closed shall be counted from the exact time when the free and safe flow of traffic on each lane is interrupted until the exact time the free and safe flow of traffic resumes.
- 6.14.9.4.1 For the purposes of calculating the amount of the reduction in the Contract price, every partial hour of lane closure shall be rounded up to the next half hour.
- 6.14.9.5 If at the time of preparing its tender, the **Contractor**, in its work planning, deems that it will be necessary to perform lane closures, it shall include in its tender price, under the relevant pay item(s) *Site Signage, Traffic Control and Traffic Hindrance Minimization System* of the Price Table, the total amount required to reflect any reduction in the Contract price applicable under the Traffic Hindrance Minimization System.
- 6.14.9.6 The reduction in the Contract price will be applied by the **Owner** at the time of processing any progress claim submitted by the **Contractor**, as work progresses.

END OF SUBSECTION