

TENDER DOCUMENTS

SUBSECTION 6.55 LIGHTING

TABLE OF CONTENTS

	PAGE
SUBSECTION 6.55 LIGHTING	1
6.55.1 GENERAL.....	1
6.55.2 MEASUREMENT UNITS.....	2
6.55.3 REFERENCE STANDARDS	2
6.55.4 MATERIALS	4
6.55.5 DESIGN	8
6.55.6 EXECUTION OF WORK	9
6.55.7 QUALITY CONTROL	12

SUBSECTION 6.55 LIGHTING

6.55.1 GENERAL

- 6.55.1.1 This subsection sets out the requirements relating to the supply and installation of lighting equipment covered by this Contract.
- 6.55.1.2 Any specific requirements, where appropriate, pertaining to the supply and installation of lighting equipment covered by this Contract are set out on the plans and in Section 4 *Special Technical Conditions*.
- 6.55.1.3 The requirements relating to the supply and installation of conduit, junction boxes and pull boxes are described in subsection 6.51 *Conduit, Junction Boxes and Pull Boxes*.
- 6.55.1.4 The requirements relating to the supply and installation of electrical cables are described in subsection 6.52 *Electrical Cables*.
- 6.55.1.5 The requirements relating to the supply and installation of the power supply are described in subsection 6.53 *Power Supply*.
- 6.55.1.6 The requirements relating to the electrical power distribution are described in subsection 6.54 *Electrical Power Distribution*.
- 6.55.1.7 The requirements relating to the supply and installation of the foundation and tension blocks are described in subsection 6.39 *Precast Concrete Elements*.
- 6.55.1.8 The following definitions apply to this Contract:
 - 6.55.1.8.1 lamp post: lighting assembly comprising a pole, a bracket or a tenon and a light fixture;
 - 6.55.1.8.2 high mast: lighting assembly comprising a pole, a mobile crown, a lift power unit and light fixtures.

6.55.2 MEASUREMENT UNITS

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

Measurement Unit	Designation	Symbol
length	meter	m
length	millimeter	mm
temperature	degree Celsius	°C
electric current intensity	ampere	A
angle plan	degree	°
luminous intensity	candela	cd
luminous flux	lumen	lm
power	watt	W

6.55.3 REFERENCE STANDARDS

6.55.3.1 The Contractor shall perform all work related to the supply and installation of the lighting equipment in accordance with the requirements of the following standards and documents to which the provisions of this Contract are added:

6.55.3.1.1 (ACNOR(CSA)) Canadian Standards Association:

- CAN/CSA C22.2 NO. 0 *General Requirements – Canadian Electrical Code, Part II;*
- CAN/CSA C22.2 NO. 9.0 *General Requirements for Luminaires;*
- CAN/CSA C22.2 NO. 9.0S1 *Supplement No. 1 to C22.2 No. 9.0, General Requirements for Luminaires;*
- CAN/CSA C22.2 NO. 39 *Fuseholders assemblies;*
- CAN/CSA C22.2 NO. 43 *Lampholders (Bi-national standard with UL 496);*
- CAN/CSA C22.2 NO. 74 *Equipment for Use with Electric Discharge Lamps;*
- CAN/CSA C22.2 NO. 106 *-High Breaking Capacity Fuses (HRC MISC);*
- CAN/CSA C22.2 NO. 141 *Emergency Lighting Equipment;*
- CAN/CSA-C22.3 NO. 1 *Aerial Networks;*
- CAN/CSA-C22.3 NO. 7 *Underground Networks;*
- CAN/CSA C22.10 *Quebec Construction Code - Chapter V, Electricity - Canadian Electrical Code, Part I (Twentieth Edition) with Quebec Amendments;*

- CAN/CSA E598-2-1 *Luminaires - Part 2: Particular Requirements - Section 1: Fixed General-Purpose Luminaires (Adopted IEC 598-2-1:1979, first edition, including Amendment 1:1987, with Canadian Specific Requirements)*;
- CAN/CSA S6 *Canadian Highway Bridge Design Code*;
- CAN/CSA S136 *North American Specification for the Design of Cold-Formed Steel Structural Members*;
- CAN/CSA W59.2-M1991 (R2008) *Welded Aluminum Construction*;
- CSA C22.2 NO 206 *Lighting Posts*;
- CAN/CSA-O15 *Poles and Poles Wooden Reinforcements for Public Services*;
- CAN/CSA-Series O80 *Wood Preservation*.

