

1.1 General

This statement of work outlines electrical and mechanical maintenance services to be provided at the Burlington Canal Lift Bridge in Burlington, ON. The bridge and its operation are a critical part of both the channel marine traffic and the highway/pedestrian traffic that straddles the Burlington Canal. It is essential for marine and highway operations that the bridge is maintained in a safe, reliable condition with the bridge being continually available for operation and that any mechanical or electrical system failures or malfunctions receive immediate attention and elimination.

Maintenance and repairs are to be provided to extend the life of the mechanical and electrical systems and to prevent any unnecessary failures and costly repairs. The program shall prioritize preventative maintenance to replace worn and aging components before they actually fail. Maintenance efforts shall be based on the Bridge Inspection, Evaluation, and Maintenance Manual, published by AASHTO, and other reference documents provided by the owner, including maintenance manuals. The Contractor shall continuously review the bridge electrical and mechanical systems and modify maintenance practices, including lubrication or other maintenance intervals, to minimize wear and ensure reliable service. The Contractor shall perform all work in accordance with all applicable local and national rules and regulations.

Maintenance activities shall include periodic verification of the functionality of the power and control systems, the integrity of the electrical system installation, integrity of the mechanical systems, oil changes, lubrication, and equipment adjustments. In addition, inspections shall be performed to record equipment deterioration and assess the need for replacement or repair of worn or end of life parts and equipment before they cause system failure or affect bridge operating reliability.

Bridge electrical and mechanical system maintenance shall also include 24/7 on-call failure and troubleshooting services during the navigation season. Following notification of a bridge electrical or mechanical system failure by the Bridgmaster or representative, the Contractor shall respond and be at the bridge within one hour of the notification by email or phone call.

1.2 Summary of Maintenance Efforts

.1 On-Call Services

Bridge electrical and mechanical system maintenance shall include 24/7 on-call failure and troubleshooting services during the navigation season. Following notification of a bridge electrical and/or mechanical system failure by the Bridgmaster or representative, the Contractor shall respond and be at the bridge within 1-hour of the notification.

.2 General Housekeeping

Maintain all work areas free of accumulated waste and rubbish. Remove and dispose of debris, used and obsolete material.

Remove excess lubricant, dust, dirt, and foreign matter from surfaces of all equipment to be maintained by this Contract.

.3 Mechanical Maintenance Scope

The Contractor shall provide maintenance, routine cleaning, inspection, testing, and complete service for all mechanical machinery that comprise the bridge mechanical systems. The following is a list of major equipment or systems to be maintained under this Contract. This list is provided for guidance and may not be comprehensive. Any other mechanical equipment that affects or contributes to the safe and reliable operation of the bridge shall be considered as part of this Contract.

Documents listed in the Reference Documents section provide guidance on maintenance for many of these components. A brief summary for some components is provided below.

.1 Span Drive Machinery

- .1 Open Gearing
- .2 Plain Bearings
- .3 Gear Couplings
- .4 Brakewheel Grid Couplings
- .5 Spring Set Thrustor Released Brakes
- .6 Span Drive Motors
- .7 Span Drive Reducers
- .8 Span Control and Height Indicator Reducers and Couplings

.2 Span Support Machinery

- .1 Counterweights
- .2 Counterweight Ropes
- .3 Counterweight Rope Sheaves
- .4 Counterweight Sheave Trunnion Bearings (SKF Roller Bearings)
- .5 Counterweight Guides
- .6 Span Raised Air Buffers
- .7 Span Seated Air Buffers
- .8 Auxiliary Counterweights
- .9 Auxiliary Counterweight Ropes
- .10 Auxiliary Counterweight Rope Sheaves
- .11 Auxiliary Counterweight Guide Rails
- .12 Auxiliary Counterweight Rope Anchors to Lift Span
- .13 Transverse Span Guides
- .14 Longitudinal Span Guides
- .15 Fixed Live Load Support (South End of Lift Span)
- .16 Live Load Support Rockers (North End of Lift Span)
- .17 Centering Devices

