

SPECIFICATIONS

For

Landscape Project/ Lighting and Accessibility

At

**FORT GEORGE
NIAGARA**

NATIONAL HISTORIC SITES

Niagara-on-the-Lake, Ontario

**FORT GEORGE
NIAGARA NATIONAL HISTORIC SITES**

Landscape Project/ Lighting and Accessibility

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General Specifications

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Drawings

Ainley Consulting Engineers	Drawing 13576-1 Figure 1 and 2
Kavski Engineering	Drawing L1, E1, E2, E3 and E4

Division 00 - General Requirements

1.1

Description:

.1 Generally the work required will include the necessary labour, materials, tools equipment, transportation and supervision to supply and install lighting fixture as per Lighting Design by Fliasher Ridout Partnership Inc. drawing L1, E1-4 and specifications excluding Bus Parking Lot Lighting that will be tendered at a later date. The work will also include the installation of underground wiring, controls and wiring to existing electrical infrastructure. The work will also include preparation and application of double chip seal asphalt to paths and roadways as per Ainley drawing 13576-1 and follow Ontario Provincial Standard for Double Chip Seal Application 303.

.2 The site is a National Historic Site recognized by Canada and must be treated as such. Excavation beyond the immediate work area as outlined in the supplied drawings is strictly prohibited. Every precaution will be taken to minimize disturbance or damage to the area surrounding or adjacent to the defined job site.

.3 The work includes, but is not necessarily confined to the following:

- .1 Excavation and subsequent backfilling of soil as required to perform the work.
- .2 Supply and installation of new materials as described for path system as shown in the drawings.
- .3 Removal and disposal of material being replaced or modified and store and reinstall accepted material deemed for reuse.
- .4 Landscaping as required
- .5 Supply and install all electrical fixtures and supporting wiring and fasteners to complete the work as described in the drawings for the illumination of the path system and specified buildings.

.4 SITE LOCATION:

Address: Fort George, National Historic Site is located at 51 Queens Parade, in Niagara-on-the-Lake, Ontario

Site Manager: Walter Willms,
Technical Services Officer,

Niagara NHS

Telephone: 905-468-1871

Email: walter.willms@pc.qc.ca

.5 PROJECT MANAGER

Following contract award, all queries and correspondence should be directed to:

Walter Willms

Technical Services Officer, Niagara National Historic Sites
(905)468-1871 or (289)241-1016

Email walter.willms@pc.qc.ca

.6 Pay all fees and obtain any necessary permits. Provide authorities with plans and specifications as required. Pay all taxes properly levied by law including Federal, Provincial and Municipal.

.7 The drawings and specifications are intended to describe the extent and kind of quality of materials and workmanship, which is required for this project and is not a definitive list of description of all components required for the work.

.8 Unless otherwise stated, obtain and install all necessary components to provide a complete job in all respects. Interpret words such as use, supply, provide. Install, erect, and the like, on that basis. Existing materials or work noted, as NIC is "Not in Contract" and is not to be included.

.9 Contractor to maintain at the site one copy of the drawings and specifications and any other pertinent information as required for the project.

.10 Contractor is to perform all work using skilled tradesmen and ensure that all items are properly fitted and accurately sit in place, square, true and plumb. Carry out all work in a neat and accurate manner in keeping with accepted and recognized trade practices and principles.

.11 Ensure that any sub-contractor provides properly qualified workmen, materials and equipment and co-ordinate all sub-trade work accordingly. Remove any new work, which in the opinion of the Engineer, is of inferior quality and/or is not in compliance with the specifications. Replace such work with new to the Project Manager or Designates approval, at no additional cost to the Crown.

1.2 MATERIALS and STANDARDS:

- .1 All materials as specified or required for a complete job shall be new and of an acceptable standard of quality required for use in this project.
- .2 Materials and workmanship are to meet with the requirements of standards such as;
 - a) CSA, CGSB, ASTM,
 - b) National Building Code as applicable to the work being performed and the materials being supplied.
 - c) Standards and Guidelines for the Conservation of Historic Places in Canada.
<http://www.historicplaces.ca/en/pages/standards-normes>

1.3 CODES and REGULATIONS:

- .1 Adhere to all local, provincial and Federal regulations applicable to the work to be performed under this contract, including the Ontario Health and Safety Act and Regulations for Construction Projects. Ensure that all requirements relating to the safety of the work and protection of workers is strictly adhered to.

1.4 EXAMINATION OF SITE:

- .1 It will be the responsibility of the contractor to view the site prior to submittal of price / fees, to assess all factors related to the completion of this project. Carefully examine the entire site, to become familiar with the adjacent surroundings, existing site conditions and accessibility to the locations of work.
- .2 Check and verify all on-site dimensions that may affect the work or the installation of materials or equipment. Report any discrepancies and obtain direction from Project Manager or designate.

1.5 CONTRACTOR'S USE OF SITE

- .1 Contractor to co-ordinate and schedule all work with the Departmental Representative to minimize disruption to the normal visitor and staff activities at the site. The co-ordination and on-site supervision of all tradesmen will be the direct responsibility of the contractor.
- .2 Work hours may be limited to 7:30 a.m. – 5:00p.m. Monday to Friday. Any works scheduled outside these hours are to be approved by the Engineer or his representative prior to undertaking the work.

.3 Contractor to co-ordinate the delivery of all materials to the site and store materials in an area, which will not interfere with normal site operations.

.4 Parking for contractor's vehicles is available in the parking area located at the Byron Street garage building; exact parking options to be verified at the site with the site Manager.
Contractor to access the work area via the walkways and/or predetermined paths identified in the Fort. Other access routes to be approved and co-ordinated with Project Manager or Designate.

.5 Contractor to limit work activities within the immediate work area around the building and prevent any unnecessary damage to the existing building surfaces and ground area.

.6 Inform Departmental Representative or designate in advance of any deliveries, impending interruptions in service or use of utilities that may disrupt Site access, normal traffic flow or normal operation of the Site.

.7 Do not unreasonably encumber Site with materials and equipment.

.8 Contractor is to arrange his operations, site storage, temporary facilities and services during the work under this contract to allow Parks Canada Staff free access to the site and maintain the normal maintenance and operational requirements of the Site.

1.6 SETTING OUT WORK

.1 Contractor will provide grades, survey control points and set such stakes as necessary to define general location, alignment and elevations of work.

.2 Contractor to assume full responsibility for and execute complete layout of work to locations, lines and elevations indicated.

1.7 EXISTING SERVICES

.1 Where work involves breaking into or connecting to existing services carry out work at times directed by authorities having jurisdiction with minimum disturbance.