6.55.3.1.2 (ASTM) ASTM International:

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

6.55.3.1.3 (ATC) Transportation Association of Canada:

- *Guide to the Design of Road Lighting Systems*.

6.55.3.1.4 (IESNA) Illuminating Engineering Society of North America:

- ANSI/IESNA RP-8-00 (R2005) *Roadway Lighting*;
- IES HB-10 *The IES Lighting Handbook*, 10th Edition;
- ANSI/IESNA RP-22 *Tunnel Lighting*;
- ANSI/IESNA RP-33 *Lighting for Exterior Environments*;
- ANSI/IESNA LM-63 *Standard File Format for Electronic Transfer of Photometric Data*;
- ANSI/IESNA LM-50 *Photometric Measurement of Roadway and Street Lighting Installations*;
- ANSI/IESNA TM-15 *Luminaire Classification System for Outdoor Luminaires + Addendum A*;
- ANSI/IESNA LM-79 – *Approved Method: Electrical and Photometric Measurements of Solid-State Lighting Products*;
- ANSI/IESNA LM-80 – *Approved Method: Measuring Lumen Maintenance of LED Light Sources*.

6.55.3.1.5 (MTQ) Ministère des Transports du Québec:

- MTQ – *Cahier des charges et devis généraux (CCDG)*;
- MTQ – *Normes – Ouvrages routiers – Tome III Ouvrages d’art, Chapitre 2 Conception des ouvrages d’art*;
- MTQ – *Normes – Ouvrages routiers – Tome III Ouvrages d’art, Chapitre 6 Structure de signalisation, d’éclairage et de signaux lumineux*.
- MTQ – *Normes – Ouvrages routiers Tome IV Abords de route, Chapitre 4 Éclairage routier*;
- MTQ - *Normes - Ouvrages routiers Tome VII Matériaux, Chapitre 8 Matériaux électriques*;
- List of approved products – *Profiled Luminaires for Roadway Lighting HOM 6210-301*;
- PSEL – *Vibration and Shock Testing – Profiled Luminaires and Surface-Mounted Luminaires*;
- PSEL –*Vibration and Shock Testing – Round Luminaires*;
- PSEL – *Testing on Aluminum Housing Paint*.

6.55.3.1.6 (NEMA) National Electrical Manufacturers Association:

- NEMA C82.4:2002 *Ballasts for High-Intensity-Discharge and Low-Pressure Sodium Lamps (Multiple-Supply Type)*;
- NEMA C136.15-1997 *Roadway and Area Lighting Equipment - Luminaires Field Identification*.

6.55.3.1.7 (UL) Underwriters Laboratories Inc.:

- UL496 *Lampholders*.

6.55.4 MATERIALS

6.55.4.1 GENERAL

6.55.4.1.1 All devices, materials and equipment for the lighting system shall be CSA approved.

6.55.4.2 LIGHT FIXTURES

6.55.4.2.1 The light fixtures shall comply with standards CAN/CSA C22.2 N° 0, CAN/CSA C22.2 N° 9.0 and CAN/CSA C22.10 and indications of the plans.

6.55.4.2.2 The light fixture housing shall be made of aluminum, either formed using an appropriate matrix, or bended and welded over the entire length of all edges. It shall be designed to withstand wind, ice and live overloads, both in handling and in installation, in accordance with standard CAN/CSA S6.