.3 Span Support Machinery

- .1 Jaw Lock Assembly
- .2 Jaw Lock Springs
- .3 Jaw Lock Crank Arm
- .4 Open Gearing
- .5 Plain Bearings
- .6 Enclosed Speed Reducer
- .7 Motor and Motor Brake
- .4 Traffic Gate Machinery
 - .1 Barrier Gates
 - .2 Traffic Gates
 - .3 Pedestrian Gates

The Reference Documents section summarizes available maintenance reference materials including the available bridge maintenance manual and the AASHTO Movable Bridge Inspection, Evaluation, and Maintenance Manual. Baseline lubrication should be performed in accordance with the manual's lubrication schedule and charts and applicable environmental rules and regulations. These documents should be followed as a guideline and the maintenance should be adjusted as necessary to minimize component wear and to ensure reliable operation. As an example, lubrication frequencies must be adjusted based on the lubrication performance during bridge operations over time.

If it is found that the bridge components are not listed or the components on the lubrication schedule are obsolete, the lubrication schedule shall be updated and submitted for review by the Bridge Master.

For those items that are not addressed by the Reference Documents, the Contractor shall work with the Bridgmaster to develop a maintenance plan.

.4 Mechanical Maintenance Procedures

The Contractor shall provide a written procedure documenting the work plan to maintain the mechanical systems. The procedure shall be submitted for approval by the Bridgmaster prior to implementing the maintenance work plan. The plan shall address the maintenance of all items that can affect operation of the lift span.

Maintenance work items that require part manufacturer support (such as the SKF trunnion bearings) will be coordinated and supported by the Contractor and shall be approved by the Bridgmaster or his representative in writing before the work is done.

.5 General Electrical Systems Description

The bridge is electrically powered with machinery and electrical motor control equipment located in each of the bridge towers. The towers are electrically connected with an electrical aerial cable installation that provides both power and control to the bridge North tower.

The bridge electrical drives, control and power and power distribution were replaced and the new system placed into service during 2017. The replaced

systems consist of state-of-the-art span drives and microprocessor based control system.

The bridge electric utility service, standby generators and main distribution switchboards are existing and were installed over 15-years ago.

The main incoming electric service to the bridge, standby generators and bridge operator's control console are located in the bridge operator's house located in close proximity to the bridge South tower.

The installed electrical elements include; electrical service to the bridge and distribution system, motors, drives, MCC's, PLC control system and associated communication system, as well as interfaces with the bridge mechanical systems and bridge fire life safety systems and electrical interfaces with the bridge mechanical systems.

.6 Electrical Maintenance Scope

The scope includes the maintenance of all bridge electrical power and control systems as well as bridge vehicular, pedestrian, and marine traffic control and signaling systems with the exception of items listed in the following section.

See the section titled *Electrical Equipment and Systems Requiring Attention/Maintenance* at the end of Annex A for a description of major electrical equipment and systems to be maintained and a baseline maintenance schedule to be used as a guideline and for tendering purposes. The provided maintenance intervals should be adjusted as necessary based on performance to ensure reliable operation.

The Contractor shall provide routine cleaning, inspection, testing, complete maintenance and service of all the items identified in the section of equipment and systems requiring attention/maintenance. All repair and replacement of parts shall also be included in the Contractor's scope of work.

The Contractor shall review and monitor the electrical power supplied to the bridge and ensure that it is used effectively and efficiently and all sources of back up electric power are maintained electrically operational and in accordance with the current equipment O&M Manuals and all applicable codes and practices. In the case of backup power, any concerns, issues or failures uncovered during the execution of its maintenance services, the Contractor shall immediately report the issue or failure to the Bridge Master. Additionally, any bridge operating control issue shall be given the highest priority and resolved by the Contractor in the timeliest manner. If the Contractor is unable to quickly resolve the issue, it shall be reported to the Bridgmaster who will obtain additional troubleshooting assistance from the bridge control system vendor, span drive supplier or other related specialists.