.2 Before commencing work, establish location and extent of service lines in area of work and notify Departmental Representative of findings.

.3 Submit schedule to and obtain approval from Departmental Representative for any shut-down or closure of active services or

facility. Adhere to approved schedule and provide notice to affected parties.

.4 Record location of new. Maintained, re-routed and abandoned service lines

1.8 DOCUMENTS REQUIRED

.1 Ensure applicable items, articles, notices and orders are posted in conspicuous location on site in accordance with Acts and Regulations of the Province of Ontario, and in consultation with Departmental Representative.

.1 Contractor's Safety Policy

.2 Constructor's Name

.3 Notice of project and a copy of Construction Documents- Drawings & Specifications

.4 Change orders, addenda and work schedules

.5 Name, trade, and employer of Health and Safety Representative or Joint Health and Safety Committee members.

.6 Ministry of Labour Orders and reports.

.7 Occupational Health and Safety Act and Regulations for Construction Projects for Province of Ontario

.8 Address and phone number of nearest Ministry of Labour Office.

.9 Material Safety Data Sheets.

.10 Written emergency Response Plan.

1.9 ACCEPTANCE

.1 Prior to the issuance of an Interim Certificate of Completion, in company with the Departmental Representative, make a check of all work. Correct all discrepancies before final inspection and acceptance.

.2 The Contractor's attention is drawn to the fact that at completion of project, in company with the Departmental Representative, make a check of all work and correct all discrepancies and defects, and that the final Certificate of Completion will not be issued until such time that the Contractor has fully completed and turned over all project documents, test results and any guarantee/warranty certificates as issued by the manufacturer.

1.10 SUBSTITUTIONS

.1 Use no substitutions without written approval. Substitutions may be permitted, after Tenders close, only if, in the Departmental Representative's opinion, there is good reason and if submitted in sufficient time to permit proper investigation and approval.

END OF SECTION

Section 01 35 26 – Environmental Protection

1.1 SUBMITTALS

- .1 Prior to commencing construction activities or delivery of materials to site submit Environmental Protection Plan for review and approval by Departmental Representative. Environmental Protection Plan shall present a comprehensive overview of known or potential environmental issues which must be addressed during construction.
- .2 Address topics at level of detail, commensurate with environmental issues and required construction tasks.
- .3 Environmental protection plan shall include:
 - .1 Names of persons responsible for ensuring adherence to Environmental Protection Plan.
 - .2 Names and qualification of persons responsible for manifesting hazardous waste to be removed from site.
 - .3 Names and qualifications of persons responsible for training site personnel.
 - .4 Description of environmental protection personnel training program.
 - .5 Erosion and sediment control plan which identifies type and location of erosion and sediment controls to be provided including monitoring and reporting requirements to assure that control measures are in compliance with erosion and sediment control plan, Federal, Provincial, and Municipal laws and regulations.
 - .6 Work area plan showing proposed activity in each portion of area and identifying areas of limited use or non-use. Include in plan measures for marking limits of use areas including methods for protection of features to be preserved within authorized work areas.
 - .7 Spill Control Plan: including procedures, instructions and reports to be used in event of unforeseen spill of regulated substances.
 - .8 Non-Hazardous solid waste disposal plan identifying methods and locations for solid waste disposal including clearing debris.
 - .9 Waste water management plan that identifies methods and procedures for management and /or discharge of waste waters which are directly derived from construction activities, such as concrete curing water, clean up water, dewatering of ground water.

1.2 OPERATION AND MAINTENANCE OF EQUIPMENT

.1 Equipment and machinery used shall meet or exceed all applicable emissions requirements.

.2 Provide drip trays to prevent the discharge of oil, grease, antifreeze, or any other material into the ground

.3 Leave machinery running only while in actual use, except where extreme temperatures prohibit shutting machinery down.

.4 Conduct all vehicle/equipment maintenance and refueling over impermeable/absorptive material situated at a designated site where all precautions have been made to prevent the discharge of oil, grease, antifreeze or any other materials into the ground. The contractor will be responsible for all costs of cleaning up any spills to the satisfaction of the Departmental Representative.

END SECTION

Division 31 Earthwork

Section 31 11 00 – CLEARING AND GRUBBING

.1 Protect all building surfaces, adjacent plant material, landscaping and entranceways from any damage that may result from the work activities. During removal operations, contractor to protect all existing surfaces and components from any damage. Ground area around building to be protected with tarps and/ or filter cloths or other acceptable methods as approved by the Engineer.

.2 Prior to final completion, should any existing surfaces or material be damaged in any way by the work of this contract, the contractor shall be responsible to repair, refinish and /or replace such finishes and materials to the Engineer's approval at no additional cost to the Crown.

END of SECTION

PART 1 – GENERAL

1.1 Submittals

- .1 Submit to Departmental Representative copies of the following documents, including updates:
 - .1 Site Specific Health and Safety Plan.
 - .2 Name and qualifications of person to be retained full time as H&S Co-ordinator.

1.2 Compliance Requirements

- .1 Comply with the Occupational Health and Safety Act for the Province of Newfoundland and Labrador, and the Occupational Health and Safety Act Regulations made pursuant to the Act.
- .2 Comply with Canada Labour Code Part II, and the Canada Occupational Safety and Health Regulations made under Part II of the Canada Labour Code.
- .3 Observe and enforce construction safety measures required by:
 - .1 National Building Code of Canada;
 - .2 Provincial Worker's Compensation Board;
 - .3 Municipal statutes and ordinances.
- .4 In event of conflict between any provisions of above authorities the most stringent provision will apply. Should a dispute arise in determining the most stringent requirement, Departmental Representative will advise on the course of action to be followed.
- .5 A copy of the Canada Labour Code Part II may be obtained by contacting:

Canadian Government Publishing
Public Works & Government Services Canada
Ottawa, Ontario, K1A 0S9
Tel: (819) 956-4800 (1-800-635-7943)
Publication No. L31-85/2000 E or F)

- .6 Maintain Workers Compensation Coverage for duration of Contract. Submit Letter of Good Standing to Departmental Representative upon request.

1.3 Responsibility

- .1 Be responsible for health and safety of persons on site, of property and for protection of persons and public circulating adjacent to work operations to extent that they may be affected by conduct of the Work.
- .2 Enforce compliance by all workers, sub-contractors and other persons granted access to work site with safety requirements of Contract Documents, applicable Federal, Provincial, and local statutes, regulations, and ordinances, and with site-specific Health and Safety Plan.