- 6.55.4.2.3 The light fixture door shall be equipped with a locking device that does not allow opening by means other than human intervention.
- 6.55.4.2.4 The light fixture optical system shall consist of an aluminum reflector with a specular finish having a reflection coefficient of 80 % and of a 3 mm thick heat-resistant borosilicate lens. The lens shall be smooth and flat.
- 6.55.4.2.5 All assembly joints of the light fixture components shall be fitted with seals that ensure the tightness of the optical compartment with respect to dust and water according to classification IP-66 of standard CAN/CSA E598-2-1.
- 6.55.4.2.6 The light fixtures shall allow butt-jointing and adjustment to a pole, a bracket or a tenon using a coupler with galvanized integrated clamps fixed to the housing.
- 6.55.4.2.7 The light fixtures to be installed on a lamp post shall be equipped with a plate or other suitable device allowing lateral and longitudinal adjustment in order to optimize the photometric performance.
- 6.55.4.2.8 The efficiency of the optical system shall be greater than 65 %, calculated by the ratio between the nominal luminous flux generated by the lamp and the luminous flux distributed by the light fixture.
- 6.55.4.2.9 All photometric distributions made by the light fixture shall be scrolled and compliant with standards ANSI/IESNA RP-8 and IES HB-10.
- 6.55.4.2.10 The ballasts shall meet the requirements of standard NEMA C82.4, according to the type of lamps indicated on the plans. In addition, the ballasts shall have the following features:
- 6.55.4.2.10.1 be designed to turn-on the lamp and operate at a temperature of -30°C at 90 % of the nominal voltage;
- 6.55.4.2.10.2 have an input voltage range of ± 10 % of the nominal voltage;
- 6.55.4.2.10.3 have a minimum power factor of 95 % and be of Type CWA or CWI;
- 6.55.4.2.10.4 be mounted on a ballast plate fixed to the housing by a hinge and a fastening element that make it possible to hook the ballast without tools;
- 6.55.4.2.10.5 be designed so that it can be disassembled without having to remove the device from its bracket.
- 6.55.4.2.11 The lamp socket shall be fitted with an anti-vibration notch and shall consist of a vitreous porcelain receptacle, a coupler and a spring-loaded contact made of a corrosion-resistant copper-plated alloy or a stainless steel contact.
- 6.55.4.2.12 The socket shall be insulated for a minimum pulse rated temperature of 5 kV according to standard UL496.

6.55.4.2.13 The initial position of the socket shall be factory set, but it shall be adjustable on site.

6.55.4.2.14 All mounting accessories, such as bolts, nuts, springs, latches, hinges, screws, rivets, hooks, safety straps and cables, shall be made of Type 316 stainless steel.

6.55.4.3 LAMPS

6.55.4.3.1 The lamps shall comply with standards CAN/CSA C22.2 N° 0, CAN/CSA C22.2 N° 74 and CAN/CSA C22.10 and indications on the plans.

6.55.4.4 POLES, BRACKETS, TENONS AND MOBILE CROWNS

6.55.4.4.1 The poles, brackets and tenons, and mobile crowns required on the structure's deck shall be of circular section, made of galvanized steel and comply with standard ASTM A123/A123M.

6.55.4.4.2 The poles, brackets and tenons, and mobile crowns required on the outside of the structure deck shall be of circular section, made of galvanized steel and comply with standard ASTM A123/A123M, or made of aluminum as indicated on the plans.

6.55.4.4.3 The brackets and tenons shall be the same type of material and finish as the poles on which they are mounted.

6.55.4.4.4 In the case of an assembly of metal parts to be galvanized, the Contractor is responsible for determining whether the nature of the components and the configuration of that assembly may be problematic in terms of the required coating density and thicknesses and for applying, where applicable, the recommendations on surface preparation according to paragraph B6 of Appendix B of standard ASTM A123/A123M.

6.55.4.4.5 Galvanized surfaces damaged during shipment or installation shall be repaired to the satisfaction of the Engineer using one of the following cold galvanization products or equivalent authorized by the Engineer:

6.55.4.4.5.1 *Sealtight Galvafruid Zinc-Rich Coating*, distributed by *W.R. Meadows of Canada Limited*;

6.55.4.4.5.2 *Z.R.C.*, manufactured by *Sealube* in Quincy, Massachusetts and distributed by *Torfasco Limited*;

6.55.4.4.5.3 *LPS-Instant Cold Galvanize*, distributed in Canada by *Furnace Engineering Company*;

6.55.4.4.5.4 *Galvanox*, manufactured by Carboline.

6.55.4.4.6 The mobile crowns shall be made of galvanized steel.

6.55.4.4.7 The lift power unit for the high masts shall consist of a motor, a transformer and a control handle.

6.55.4.4.8 The lift power unit shall come from the same manufacturer as that of the high masts installed under this Contract.

6.55.4.4.9 The Contractor shall supply an additional lift power unit for all high mast structures and deliver it to the Owner.

6.55.4.5 FUSE HOLDERS AND FUSES

6.55.4.5.1 The fuses shall be HRC I-J, designed for a 15 A current with an interrupting capacity of 100,000 A and compliant with standard CAN/CSA C22.2 N° 106.

6.55.4.5.2 All fuses for this Contract shall be supplied by the same manufacturer.

6.55.4.5.3 The fuse-holders shall be appropriate for the class of fuses indicated in paragraph 6.55.3.5.1 and the fuse-holders must comply with the requirements of standard CAN/CSA C22.2 N° 39.