If the Contractor and/or bridge personnel propose any new installation and/or modification work for the bridge electrical systems, a written quotation must be provided to the Bridgmaster and approval given by the Bridgmaster for such work to be performed by the Contractor prior to either procurements of materials and equipment or the work proceeding. Note that the scheduling of any and all bridge operating invasive work must be coordinated with and approved by the Bridge Master.

.7 Navigational Start Up

Provide 40 hours of electrical/technical support to facilitate annual navigational season start up. This shall include ensuring that marine navigational aids, vehicular/pedestrian traffic control and the bridge systems are operational and functioning in accordance with that defined in the O&M Manual.

.8 Additional Work

Any work/repairs outside of the contract shall be identified to the Bridgmaster and approval to proceed shall be received prior to carrying out the work. Invoices shall identify the work in detail, listing material and labour, the authorizing officer and date and the specific work order reference number.

A quote together with details of work to be done shall be provided at the time of requesting approval. The Bridgmaster retains the right to disapprove the quote and subcontract the work to a third party.

.9 Exclusions

Maintenance work for Building Services for the workshop building is excluded from this request. In addition, the electric service transformer and metering equipment, the existing standby generators, and maintenance required for the PLC programming and interfaces with bridge field devices will be performed by others but with basic and routine work, input and coordination with the Maintenance Contractor under this contract as described herein.

A summary of exclusions follows:

- .1 Telephone
- .2 Fire alarm system
Note: although the servicing of the fire alarm system shall not be included, the power supply for the system shall be included.
- .3 Power supplied to the bridge
Note: although the servicing of the power supplied to the bridge shall not be included, the Contractor shall participate and support the electric utility when they are performing testing or maintenance of the power supply for the bridge.
- .4 Tower elevators (Note: although the servicing of the tower elevators shall not be included, the power supply for the system shall be included).
- .5 Major work on the emergency generators (Note: servicing the mechanical diesel engines shall not be included, inspection and troubleshooting of the related electrical power, control, alarm and monitoring systems shall be included. Additionally, basic routine maintenance and testing shall be included as herein described).
- .6 Pier lighting

.10 Work Completion

The Contractor shall complete the work as specified. Failure to do so may result in the Contractor being charged for additional shutdown costs, and cost of having the work completed by other forces, and any costs incurred by the PSPC.

1.3 Reference Documents

Mechanical and electrical machinery shall be maintained in accordance with the provided documents and with best industry practice. General practice shall follow the inspection and maintenance requirements outlined in the information provided in the following reference documents.

.1 Mechanical

The following is a list of documents made available by PSPC for use in maintaining the mechanical systems.

- .1 Burlington Canal Lift Bridge Maintenance Manual
- .2 Burlington Canal Lift Bridge Maintenance Log
- .3 Span Lock Rehabilitation Operating and Maintenance
Manual
- .4 New Span Lock Machinery Lube Schematic
- .5 Operation and Maintenance Manual - Volume 2
Inspection and Maintenance
- .6 Span Drive Machinery Assembly Lubrication Drawing

Note that the listed documents are not comprehensive. Other equipment that affect or contribute to the safe and reliable operation of the bridge shall be considered as part of this Contract even if not described in the reference documents. If modifications of the documents are made, the Contractor shall revise and update the documents.

.2 Electrical

In addition to the statutory Codes and Standards, the following documentation specifically related to the Burlington Canal Lift Bridge shall be made available by PSPC for use in maintaining the bridge electrical systems:

- .1 Burlington Canal Lift Bridge Maintenance Manual for
the Bridge for the Replacement of Controls, Drives and Overhead Cables
10 Volumes
- .2 Burlington Canal Lift Bridge Maintenance Log
- .3 Burlington Canal Lift Bridge Arc Flash and Protective
Coordination Study
- .4 Burlington Canal Lift Bridge Operating Procedure for
Bridge Auxiliary Drive and Mobile Generator

Note that the listed documents are not comprehensive. Other equipment that affect or contribute to the safe and reliable operation of the bridge shall be considered as part of this Contract even if not described in the reference documents. If modifications of the documents are made, the Contractor shall revise and update the documents.