1.4 Site Control
and Access

- .1 Control work site and entry points to construction areas.
 - .1 Delineate and isolate construction areas from other areas of site Facility by use of appropriate means.
 - .2 Post notices and signage at entry points and at other strategic locations identifying entrance onto site to be restricted to authorized persons only.
 - .3 Signage must be professionally made, bilingual in both official languages or display internationally understood graphic symbols.
- .2 Approve and grant access to site only to workers and authorized persons.
 - .1 Immediately stop non-authorized persons from circulating in construction areas and remove from site.
 - .2 Provide site safety orientation to all persons before granting access. Advise of site conditions, hazards and mandatory safety rules to be observed on site.
- .3 Secure site at night time to extent required to protect against unauthorized entry.
- .4 Ensure persons granted access to site wear appropriate personal protective equipment (PPE) suitable to work and site conditions.
 - .1 Provide such PPE to authorized persons who require access to perform inspections or other approved purposes.

1.5 Protection

- .1 Carry out work placing emphasis on health and safety of the Public, Facility personnel, construction workers and protection of the environment.
- .2 Erect safety barricades, lights and signage on site to effectively delineate work areas, protect pedestrian and vehicular traffic around and adjacent to work and to create a safe working environment.
- .3 Should unforeseen or peculiar safety related hazard or condition become evident during performance of work, immediately take measures to rectify the situation and prevent damage or harm. Advise Departmental Representative verbally and in writing.

1.6 Filing Of
Notice

- .1 File Notice of Project and other Notices with Provincial authorities prior to commencement of Work.

1.7 Permits

- .1 Post on site permits, licenses, compliance certificates specified in section 01 10 10.

- .2 Where particular permit or compliance certificate cannot be obtained at the required stage of work, notify Departmental Representative in writing and obtain his/her approval to proceed before carrying out that portion of work.

1.8 Hazard Assessments

- .1 Conduct site specific health and safety hazard assessment before commencing project and during course of the work. Identify risks and hazards resulting from site conditions, weather conditions and work operations.
 - .1 Also, conduct assessment when the scope of work has been changed by Change Order and when potential hazard or weakness in current health and safety practices are identified by Departmental Representative or by an authorized safety Representative.
- .2 Record results in writing and address in Health and Safety Plan.
- .3 Keep copy of all assessments on site.

1.9 Project/Site Condition

- .1 The following are known or potential project related health, environmental and safety hazards at site which must be properly managed if encountered during course of work:
 - .1 Existing hazardous products are:
 - .1 work within and adjacent to roadway .
 - .2 work adjacent to streams and water
- .2 Above list shall not be construed as being complete and inclusive of potential health, and safety hazards encountered during work. Include above items into hazard assessment process.
- .3 Obtain from Departmental Representative, copy of MSDS Data sheets for existing hazardous products stored on site or used by Facility personnel.

1.10 Health And Safety Meetings

- .1 Attend pre-construction health and safety meeting conducted by Departmental Representative. Have following persons in attendance:
 - .1 Site Superintendent.
 - .2 Contractor's designated Health and Safety Site Supervisor.
 - .3 Health & Safety Site Coordinator.
 - .4 Departmental Representative will advise of date, time and location.

1.11 Health And Safety Plan

- .1 Develop written site-specific Project Health and Safety Plan, based on hazard assessments, prior to commencement of work.
 - .1 Submit copy to Departmental Representative within 5 calendar

days of acceptance of bid.

.2 Submit updates as work progresses.

.2 Health and Safety Plan shall contain three (3) parts with following information:

.1 Part 1 - Hazards: List of individual health risks and safety hazards identified by hazard assessment process.

.2 Part 2 - Safety Measures: engineering controls, personal protective equipment and safe work practices used to mitigate hazards and risks listed in Part 1 of Plan.

.3 Part 3a: Emergency Response: standard operating procedures, evacuation measures and emergency response in the occurrence of an accident, incident or emergency.

.1 Include response to all hazards listed in Part 1 of Plan.

.2 Evacuation measures to complement the Facility's existing Emergency Response and Evacuation Plan. Obtain pertinent information from Departmental Representative.

.3 List names and telephone numbers of officials to contact including:

.1 General Contractor and all Subcontractors.

.2 Federal and Provincial Departments as stipulated by laws and regulations and local emergency resource organizations, as needed based on nature of emergency or accident.

.3 Officials from PWGSC and site Facility management. Departmental Representative will provide list.

.3 Part 3b - Site Communications:

.1 Procedures used on site to share work related safety issues between workers, subcontractors, and General Contractor.

.2 List of critical tasks and work activities, to be communicated with the Facility Manager, which has risk of affecting tenant operations, or endangering health and safety of Facility personnel and the general public. Develop list in consultation with the Departmental Representative.

.4 Prepare Health and Safety Plan in a three column format, addressing the three parts specified above, as follows:

Column 1	Column 2	Column 3
Part 1 Identified Hazards	Part 2 Safety Measures	Part 3a/3b Emergency Response & Site Communications

.5 Develop Plan in collaboration with subcontractors. Address work activities of all trades. Revise and update Plan as Sub-contractors arrive on site.

.6 Implement and enforce compliance with requirements of Plan for full duration of work to final completion and demobilization from site.

- .7 As work progresses, review and update Plan. Address additional health risks and safety hazards identified by on-going hazard assessments.
- .8 Post copy of Plan, and updates, on site.
- .9 Submission of the Health and Safety Plan, and updates, to the Departmental Representative is for review and information purposes only. Departmental Representative's receipt, review and any comments made of the Plan shall not be construed to imply approval in part or in whole of such Plan by Departmental Representative and shall not be interpreted as a warranty of being complete and accurate or as a confirmation that all health and safety requirements of the Work have been addressed and that it is legislative compliant. Furthermore, Departmental Representative's review of the Plan shall not relieve the Contractor of any of his legal obligations for Occupational Health and Safety provisions specified as part of the Work and those required by provincial legislation.

1.12 Safety
Supervision and
Inspections

- .1 Designate one person to be present on site at all times, responsible for supervising health and safety of the Work.
 - .1 Person to be competent in Occupational Health and Construction Safety as defined in the Provincial Occupational Health and Safety Act.
- .2 Assign responsibility, obligation and authority to such designated person to stop work as deemed necessary for reasons of health and safety.
- .3 Conduct regularly scheduled informal safety inspections of work site on a minimum bi-weekly basis.
 - .1 Note deficiencies and remedial action taken in a log book or diary.
- .4 Keep inspection reports on site.

1.13 Training

- .1 Ensure that all workers and other persons granted access to site are competently trained and knowledgeable on:
 - .1 Safe use of tools and equipment.
 - .2 How to wear and use personal protective equipment (PPE).
 - .3 Safe work practices and procedures to be followed in carrying out work.
 - .4 Site conditions and minimum safety rules to be observed on site, as given at site orientation session.