6.55.4.5.4 No adaptor shall be used with the fuse-holders.

6.55.4.6 IDENTIFICATION PLATES

6.55.4.6.1 The pole identification plates shall be made of 3003-H14 aluminum alloy with a thickness of 0.8 mm.

6.55.4.6.2 The plate surface shall be chromate-treated before being coated with black Duracron Series 630 thermosetting enamel having a sheen of 15 %.

6.55.4.6.3 Unless otherwise indicated on the plans, the identification plate on the poles shall contain the following information:

6.55.4.6.3.1 the name of the structure, such as "JC" for the Jacques Cartier Bridge, "CH" for the Champlain Bridge, "AB" for the Bonaventure Expressway, "HM" for the Honoré Mercier Bridge, "ES" for the Champlain Bridge Ice Control Structure and "TM" for the Melocheville Tunnel, immediately followed by the structure section number, the circuit number and the lamp post identification number (e.g. 01-02-06);

6.55.4.6.3.2 the voltage, the power and the number of luminaires on the same phase shall appear in the lower portion of the identification plate.

6.55.5 DESIGN

6.55.5.1 TEMPORARY LIGHTING

6.55.5.1.1 The Contractor shall provide the temporary lighting for the entire duration of the work. The temporary lighting shall comply with the standards of the Transportation Association of Canada and have a level in lux identical to that of the existing lighting. The classifications to be complied with for the different roads are indicated on the plans.

6.55.5.1.2 Given the new lamp post delivery lead time, the Contractor may temporarily reuse the existing lamp posts by temporarily installing them on the new concrete bases. If the bolt circle does not match, the Contractor shall use transition bases. The Contractor shall, however, bear the costs of all work related to the relocation of the equipment, of power supply, connection, modifications, as well as all incidental expenses, to make the system complete and functional.

6.55.5.1.3 In order to establish the lighting requirements and determine the scope of work that it will have to perform according to the sequences of traffic maintenance, the Contractor shall consult all traffic maintenance plans.

6.55.5.1.4 Before installing the temporary lighting system(s), the Contractor shall provide, to the Engineer for review, the photometric calculations, in AGI 32 format, showing that the conditions on the plans are met. The criteria listed below, without however being limited thereto, shall also be met:

6.55.5.1.4.1 lamp Lumen Depreciation (LLD) factor: 0.90;

6.55.5.1.4.2 ballast Factor (BF): 0.95;

6.55.5.1.4.3 luminaire Dirt Depreciation (LDD) factor: 0.51;

6.55.5.1.4.4 combined lighting depreciation factor: 0.44;

6.55.5.1.4.5 standard reflectances for the interior surfaces of the tunnels, namely 0.40 for the walls and ceiling, and 0.25 for the pavement.

6.55.5.2 PERMANENT LIGHTING

6.55.5.2.1 Except for wall lighting, the Contractor is responsible for designing the structure that supports the light fixture, in accordance with the indications on the plans.

6.55.5.2.2 The lighting structures consisting of poles, brackets or mobile crowns, where applicable, shall be designed to withstand dead loads and wind, ice and live overloads, both in handling and in installation, in accordance with standard CAN/CSA S6.

6.55.5.2.2.1 The design of the welded assemblies of the aluminum structures shall comply with standard CAN/CSA W59.2.

6.55.5.2.2.2 The steel structures shall be designed in accordance with standard CAN/CSA S136.

6.55.5.2.2.2.1 At least fourteen (14) days before any lighting structures are ordered and fabricated, the Contractor shall submit, to the Engineer for review, a detailed shop drawing of the new lighting structures, including the dimensions and design notes, bearing the seal and signature of an engineer member of the *Ordre des ingénieurs du Québec (OIQ)*.

6.55.6 EXECUTION OF WORK

6.55.6.1 GENERAL

6.55.6.1.1 The lamp posts, high masts and wall light fixtures shall be installed according to the indications on the plans and in accordance with the manufacturers' recommendations.

6.55.6.2 PLANNING

6.55.6.2.1 At least fourteen (14) days before the installation of the light fixtures begins, the Contractor shall submit to the Engineer, for review and comment, the technical data sheets for the lamps, ballasts and light fixtures, which shall be accompanied by the photometric data.