1.4 Minimum Standards

.1 General

Where applicable, execute work to meet and/or exceed the requirements of the following codes and Specifications:

- .1 Latest edition of the Bridge Inspection, Evaluation, and Maintenance Manual published by the American Association of State highway and Transportation Officials (AASHTO).
- .2 CAN/CSA S6-00 Canadian Highway Bridge Design Code.
- .3 National Building Code of Canada 2015, National Fire Code of Canada 2015, Ontario Building Code 2017 and any other code of provincial or local application.
- .4 Fire Commissioner of Canada, No. FC 301, Standard for Construction Operations, and No. FC 302, Standard for Welding and Cutting, latest version.
- .5 All applicable local and national safety regulations, including the Occupational Health and Safety Act and Regulations for Construction Projects, Revised Statutes of Ontario 2018.
- .6 All applicable local and national environmental regulations, including the environmental Protection Act, O. Reg. 127/01 and O. Reg. 153/04.

.2 Electrical

Where applicable, execute work shall meet and/or exceed the requirements of the following codes and Specifications:

- .1 Contractor shall comply with all PSPC Department Policies on Electrical Safety DP058.
- .2 The Ontario Electrical Safety Code 26th Edition/ 2015 - Effective May 5, 2016, and all bulletins (Ontario).
- .3 CSA C22.1-02 Canadian Electrical Code 2015, Part I, except where specified otherwise.
- .4 Electrical Safety Authority and local applicable codes and regulations.

In any case of conflict or discrepancy, the more stringent requirements shall apply.

.3 Mechanical

The bridge mechanical systems shall be maintained in accordance with the provided reference documents (including the maintenance manual), component manufacturers' instructions, and best industry practices. All provided information shall be used as a guideline and for tendering purposes. The maintenance tasks should be adjusted as necessary to minimize component wear and to ensure reliable operation. As an example, lubrication frequencies must be adjusted based on the lubrication performance during bridge operations over time.

If it is found that the bridge components are not listed or the components on the lubrication schedule are obsolete, the lubrication schedule shall be updated and submitted for review by the Bridge Master.

1.5 Coordination and Schedule

.1 Contract Schedule and Coordination

- .1 Within two weeks after the award of this Contract, the Contractor, in consultation with the Bridgmaster, shall submit a work schedule listing equipment and systems to be inspected, tested, serviced or repaired and the time the work is done. Notify the Bridgmaster of any changes to the maintenance schedule.
- .2 The Bridgmaster reserves the right to modify the work schedule to meet the needs of the situation.
- .3 Register site attendance in log book with the PSPC representative and/or Security Officer on entering and leaving premises.
- .4 The Contractor shall ensure that all the relevant and applicable rules and regulations from Authorities having jurisdiction over the bridge area including highway and the waterway are met and adhered to.

.2 Maintenance Schedule

The bridge is normally available for opening 24/7 during the navigable channel operating season from mid-March through December 31 each year.

The Contractor Shall:

- .1 Provide 24/7 on-call service during the bridge operating navigable season. This on-call service shall require the Contractor to respond to requests for services within 1-hour of notification. The Contractor shall be responsible for troubleshooting, repairing or replacing any item that has failed. This shall include both items that have caused a bridge operating failure or items that have failed but have not caused a bridge outage.
- .2 During the bridge shutdown season from January 1 through mid-March, the Contractor shall perform annual maintenance of the bridge electrical and mechanical systems as described in this statement of work. Note that during this bridge outage season, the Contractor is not required to be on-call but to respond on an as needed basis to requests for assistance from the Bridgmaster.

.3 Inspection by Electrical Safety Authority

During the execution of its maintenance services of the bridge the Maintenance Electrical Contractor may be called upon to perform repairs or modify parts of the bridge electrical systems in order to maintain it in a safe and reliable condition.