1.14 Minimum Site
Safety Rules

- .1 Notwithstanding the requirement to abide by federal and provincial health and safety regulations, the following safety rules shall be considered minimum requirements to be obeyed by all persons granted site access:
 - .1 Wear personnel protective equipment (PPE) appropriate to function and task on site; the minimum requirements being hard hat, safety footwear and eye protection.
 - .2 Immediately report unsafe activity or condition at site, near-miss accident, injury and damage.
 - .3 Maintain site in tidy condition.
 - .4 Obey warning signs and safety tags.
- .2 Brief workers on site safety rules and on disciplinary measures to be taken by Departmental Representative for violation or non compliance of such rules. Post rules on site.
- .3 The following actions or conduct by Contractor, workers and subcontractors will be considered as non conformance with the health and safety requirements of the contract for which a Non-Compliance Notification will be issued to the General Contractor by the Departmental Representative:
 - .1 Failure to follow the minimum site safety rules specified above.
 - .2 Negligence resulting in serious injury or major property damage.
 - .3 Deliberate non-compliance with Federal and Provincial Acts and Regulations.

- .4 Falsification of information in Workers Compensation Reports, safety reports and other health and safety related documents submitted to Departmental Representative or to Authority having jurisdiction.
- .5 Possession of firearms on site.
- .6 Possession of non-prescriptive illegal drugs or alcohol.
- .7 Action, or lack thereof, resulting in the issuance of Warnings, Fines or Stop Work Orders from a Provincial Authority having jurisdiction.
- .8 Violation of other specified health and safety rules and requirements as determined by Departmental Representative.

- .4 See elsewhere in this section for details on Non-Compliance Notifications and resulting disciplinary measures.

1.15 Accident Reporting

- .1 Investigate and report the following incidents and accidents:
 - .1 Those as required by Provincial Occupational Health and Safety Act and Regulations.
 - .2 Injury requiring medical aid as defined in the Canadian Dictionary of Safety Terms-1987, published by the Canadian Society of Safety Engineers (C.S.S.E)as follows:
 - .1 Medical Aid Injury: any minor injury for which medical treatment was provided and the cost of which is covered by Workers' Compensation Board of the province in which the injury was incurred.
 - .2 Property damage in excess of \$5000.00,
 - .3 Interruption to Facility operations with potential loss to a Federal Dept. in excess of \$5000.00,
 - .4 Those which require notification to Workers Compensation Board or other regulatory agencies as stipulated by applicable law or regulations.

- .2 Send written report to Departmental Representative for all above cases.

1.16 Tools and Equipment Safety

- .1 Routinely check and maintain tools, equipment and machinery for safe operation.
- .2 Conduct checks as part of site safety inspections. When requested, submit proof that checks and maintenance have been carried out.
- .3 Tag and immediately remove from site items found faulty or defective.

1.17 Hazardous Products

- .1 Comply with requirements of Workplace Hazardous Materials Information System (WHMIS).
- .2 Keep MSDS data sheets for all products delivered to site. Post on site. Submit copy to Departmental Representative upon receipt.

1.18 Confined
Spaces

- .1 Carry out work in confined spaces in compliance with:
 - .1 Provincial Occupational Health and Safety Regulations and;
 - .2 Canada Occupational Safety and Health Regulations (COSH) made under the Canada Labour Code - Part II.
- .2 Conduct hazard assessment and address in Safety Plan before entering confined space.

1.19 Posting of
Documents

- .1 Post on site safety documentation as stipulated by Authorities having jurisdiction and as specified herein. Place in a common visible location.

1.20 Site Records

- .1 Maintain on site a copy of all health and safety documentation and reports specified to be produced as part of the work and received from authorities having jurisdiction.
- .2 Upon request, make available to Departmental Representative and to other authorized safety representative for review. Provide copy when directed by Departmental Representative.

1.21 Non Compliance
and Disciplinary
Measures

- .1 Immediately address and correct health and safety violations and non-compliance issues.
- .2 Negligence or failure to follow occupational health and safety provisions specified in the Contract Documents and of those of applicable federal and provincial laws and regulations could result in disciplinary measures taken by the Departmental Representative against the General Contractor.
- .3 PWGSC uses a system of Non-Compliance Notifications and Disciplinary Measures on projects as follows:
 - .1 A non-compliance notification will be issued to the General Contractor, by the Departmental Representative, whenever there is a violation or failure to follow any of the project's occupational health and safety requirements by a worker, subcontractor or any other person to whom the Contractor has granted access to the work site.
 - .2 Non-Compliance notifications are progressive in nature resulting in increased disciplinary measures imposed depending on the frequency, nature and severity of the infraction.
 - .3 Disciplinary measures could include:
 - .1 Removal of the offending person or party from site;

- .2 Financial penalties in the form of progress payment reduction or holdback assessments made against the Contract and;
- .3 Taking the Work Out of Contractor's Hands in accordance with the General Conditions.
- .4 Departmental Representative will make final decision as to what constitutes a violation and when to issue a Non-Compliance Notification.
- .5 Non-compliance Notifications issued by Departmental Representative shall not be construed as to overrule or disregard warnings, orders and fines levied against Contractor by a regulatory agency having jurisdiction.
- .6 Details of the Non-Compliance Notification and Disciplinary Measures system will be provided by Departmental Representative upon acceptance of bid and prior to commencement of work.
- .7 Further details on the disciplinary system will be provided at the pre-construction Health and Safety meeting.
- .8 Be responsible to fully brief workers and subcontractors on the operation and importance of this system.

PART 2 - PRODUCTS

2.1 NOT USED .1 Not Used.

PART 3 - EXECUTION

3.1 NOT USED .1 Not Used.

1 General

1.1 SECTION INCLUDES

- .1 Inspections and declarations.
- .2 Closeout submittals
- .3 Operation and maintenance manual format.
- .4 Contents each volume.
- .5 Recording actual site conditions.
- .6 Record (as-built) documents and samples.
- .7 Record documents.
- .8 Final survey.
- .9 Warranties and bonds.