6.55.6.2.2 The photometric data shall be established by an independent testing laboratory member of the *Association des firmes de génie-conseil - Québec (AFG)* and shall comprise the total power consumed (W), light intensity (cd), spectral distribution, luminous flux (lm), standard performance of the luminaire, utilization factor, type of lamp and name of the manufacturer thereof.

6.55.6.2.3 The technical data sheets for the ballasts shall include the ballast factor and the total harmonic distortion rate.

6.55.6.3 MAINTENANCE OF THE EXISTING LIGHTING

6.55.6.3.1 Except where temporary lighting is required, the Contractor shall ensure that all existing roadway lighting systems are maintained in operation until the new lighting system is functional. A site visit shall take place with the Engineer, the Contractor's qualified person in electricity and the Superintendent before the work begins. The condition of the system at the time of that visit will serve as reference to the Contractor for the maintenance of lighting.

6.55.6.3.2 When lighting circuits have to be cut-off in order to complete work of other disciplines, such as excavations for the removal and installation of new concrete foundation bases for overhead signage structures or any excavation work near the existing electrical conduit, the Contractor shall ensure the continuity of the lighting circuits while freeing the space needed for the work.

6.55.6.4 TEMPORARY LIGHTING

6.55.6.4.1 The Contractor shall ensure, before the removal of the existing systems, that the required temporary lighting is provided.

6.55.6.4.2 After the installation of the temporary lighting system, the lighting levels obtained on the worksite shall be checked every week in the presence of the Engineer. At every check, a report containing the readings taken shall be submitted to the Engineer.

6.55.6.5 PERMANENT LIGHTING

6.55.6.5.1 The Contractor shall supply and install all lamp posts, concrete bases, wooden posts, brackets, light fixtures, control devices, conduit and wiring necessary for the supply and installation of a complete and functional lighting system.

6.55.6.6 INSTALLATION OF THE LIGHTING STRUCTURES CONSISTING OF POLES, BRACKETS, TENONS AND MOBILE CROWNS

6.55.6.6.1 The Contractor shall handle the lighting structure modules and segments using the lifting points specified by the manufacturer.

6.55.6.6.2 The Contractor shall supply and install conductors for the power supply and grounding inside the poles and, where applicable, inside the brackets and tenons, in accordance with the requirements described in subsection 6.52 *Electrical Cables*. The type of conductor shall be as indicated on the plans. The conductors inside the high masts shall be supplied and pre-assembled by the manufacturer.

6.55.6.6.3 The poles shall be installed level using a spirit level or a plumb bob.

6.55.6.6.4 The access door on the poles shall be oriented so that it opens on the traffic lane side and so that the electrician is facing the direction of traffic.

6.55.6.6.5 The use of electrical or percussion tools to tighten bolts is prohibited.

6.55.6.6.6 The Contractor shall use a properly calibrated torque wrench to tighten the bolts. For the high masts, the Contractor shall follow the following tightening sequence:

6.55.6.6.6.1 installation of the leveling nuts at the required height;

6.55.6.6.6.2 installation of a temporary plate, used to level the nuts;

6.55.6.6.6.3 removal of the temporary plate and installation of the tower;

6.55.6.6.6.4 installation and tightening of the upper nuts, following the sequence;

6.55.6.6.6.5 firm tightening of the leveling nuts;