When such repairs or modifications are major and undertaken by the Maintenance Electrical Contractor as part of his maintenance services, the Contractor shall arrange for the inspection and obtain safety certificates from Electrical Safety Authority having jurisdiction over the project for its work.

Additionally, they shall perform his work to the complete satisfaction and approval of the Bridgemaster.

.4 Cooperation with Other Contractors

The Contractor shall co-operate with other contractors hired by PSPC to perform any work on the bridge not directly related to the maintenance work specified herein. The Contractor shall maintain coordinated timing of maintenance work and adequate space separation to co-operate with other contractors hired by PSPC.

.5 Health and Safety

The Contractor shall comply to Ontario Health and Safety Regulations.

.6 Cooperation and Protection

Perform work with minimum disturbance to the operators and normal operation of the lift bridge. The bridge is in operation from mid-March to the end of December of every year. The Contractor shall coordinate with and obtain approval from the Bridgemaster for any required bridge or power outages necessary to perform his work.

The Maintenance Contractor will be granted use of existing bridge facilities with the permission and defined limitations of the Bridgemaster at no cost to the Maintenance Contractor.

.7 Power Shut Downs

Power shut down shall be kept to a minimum. Scheduled shut downs with stating times and durations shall be requested well in advance and with the approval of the Bridgemaster obtained prior to proceeding with the shutdown. Maintain all electrical services to all other branch circuits of the bridge area. Premium time and cost, if required for any shutdown work, must be submitted and approved by the Bridgemaster prior to proceeding with the work. Note that these unquantified scheduled shutdowns shall not be allowed for in the Maintenance Contractors bid.

Provide temporary services, equipment and wiring as necessary to maintain continuity of crucial loads deemed so by the PSPC representative and the Bridgemaster.

.8 Meetings

The Contractor or his representative shall attend monthly meetings at site when notified by the Bridgemaster. Time spent at the meeting is counted towards the committed employee-hours. For tendering purposes, it shall be assumed that a monthly meeting will take place for every month of the contract and each will have a duration of 2-hours.

1.6 Parts, Equipment and Tools

.1 General

The Contractor shall supply all the equipment and tools required for this Contract. All equipment and tools used must be safe, suitable for the purpose intended, and in good condition.

Supply the Bridgemaster with the year, make, model and capacity of Contractor's equipment and calibration certification of all meters and recording instrumentation, if requested.

.2 Materials

Use new materials unless specified otherwise.

PSPC will provide a stock of electrical fittings to facilitate electrical maintenance and minor repair. The Contractor shall inform the Bridgemaster of any materials required but not found in the stock.

Purchase of any special, unstocked electrical materials or equipment by the Contractor for any work under this Contract must be approved by the Bridgemaster prior to the procurement of such material and equipment. A quote with details of the material from the supplier shall be provided at the time of requesting approval. The Bridgemaster retains the right to disapprove the purchase and procure the same material through other channels.

.3 Lubricants, Lubricating Equipment, and Tools

.1 Use new lubricants unless specified otherwise.

.2 PSPC will provide the lubricants that the Maintenance Contractor is to use on the equipment. The Contractor shall inform the Bridgemaster of any materials required but not found in stock. The Bridgemaster shall either approve the Contractor to procure the defined stock items or make other arrangements for their procurement if he deems they are necessary for the maintenance of the bridge. Re-stocking of maintenance materials is not considered part of this base contract.

.3 Purchase of any materials by the Contractor for any work under this Contract must be approved by the Bridgemaster first. A quote with details of the material from the supplier shall be provided at the time of requesting approval. The Bridgemaster retains the right to disapprove the purchase and procure the same material through other channels.

.4 The Contractor shall supply all Lubricating Equipment (such as grease guns, brushes, sprayers, caulk guns, etc. to apply lubricants) and Tools (such as allen keys, wrenches, etc.) to complete the required lubrication and maintenance of the machinery.