1.2 INSPECTIONS AND DECLARATIONS

- .1 Document 100 - OAA/OGCA Take-Over Procedures shall form the basis of Closeout Procedures for this Project unless otherwise amended by Division 01 Sections.
- .2 Contractor's Inspection: Contractor and all Subcontractors shall conduct an inspection of Work, identify deficiencies and defects, and repair as required to conform to Contract Documents.
 - .1 Notify Departmental Representative in writing of satisfactory completion of Contractor's Inspection and that corrections have been made.
 - .2 Request Departmental Representative's Inspection.
 - .3 Departmental Representative's Inspection: Departmental Representative and Contractor will perform inspection of Work to identify defects or deficiencies. Correct defective and deficient Work accordingly.
 - .4 Completion: submit written certificate that following have been performed:
 - .1 Work has been completed and inspected for compliance with Contract Documents.
 - .2 Defects have been corrected and deficiencies have been completed.
 - .3 Equipment and systems have been tested, adjusted and are fully operational.
 - .4 Certificates required by authorities having jurisdiction have been submitted.
 - .5 Operation of systems have been demonstrated to Owner's personnel.
 - .6 Work is complete and ready for Final Inspection.
 - .5 Final Inspection: when items noted above are completed, request final inspection of Work by Owner, Departmental Representative and Contractor. If Work is deemed incomplete by Owner, complete outstanding items and request re-inspection.
 - .6 Declaration of Substantial Performance: when Owner consider deficiencies and defects have been corrected and it appears requirements of Contract have been substantially performed, make application for Substantial Performance of the Work.
 - .7 Commencement of Warranty Periods: the date of Substantial Performance of the Work shall be the date for commencement of the warranty period.
 - .8 Commencement of Lien Periods: the date of publication of the certificate of Substantial Performance of the Work shall be the date for commencement of the lien period, unless required otherwise by the lien legislation applicable at the Place of the Work.
 - .9 Final Payment: When Owner and Departmental Representative consider final deficiencies and defects have been

corrected and it appears requirements of Contract have been completed, make application for final payment.

.10 Payment of Hold-back: After issuance of certificate of Substantial Performance of the Work, submit an application for payment of holdback amount.

- 1.4 CLOSEOUT SUBMITTALS**
- .1 Prepare instructions and data using personnel experienced in maintenance and operation of described products.
 - .2 Copy will be returned after final inspection, with Departmental Representative's comments.
 - .3 Revise content of documents as required prior to final submittal.
 - .4 Two weeks prior to Substantial Performance of the Work, submit to the Departmental Representative, two final copies of operating and maintenance manuals in Canadian English.
 - .5 Ensure spare parts, maintenance materials and special tools provided are new, undamaged or defective, and of same quality and manufacture as products provided in Work.
 - .6 If requested, furnish evidence as to type, source and quality of products provided.
 - .7 Defective products will be rejected, regardless of previous inspections. Replace products at own expense.
 - .8 Pay costs of transportation.

**1.5 OPERATION AND
MAINTENANCE MANUAL
FORMAT**

- .1 Organize data in the form of an instructional manual.
- .2 Binders: vinyl, hard covered, 3 'D' ring, loose leaf 219 x 279 mm8.5 x 11 inch with spine and face pockets.
- .3 When multiple binders are used, correlate data into related consistent groupings. Identify contents of each binder on spine.
- .4 Cover: Identify each binder with type or printed title 'Project Record Documents'; list title of project and identify subject matter of contents.
- .5 Arrange content by systems, under Section numbers and sequence of Table of Contents.
- .6 Provide tabbed fly leaf for each separate product and system, with typed description of product and major component parts of equipment.
- .7 Text: Manufacturer's printed data, or typewritten data.
- .8 Drawings: provide with reinforced punched binder tab. Bind in with text; fold larger drawings to size of text pages.
- .9 Provide 1:1 scaled CAD files in *.dxf AutoCAD Release 2007 or newer format on CD-ROM.

**1.6 CONTENTS - EACH
VOLUME**

- .1 Table of Contents: provide title of project;
 - .1 date of submission;
 - .2 names, addresses, and telephone numbers of Departmental Representative and Contractor with name of responsible parties; and
 - .3 schedule of products and systems, indexed to content of volume.
- .2 For each product or system, list names, addresses and telephone numbers of subcontractors and suppliers, including local source of supplies and replacement parts.
- .3 Product Data: Mark each sheet to clearly identify specific products and component parts, and data applicable to installation; delete inapplicable information. Provide logical sequence of instructions for each procedure, incorporating manufacturer's instructions specified in Section 01 45 00.

1.7 RECORDING ACTUAL SITE CONDITIONS

- .4 Drawings: Supplement product data to illustrate relations of component parts of equipment and systems, to show control and flow diagrams.
- .5 Certificate of Acceptance: Relevant certificates issued by authorities having jurisdiction, including code compliance certificate.

- .1 Record information on 2 sets of black line opaque drawings, and within the Project Manual, provided by Departmental Representative.
- .2 Annotate with red, maintaining separate colours for each major system, for recording changed information.
- .3 Record information concurrently with construction progress. Do not conceal Work of the Project until required information is accurately recorded.
- .4 Maintain project record drawings and record accurately deviations from contract documents.
- .5 Contract drawings, specifications and shop drawings: legibly mark each item to record actual construction, including:
 - .1 Field changes of dimension and detail.
 - .2 Changes made by change orders.
 - .3 Details not on original Contract Drawings.
 - .4 References to related shop drawings and modifications.
 - .5 Manufacturer, trade name, and catalogue number of each product actually installed, particularly optional items and substitute items.
 - .6 Changes made by Addenda, change orders and site instructions.
- .6 Other Documents: maintain manufacturer's certifications, required by individual specifications sections.

1.8 RECORD (AS-BUILT) DOCUMENTS AND SAMPLES

- .1 In addition to requirements in General Conditions, maintain at the site for Departmental Representative one record copy of:
 - .1 Contract Drawings.
 - .2 Specifications.
 - .3 Addenda.
 - .4 Change Orders and other modifications to the Contract.
 - .5 Reviewed shop drawings, product data, and samples.
 - .6 Field test records.
 - .7 Inspection certificates.
 - .8 Manufacturer's certificates.
- .2 Store as-built documents and samples in field office apart from documents used for construction. Provide files, racks, and secure storage.
- .3 Label as-built documents and file in accordance with section number listings in List of Contents of the Project Manual. Label each document "AS-BUILT DOCUMENTS" in neat, large, printed letters.
- .4 Maintain as-built documents in clean, dry and legible condition. Do not use as-built documents for construction purposes.
- .5 Keep as-built documents and samples available for inspection by Departmental Representative.

1.9 RECORD DOCUMENTS

.1 Prior to Substantial Performance of the Work, electronically transfer the marked up information from the as-built documents to a master set of drawing and specification files provided by the Departmental Representative, as follows:

.1 Drawings: AutoCAD 2007 or later.

.2 Specifications: Adobe Acrobat.

.2 Mark revised documents as "RECORD DOCUMENTS". Include all revisions, with special emphasis on mechanical.

.3 Employ a competent computer drafts person to indicate changes on the electronic set of record drawings. Provide updated record drawings in Adobe Acrobat.