- 6.55.6.6.6.6 marking of a ridge of all upper nuts as well as the underside of the footing prior to proceeding with the final tightening by the “Turn of the Nut” method;
- 6.55.6.6.6.7 for the final tightening, a 1/6 turn of the nut, or 60° with a tolerance of -0°/+20° shall be done. To do so, the tightening shall be carried out, by the Contractor, in two (2) stages, following the sequence shown on the plans, and the operation shall be repeated a second time;
- 6.55.6.6.6.8 installation of lock-nuts by firm tightening.
- 6.55.6.6.7 The nuts shall be new and hot galvanized.
- 6.55.6.6.8 Firm tightening is equivalent to one-hand tightening.
- 6.55.6.6.9 Manual tightening requires an open key for upper nuts, a pipe of a minimum length of 2 m allowing for the passages of the keys, a long socket and a pawl. The final tightening may be done with a hydraulic wrench or any other suitable equipment, provided that marking is performed in advance and provided that the specified turn of the nut fraction is respected.
- 6.55.6.6.10 The distance between the top of the block and the underside of the anchor footing shall not exceed 50 mm.
- 6.55.6.6.11 The Contractor shall supply and install nut covers after the poles are installed.
- 6.55.6.6.12 The wiring inside the poles shall be connected to the electrical power distribution system using fuse-holders and fuses, accessible through the access door.
- 6.55.6.6.13 When a lamp post is installed on an existing base, the Contractor shall coordinate the bolt circles of the new structure with that of the existing block.
- 6.55.6.6.14 An identification plate shall be installed in such a manner that the information appearing thereon is on the traffic lane side and visible from the lane adjacent to the pole. Furthermore, this plate shall be fixed to the pole with stainless steel rivets or screws.
- 6.55.6.7 REMOVAL OF THE EXISTING LIGHTING SYSTEMS
- 6.55.6.7.1 The Contractor shall remove and dispose of the lamp posts, foundation blocks or concrete bases, conduit and conductors, manholes, duct banks, junction boxes, pull boxes, supports and accessories located in the work zone.
- 6.55.6.7.2 The Contractor shall load, transport and unload all lamp posts, namely the poles, brackets and luminaires, at the Owner’s Jacques Cartier Service Centre. The lamp posts shall be dismantled into a pole, a bracket and a light fixture. The Contractor shall dispose of all other demolition materials that the Owner does not want. The Contractor shall notify the Engineer one week before the delivery of the equipment.

6.55.6.8 INSTALLATION OF THE LIGHT FIXTURES AND LAMPS

- 6.55.6.8.1 The Contractor shall connect the light fixtures to the power supply and mount them on the supports, as indicated on the plans.
- 6.55.6.8.2 The Contractor shall adjust the light fixtures on the supports so that they are level and horizontal.
- 6.55.6.8.3 The Contractor shall install the lamps and check the adjustment of the sockets on the basis of the photometric distribution recommended by the manufacturer of the light fixtures.
- 6.55.6.8.4 The light fixtures under this Contract shall not undergo final commissioning before the issuance of the Interim Certificate of Completion.

6.55.6.9 REPLACEMENT LAMPS

- 6.55.6.9.1 The Contractor shall provide the Owner with a set of replacement lamps in a number equivalent to 5 % of the lamps supplied and, to a minimum, one lamp for each type of luminaire supplied and installed.
- 6.55.6.9.2 The replacement lamps shall be supplied in their original container. The containers shall be identified by type, intensity and voltage of the lamps as well as by the name of the structure and the section number (e.g. "JC4").
- 6.55.6.9.3 A list of the replacement lamps supplied shall be submitted to the Engineer before the issuance of the Interim Certificate of Completion.

6.55.7 QUALITY CONTROL

6.55.7.1 GENERAL

- 6.55.7.1.1 The Contractor shall ensure that the qualified personnel are present and that the measuring and testing devices are available to conduct the tests required under this Contract.
- 6.55.7.1.2 The Contractor shall notify the Engineer in writing, at least fourteen (14) days prior to the installation, so that the latter may inspect the structures and lighting equipment, prior to authorizing their installation. The Contractor shall not, under any circumstances, bypass this inspection before the installation.
- 6.55.7.1.3 Following this inspection, the Engineer will inform the Contractor of any unacceptable conditions detected and will ask the Contractor to carry out the repairs, to his satisfaction, prior to the installation. Once the defects have been corrected, the Contractor may proceed with the installation.
- 6.55.7.1.4 The Contractor shall notify the Engineer in writing at least fourteen (14) days before the conducting the required tests, if any.

6.55.7.1.5 No tests shall be conducted without the authorization of the Engineer. Any flaws or defects that come to light during testing shall be rectified by the Contractor to the complete satisfaction of the Engineer.

6.55.7.2 PHOTOMETRIC TESTING AND MEASUREMENT

6.55.7.2.1 The Contractor shall conduct commissioning tests after the connection of the light fixtures in order to check whether the lamps and photocell work.

6.55.7.2.2 Before the issuance of the Interim Certificate of Completion, the Contractor shall conduct lighting tests during the evening and at night in order to demonstrate to the Engineer that the light fixtures are adjusted properly and that the photometric measurements comply with the recommendations of the manufacturer of the light fixtures. To that end, photometric measurements shall be taken at each light fixture and the results shall be submitted to the Engineer in writing.

6.55.7.2.3 If the measurements and tests do not meet the requirements of this Contract or the manufacturer's recommendations, the Contractor shall make the necessary corrections at its expense and to the satisfaction of the Engineer.

END OF SUBSECTION