.5 Use of any lubricant that is not currently in use at the bridge shall be approved by the Bridgmaster prior to use.

.6 Use of lubricants supplied by PSPC shall comply with applicable environmental rules and regulations. Specifically use of wire rope lubricant. If an environmentally friendly wire rope lubricant is selected by PSPC, complete removal of the existing wire rope lubricant may be necessary based on compatibility of the wire rope lubricants. Removal and installation of wire rope lubricant shall comply with all applicable environmental rules and regulations.

.4 Replacement Parts

In cases where items are found to have worn out or are damaged beyond repair, the Contractor shall source and replace the item. Where possible the contractor shall use replacement parts by the manufacturer of the original part. Replacement parts are considered Additional Work and cost to the contract.

If an original part is not available, replacement parts by another manufacturer may be used with written approval from PSPC. The Contractor should recommend a replacement. The cost of the procurement and installation of the replacement part is not included in this contract. PSPC retains the right to appoint the Contractor or a separate agent for the procurement and installation of any identified replacement part.

.5 Spare Parts

The Contractor shall provide a list of recommended spare parts to be stocked on site within one month after award of this Contract. The list shall include the name, part/catalogue number and supplier/manufacturer of each of the spare parts. As a basis for the preparation of this list the Contractor shall use the latest Maintenance Manuals for the bridge.

1.7 Personnel

.1 Electrical Maintenance Contractor Qualifications and Experience

.1 General labourers shall not perform any electrical work.

.2 The Electrical Maintenance Contractor shall be qualified in all aspects of power distribution, control and drive systems associated with movable heavy structures.

.3 The Maintenance Electrical Contractor shall have been involved in the construction/installation or maintenance of the electrical power and control systems of at least one (1) movable highway bridges over similar navigable waterways carrying similar highway traffic to the Burlington Canal Lift Bridge.

.4 The Electrical Maintenance Contractor shall provide the services of a Master Electrician registered in the Province of Ontario to manage the electrical maintenance for the bridge as herein specified and in accordance with Electricity Act, Part VIII, 1998 and Licensing of Electrical Contractors & Master Electricians, Regulation 570/05.

- .1 The Master Electrician designated by the Maintenance Electrical Contractor shall be responsible for; planning and having direct supervision of electrical work carried out on behalf of the Maintenance Electrical Contractor, ensuring that the electrical work is carried out in accordance with applicable laws, including the Electrical Safety Code and the laws relating to health and safety and consumer protection, on behalf of the Maintenance Electrical Contractor and for other matters of a similar nature.
- .2 The Master Electrician shall only be designated to the Maintenance Electrical Contractor contracted for the maintenance of the Burlington Canal Lift Bridge, the designated Master Electrician must be actively employed by the designating Maintenance Electrical Contractor and are not permitted to undertake electrical work unless they hold a valid certificate of qualification, as defined by the Trades Qualification & Apprenticeship Act, for the work being performed. To apply for a contractor's license the applicant must designate a Master Electrician and provide a signed declaration that they accept the designation and agree to carry out the responsibilities on behalf of the electrical contractor.
- .3 In accordance with the Electricity Act Part VIII and its Regulations a license holder is responsible to conduct themselves with honesty and integrity and in accordance with the principle of protecting consumers and to ensure that all activities are carried out in accordance with all laws including the Consumer Protection Act.
- .4 The Maintenance Electrical Contractor shall ensure that his Master Electrician is adequately supported to perform the scope of this request and meet the scheduled maintenance, troubleshooting and emergency callout services.
- .5 Contractor shall be competent on high voltage electrical work and testing. The contractor shall also be fully qualified and knowledgeable of PLC control, communications systems and variable frequency drive systems utilized in a tower drive vertical lift bridge environment.
- .6 The Electrical Engineer assigned to the contract shall be provincial licensed and registered with Professional Engineers Ontario (PEO)
- .7 The Electrical Technologist/Technician assigned to the contract shall hold a diploma or certificate specialized in Electrical Technology from a recognized educational institution.
- .8 The Electrician assigned to the contract shall be Provincial licensed journeyman qualified in the work of the Contract as per Regulation 1051/1990. Journeyman means a person who has successfully completed all the academic training and work experience required under the Apprenticeship and Tradesmen's Qualifications Act

related to the Certified trade involved and has been issued a Certificate of Qualification by the governing body for the Province of Ontario.