.4 Employ a competent specification writer to indicate changes to the electronic set of record specifications. Provide updated record specifications in Adobe Acrobat on CD-ROM.

.5 Submit completed record documents to Owner on a CD-ROM, accompanied by three (3) hard copy sets.

1.10 FINAL SURVEY

.1 Submit final site survey certificate certifying that elevations and locations of completed Work are in conformance, or non-conformance with Contract Documents.

.2 Inaccurate or neglectful information shall become a liability of the Contractor.

1.11 WARRANTIES AND BONDS

.1 Separate each warranty or bond with index tab sheets keyed to Table of Contents listing.

.2 List subcontractor, supplier, and manufacturer, with name, address, and telephone number of responsible principal.

.3 Obtain warranties and bonds, executed in duplicate by subcontractors, suppliers, and manufacturers, within ten (10) days after completion of the applicable item of work.

.4 Except for items put into use with Owner's permission, leave date of beginning of time of warranty until the Date of Substantial Performance is determined.

.5 Verify that documents are in proper form, contain full information, and are notarized.

.6 Co-execute submittals when required.

.7 Retain warranties and bonds until time specified for submittals.

End of Section

1 General

1.1 SECTION INCLUDES

- .2 Waste management plan.
- .3 Third party responsibilities.
- .4 Storage, Handling and Protection
- .5 Waste management plan implementation.
- .6 Disposal of waste.

1.2 WASTE MANAGEMENT PLAN

- .1 Draft Waste Management Plan: Within twenty (20) days after receipt of Notice of Award of Bid, or prior to any waste removal, whichever occurs sooner.
- .2 Contractor to submit a Draft Waste Management Plan to the Department Representative for review, refer to sample attached to the end of this Section.
- .3 Draft Plan shall contain the following:
 - .1 Analysis of the proposed site waste generated, including types and quantities.
 - .2 Landfill Options: The name of the landfill where trash will be disposed, the applicable landfill fees, and the projected cost of disposing of Project waste in the landfill.
 - .3 Alternatives to Landfill: A list of each material proposed to be salvaged, reused, or recycled during the course of the Project, the proposed local market for each material, and the estimated net cost savings or additional costs resulting from separating and recycling versus landfill each material; "Net" means that the following have been subtracted from the cost of separating and recycling:
 - .1 Revenue from the sale of recycled or salvaged materials, and
 - .2 Landfill tipping fees saved due to diversion of materials from the landfill. The list of these materials is to include, at minimum, the following materials:
 - .1 Cardboard.
 - .2 Clean dimensional wood.
 - .3 Beverage containers.
 - .4 Plastic buckets; waste can be reduced by using plastic lined cardboard dry packed materials instead of premixed moist packed materials where this option is available.
 - .5 Paint.
 - .7 Packaging, where recycling programs are available.
 - .8 Rigid plastic foam insulation, where recycling programs are available.
- .4 Resources for Development of Waste Management Plan: The following sources may be useful in developing the Draft Waste Management Plan:
 - .1 Recycling Haulers and Markets: Investigate local haulers and markets for recyclable materials, and incorporate into Waste Management Plan.
 - .2 Recycling Economics Information: Information available to bidders with regards to estimating the value of recyclable costs is included in Waste Reduction Information for Bidders.

.5 Final Waste Management Plan: Once the Owner has determined which of the recycling options addressed in the draft Waste Management Plan are acceptable, the Contractor shall submit, within ten (10) calendar days a Final Waste Management Plan, containing the following:

.1 Analysis of the proposed jobsite waste to be generated, including types and quantities.

.2 Landfill options: The name of the landfill where trash will be disposed of, the applicable landfill tipping fees, and the projected cost of disposing of all Project waste in the landfill.

.3 Alternatives to Landfill: A list of the waste materials from the Project that will be separated for reuse, salvage, or recycling.

.4 Meetings: A description of the regular meetings to be held to address waste management, refer to Section 013100.

.5 Materials Handling Procedures: A description of the means by which any waste materials identified in 1.5.3 above will be protected from contamination, and a description of the means to be employed in recycling the above materials consistent with requirements for acceptance by designated facilities.

.6 Transportation: A description of the means of transportation of the recyclable materials, whether materials will be site-separated and self-hauled to designated centres, or whether mixed materials will be collected by a waste hauler and removed from the site, and destination of materials.

.7 Where requirements are more stringent than the specified waste management plan the contractor shall conform to the following policy:

In addition all waste will be qualified by type of material and its weight. At a minimum the following products must be recycled: beverage containers, clean dimensional wood, corrugated cardboard, glass, metals and plastic.

After acceptance of their project proposal and before starting work, contractors must submit to the Departmental Representative a partially completed Waste Management Form. The form must include a list of expected waste materials and the recycling facilities to which contractors will take the waste. Contractors must also identify any waste materials that cannot be recycled or reused and must be disposed of in a landfill. If the contractors believe that they will not be able to recycle at a minimum to 50% of the project waste, they must receive written exception prior to beginning work.

1.3 THIRD PARTY RESPONSIBILITY

.1 Subcontractors shall cooperate fully with Contractor to implement the Waste Reduction Plan.

.2 Failure to cooperate may result in the Owner not achieving their environmental goal requirements and may result in penalties being assessed by the Contractor to the responsible Subcontractors.

1.4 STORAGE, HANDLING AND PROTECTION

.1 Store materials to be reused, recycled and salvaged in locations as directed by Consultant.

.2 Unless specified otherwise, materials for removal do not become Contractor's property.

.3 Protect, stockpile, store and catalogue salvaged items.

.4 Separate non-salvageable materials from salvaged items. Transport and

- deliver non-salvageable items to licensed disposal facility.
- .5 Protect structural components not removed for demolition from movement or damage.
- .6 Support affected structures. If safety of building is endangered, cease operations and immediately notify Consultant.
- .7 Protect surface drainage, storm sewers, sanitary sewers, and utility services from damage and blockage.