.9 In the case of special testing, i.e.: injection testing of breakers, double testing of transformers, etc., a technician with a minimum of 5 years' experience shall be acceptable.

.10 In the case of thermo-scan (infrared scanning), the technician shall hold a Certificate of Training as received from a recognized course acceptable to the Department.

.2 Mechanical Experience

.1 The contractor shall be qualified journeyman or millwright in the maintenance and servicing of heavy machinery such as open gearing, bearings, couplings, and enclosed gear reducers.

.3 Subcontractor

.1 Immediately after the award of the contract, the Contractor shall provide the Bridgmaster with the name and address of any sub-contractors intended to be used for routine maintenance as part of the Contract.

.2 The Contractor may hire subcontractors, with the approval of the Bridgmaster, for one-time maintenance work. The requirement of this document in its entirety applies to the subcontractor's work and employees.

.3 A quote from subcontractor's together with details of work to be done shall be provided at the time of requesting approval. The Bridgmaster retains the right to reject any subcontractor and procure the same service or services through other channels.

.4 Contractor's Employees

.1 All Contractor's employees shall be neatly and properly attired for the work to be performed. Personal protective equipment, including safety footwear, is mandatory at all times.

.2 All Contractor employees shall abide by non-smoking restrictions. Smoking is only allowed in designated areas.

1.8 Documentation of Systems

.1 Site Documents

File and maintain the following documents on site at the bridge

.1 The contract documents.

.2 Test and inspection reports and a log book.

.3 Up-to-date documentation for the operation and maintenance of the bridge. These documents should be properly bound, catalogued and filed and readily available for maintenance work. The documents should include but not limited to:

- .1 All electrical and mechanical drawings updated with the latest revision. Both hard copies and digital copies should be properly filed at site with the Bridgemaster. All new drawings shall be produced in CAD (computer aided drafting) and in .dwg format. Shop drawings and catalogue cut-sheets of new equipment shall also be included and filed in hard copy and electronic form.
- .2 All operation and maintenance manuals existing and new, properly bound in binders.
- .3 All programs for the PLC (programmable logic controller), drives, and digital/analogue controllers shall be backed up and hard copies shall be printed out. Both digital and hard copies shall be filed at site and provided to the Bridgemaster.

All the documents mentioned above shall remain the property of PSPC and not be removed from site throughout the Contract and at the end of the Contract.

1.9 Premises Security and Security Clearances

- .1 Maintain premises security during work; close and lock gates, windows and doors on completion of work.
- .2 Only designated employees of the Contractor and approved subcontractors are allowed at site. The Bridgemaster reserves the right to reject access to the bridge premises to anyone associated with this contract.
- .3 The contractor shall submit his name, address and date of birth and the name, address and date of birth of all employees who will be required to work in the above-mentioned facility, occupied premises, to the PSPC representative immediately following notification of contract award.

1.10 Fees and Permits

- .1 The Contractor shall pay all fees required to obtain permits or certificates and shall make all arrangements with local utilities for isolation, grounding and re-energizing of electrical power, if such requirements are required to carry out the maintenance work.

1.11 Right to Use Other Forces

- .1 PSPC retains the right to appoint the Contractor or other agent for procurement of maintenance or for Additional Work. PSPC reserves the right to use their own, or any other forces of their choosing, to make any alterations on the bridge if they so desire.