1.5 WASTE MANAGEMENT PLAN IMPLEMENTATION

- .1 Manager: Contractor to designate an on-site party (or parties) responsible for instructing workers and overseeing and documenting results of the Waste Management Plan for the Project.
 - .2 Distribution: Contractor to distribute copies of the Waste Management Plan to the Job Site Foreman, each Subcontractor and the Departmental Representative.
 - .3 Instruction: Contractor shall provide on-site instruction of appropriate separation, handling, and recycling, salvage, reuse, and return methods to be used by all parties at the appropriate stages of the Project.
 - .4 Separation facilities: Contractor shall lay out and label a specific area to facilitate separation of materials for potential recycling, salvage, reuse, and return. Recycling and waste bin areas are to be kept neat and clean and clearly marked in order to avoid contamination of materials.
 - .5 Hazardous wastes: Hazardous wastes shall be separated, stored, and disposed of according to local regulations.
 - .6 Application for Progress Payments: Contractor shall submit with each Application for Progress Payment a Summary of Waste Generated by the Project:
 - .1 Failure to submit this information shall render the Application for Payment incomplete and shall delay Progress Payment.
 - .2 The Summary shall be submitted on a form acceptable to the Owner and shall contain the following information:
 - .1 The amount in tonnes or cubic metres of material land filled from the Project,
 - .2 The identity of the landfill, the total amount of tipping fees paid at the landfill, and
 - .3 The total disposal cost. Include manifests, weight tickets, receipt, and invoices.
 - .3 For each material recycled, reused, or salvaged from the Project, the amount tonnes or cubic metres, the date removed from the job site, the receiving party, the transportation cost, the amount of any money paid or received for the recycled or salvaged material, and the net total cost or savings of salvage or recycling each material.
 - .4 Attach manifests, weight tickets, receipts, and invoices.
- .1 Burying of rubbish and waste materials is prohibited unless approved by authority having jurisdiction.
 - .2 Disposal of waste into waterways, storm, or sanitary sewers is prohibited.

1.6 DISPOSAL OF WASTE

End of Section

- | | | |
|---------------------------------------|----|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <u>1 General</u> | .1 | This Section covers items common to Sections of Division 16. This section supplements requirements of Division 1. |
| <u>2 Codes and Standards</u> | .1 | Do complete installation in accordance with CSA C22.1 except where specified otherwise. |
| | .2 | Do overhead and underground systems in accordance with CSA C22.3No.1-M1 except where specified otherwise. |
| | .3 | Abbreviations for electrical terms: to CSA Z85. |
| <u>3 Care, Operation and Start-up</u> | .1 | Instruct Consultant and operating personnel in the operation, care and maintenance of equipment. |
| | .2 | Arrange and pay for services of manufacturer's factory service engineer to supervise start-up of installation, check, adjust, balance and calibrate components. |
| | .3 | Provide these services for such period, and for as many visits as necessary to put equipment in operation, and ensure that operating personnel are conversant with all aspects of its care and operation. |
| <u>4 Voltage Ratings</u> | .1 | Operating voltages: to CAN3-C235. |
| <u>5 Permits, Fees and Inspection</u> | .1 | Submit to Electrical Safety Authority and Hydro Utility Company necessary number of drawings and specifications for examination and approval prior to commencement of work. |
| | .2 | Pay associated fees. |
| | .3 | Consultant will provide drawings and specifications required at no cost. |
| | .4 | Notify Consultant of changes required by Electrical Safety Authority prior to making changes. |
| | .5 | Furnish Certificates of Acceptance from Electrical Safety Authority on completion of work to Consultant. |

6 Materials and
Equipment

- .1 Equipment and material to be CSA certified. Where there is no alternative to supplying equipment which is not CSA certified, obtain special approval from Electrical Safety Authority.
- .2 Factory assemble control panels and component assemblies.

7 Wiring
Identification

- .1 Identify wiring with permanent indelible identifying markings, either numbered or coloured plastic tapes, on both ends of phase conductors of feeders and branch circuit wiring.
- .2 Maintain phase sequence and colour coding throughout.
- .3 Colour code: to CSA C22.1.
- .4 Use colour coded wires in communication cables, matched throughout system.

8 Wiring
Terminations

- .1 Lugs, terminals, screws used for termination of wiring to be suitable for either copper or aluminum conductors.

9 Manufacturers
and CSA Labels

- .1 Visible and legible after equipment is installed.

10 Warning Signs

- .1 As specified and to meet requirements of Electrical Safety Authority and Consultant.

11 Location of
Dimmers

- .1 Locate outlets in accordance with Ontario Electrical Safety Code
- .2 Do not install outlets back-to-back in wall; allow minimum 150 mm horizontal clearance between boxes.
- .3 Change location of outlets at no extra cost or credit, providing distance does not exceed 3000 mm, and information is given before installation.
- .4 Locate dimmers on latch side of doors. Locate disconnect devices in mechanical and elevator machine rooms on latch side of floor.

12 Load Balance

- .1 Measure phase current to panelboards with normal loads operating at time of acceptance. Adjust branch circuit connections as required to obtain best balance of current between phases and record changes.
- .2 Measure phase voltages at loads and adjust transformer taps to within 2% of rated voltage of equipment, as feasible.
- .3 Submit, at completion of work, report listing phase and neutral currents on panelboards, dry-core transformers and motor control centres, operating under normal load. State hour and date on which each load was measured, and voltage at time of test.

13 Conduit and Installation

- .1 Install external conduit level and plumb using rated hardware
- .2 For external EMT use only compression fittings. All other types of fittings will be disallowed.
- .3 Avoid drilling in external walls as much as possible. Weather –seal all resulting penetrations.

14 Field Quality Control

- .1 Conduct and pay for following tests:
 - .1 Power distribution system including phasing, voltage, grounding and load balancing.
 - .2 Circuits originating from branch distribution panels.
 - .3 Lighting and its control.
- .2 Furnish manufacturer's certificate or letter confirming that entire installation as it pertains to each system has been installed to manufacturer's instructions.
- .3 Insulation resistance testing.
 - .1 Megger circuits, feeders and equipment with a 500 V
 - .4 Check resistance to ground before energizing.
- .4 Provide instruments, meters, equipment and personnel required to conduct tests during and at conclusion of project.
- .5 Submit test results for Consultant's review and acceptance.

15 Co-ordination
of Protective
Devices

- .1 Ensure circuit protective devices such as overcurrent trips, relays and fuses are installed to required values and settings.

PART 1 - GENERAL

1.1 References

- .1 Canadian Standards Association (CSA)
 - .1 CAN/ CSA C22.2. No.18, Outlet Boxes, Conduit Boxes and Fittings.
 - .2 CSA CSS.2 No. 45-M Rigid Metal Conduit.
 - .3 CSA C22.2 No. 56 Flexible Metal Conduit and Liquid-Tight Flexible Metal Conduit.
 - .4 CSA C22.2 No. 83 Electrical Metallic Tubing.
 - .5 CSA C22.2 No.211.2 Rigid PVC (Unplasticized) Conduit.

1.2 Location of Conduit

- .1 Drawings do not indicate all conduit runs. Those indicated are in diagrammatic form only.

PART 2 - PRODUCTS

2.1 Conduits

- .1 Hot dipped galvanized electrical metallic tubing (EMT) for all indoor use.
- .2 Rigid PVC with thermal expansion joints for outdoor use.
- .3 Flexible steel liquid-tight conduit for all local disconnect-to-motor and field instrumentation connections.
- .4 Rigid PVC conduit: to CSA C22.2 No.211.2.
- .5 Flexible metal conduit: to CSA C22.2 No.56
- .6 Flexible PVC conduit: to CAN/CSA C22.2 No.227.3

2.2 Conduit Fastenings

- .1 One hole steel straps to secure surface conduits NPS 2 and smaller.
- .2 Beam clamps to secure conduits to exposed steel work.
- .3 Channel type supports for two or more conduits at 1.5 m oc.
- .4 Galvanized steel threaded rods, 6 mm dia. to support suspended conduit and channels.

- 2.3 Conduit Fittings**
- .1 Fittings: manufactured for use with conduit specified. Material & finish: same as conduit.
 - .2 For EMT conduit only compression fittings are acceptable. All others will be rejected.
 - .3 Factory "ells" where 90° bends are required for NPS 3/4 and larger conduits.

- 2.4 Boxes**
- .1 Cast aluminum boxes and metal covers with gaskets and compression fittings for EMT conduit.

- 2.5 Fish Cord**
- .1 Polypropylene.

PART 3 - EXECUTION

- 3.1 Installation**
- .1 Install conduits to minimise visibility in exposed locations and cause minimum interference with heritage nature of the buildings.
 - .2 Use electrical metallic tubing (EMT) except where specified otherwise.
 - .3 X-ray all floors and concrete walls before drilling penetrations.
 - .4 For the outdoor EMT use only cast aluminum boxes.
 - .5 Group conduit runs where feasible.
 - .6 Minimum conduit size: NPS 1/2.
 - .7 Mechanically bend metal conduit cold. Replace conduit if kinked or flattened more than 1/10-th of its original diameter.
 - .8 Field threads on rigid conduit must be of sufficient length to draw conduits up tight.
 - .9 Install fish cord in empty conduits.
 - .10 Where conduits become blocked, remove and replace blocked section. Do not use liquids to clean out conduits.
 - .11 Deburr, dry and clean out all conduits before installing wire.
 - .12 Fire-seal all conduit penetrations in fire rated floors and walls.

- .13 Water-seal all conduit penetrations in outside walls.
- .14 In attic space, use PVC conduits with thermal expansion joints. Support conduits on concrete sleeper tiles.

3.2 Surface Conduits

- .1 Run parallel or perpendicular to building lines.
- .2 Run conduits in flanged portion of structural steel.
- .3 Group conduits wherever possible.
- .4 Do not pass conduits through structural members.

PART 1 - GENERAL

1.2 Related
Sections

.1 Electrical General Requirements Section 16010.

1.3 Product Data

.1 Submit product data in accordance with Section 01300 – Submittals.

PART 2 - PRODUCTS

2.1 Luminaires

.1 Contemporary LED fixture with:

- .1 Housing: die-cast aluminum weatherproof enclosure.
- .2 Mounting base: integral with the post or bollard..
- .3 Electrical rating: 120V, 30W, 0.9 PF or better.
- .4 Lamp type: LED with integral driver.
- .5 Lens: integral to LED bars. Sealed to IP66 rating.
- .6 Light Distribution: Type T4FT for parking and T4W for walkway.
- .7 Colour rendition: CCT Index 3500K at 70 CRI.
- .8 Life span: 50,000 hours or better for LED and driver.
- .9 Lumen depreciation: less than 70% over 50,000 hours.
- .10 Integral surge protection: 10kV transient voltage.
- .11 LED bars and driver removable without tools.
- .12 Operating ambience: - 20°C to + 40°C.
- .13 Finish: powder coated black.
- .14 Acceptable products: SOLERA SRB8-T-E-TP-BL, or approved equal.
- .15 Warranty: 5 calendar years, 50,000 hours.

- 2.2 Lighting Poles
- .1 Steel poles: designed for underground wiring and:
 - .1 Suitable for base-top installation.
 - .2 Style: steel tube, 200 mm I.D. x 3 mm.
 - .3 Length: 3.0 m.
 - .4 Luminaire Installation: pole-top, press-fit & secure.
 - .5 Access handhole for wiring connections and fuses, with welded-on reinforcing frame and bolted-on cover with stainless steel tamper proof screws.
 - .6 Finish: hot dipped galvanized after fabrication, and powder coated black.
 - .7 Grounding lugs for grounding rod and conductor.
 - .8 Fusing: 5A, 250V OTM type with rubber boot.
- 2.3 Grounding
- .1 Grounding electrodes at end of each lighting string and:
 - .1 Grounding rods: steel copper clad 19 mm dia., 3 m long.
 - .2 Grounding conductor: bare stranded copper.
- 2.4 Ducts
- .1 Rigid PVC ducts type DBII in trench.
 - .2 Flex PVC duct matching type and size for entry to lighting poles.
- 2.5 Wiring
- .1 Wiring in duct: AWG 10 RWU 90Cu, live, neutral and ground conductor in each duct.
 - .2 Wiring in poles: AWG 12 RW90 Cu.
- 2.6 Lighting Control
- .1 Central photocell and contactors for entire area.
 - .2 Central 365-day timer-clock.
 - .3 Dedicated circuit breaker panel in existing panels.

PART 3 - EXECUTION

3.1 Photometric Models

- .1 Prior to placing orders, submit for Lighting Designer's approval a photometric model of proposed luminaires prepared by the luminaire manufacturer.
- .2 Expected results are:
 - .1 Average horizontal and vertical illuminance: 10 lux on the parking and walkways .
 - .2 Average horizontal illuminance: 3.3 lux or better for 3 m either side of the pathway.
 - .3 Uniformity ratio: Max/Min of 10:1 Avg/Min of 4:1, or better.
 - .4 Glare: 40%, or better.
 - .5 Light loss factor: 0.7.
- .3 Place luminaire orders only after Lighting Designer's approval.

3.2 Installation

- .1 Stake out proposed locations of poles and bollards and obtain Lighting Designer's approval before proceeding.
- .2 Pour reinforced concrete bases and set in anchored bolts. Set base tops flush with grade.
- .3 Install poles and bollards true and plumb, in accordance with manufacturer's instructions. Set for luminaire mounting height 3.86 m for poles and 0.90m for bollards.
- .4 Install grounding rods at end poles and bollards and connect to ground lug.
- .5 Install ducts and wiring in trenches.
- .6 Install luminaires on poles and secure with screws.
- .7 Check luminaire orientation, level and tilt.
- .8 Connect luminaires to lighting circuit.
- .9 Perform tests in accordance with Section 16010 - Electrical General Requirements.
- .10 Energize circuits and program the clock.