1.12 Maintenance Manuals

- .1 As directed and scheduled by PSPC during the tendering process, the bidder shall participate in a site visit to the bridge. During the site visit, the Bidder will have the opportunity to interrogate all maintenance related documentation held at the bridge to assess its completeness and as a basis for their bid.
- .2 Following award of the contract the Contractor shall review the existing reference documents and, where maintenance information is missing, obtain maintenance manuals of the systems and equipment. Where manufacturer's maintenance

information is unavailable, the Contractor shall document the maintenance/service required in the form of updated manuals to be submitted to the Bridgmaster for approval.

- .3 All maintenance manuals shall remain on site throughout the contract period and at the end of the contract. These manuals shall remain as PSPC property and be available to PSPC staff.

1.13 Guarantees

- .1 The Contractor shall guarantee any materials used and any work executed by him or his appointed sub-contractor, for a period of one year from the date of completion of the work.

1.14 Existing Services

- .1 Protect and maintain existing active services and facilities. Use existing services at no cost for maintenance of those items that are not covered under this contract.

1.15 Monthly and Annual Maintenance Report

- .1 Monthly Maintenance Report

A monthly Work Report summarizing the work done and the employee hours spent at site should also be submitted.

- .1 Time spent for this inspection and writing of the report shall be charged as Maintenance hours.

- .2 It shall be included as Item 1 Committed hours or billed as non-emergency service if the committed number of hours in that month has been exceeded

- .2 Annual Maintenance Report

The Contractor shall produce an annual electrical and mechanical inspection report for each fiscal year during the terms of this Contract. In case PSPC chooses to hire a third party to do an annual inspection, the Contractor shall co-operate with the third party to produce the electrical section of the Annual Inspection Report. In this case, no separate annual report is required. Unless otherwise arranged and approved by PSPC, the Annual Electrical Inspection Report shall be due at the end of April of each year during the terms of this Contract.

In the event that PSPC decides that a third party performs the bridge mechanical and electrical maintenance inspection, the Contractor shall provide the necessary support for the third party to perform their inspection work.

The maintenance inspection report shall include but not be limited to the following sections on all the electrical systems of the bridge: visual inspection of the bridge electrical systems including all equipment, sub-systems, electrical installation, raceways, cabling including droop cables and cable reels as well as the tower to tower aerial cable installation. The report shall include:

- .1 Major electrical work and modification completed during the year.
- .2 Items of concerns and items identified by the Bridgemaster for special attention.
- .3 Recommendations
- .4 Reports of Tests and Inspection done by the Contractor and third party.
- .5 Photographs and drawings.

Time spent for this inspection and writing of the report shall be charged as Maintenance hours.

It shall be included as Item 1 Committed hours or billed as non-emergency service if the committed number of hours in that month has been exceeded

1.16 Final Inspection

- .1 The Contractor shall provide a final inspection of the mechanical and electrical systems within two months of the end of the Maintenance Contract. The final inspection shall be coordinated for inspection in the presence of PSPC Representative. Time spent for this inspection shall be charged as maintenance hours. It shall be included as committed hours or billed as non-emergency service, if the committed number of hours in that month has been exceeded.
- .2 All deficiencies known to the Bridgemaster and not rectified during the execution of the contract, and those deficiencies uncovered during the final inspection, shall be corrected prior to the Maintenance Contract closeout.

1.17 Electrical Equipment and Systems Requiring Attention/Maintenance

The following is a list of major electrical equipment or systems to be maintained under this Contract. This list is provided for guidance and tendering purposes and may not be comprehensive.

Apart from the exceptions noted in the Electrical Scope, the maintenance shall include all electrical equipment in the bridge area that supplies or transmits electrical power, or that affects or contributes to the safe operation of the bridge, bridge auxiliaries, or facilities shall be considered as part of this Contract.

Suggested minimum maintenance/service intervals are provided in the following table in accordance with this key:

W - Weekly

M - Monthly

A - Annually

SA - Semi Annually

Caution: The recommended intervals are provided for tendering purposes only. Actual intervals may depend on the environment, duty cycle, etc. Adjust the intervals as necessary to provide preventative maintenance to ensure reliability.

| Item | Description | Location | Maintenance/Service | Remarks | Interval |
|------|---|----------------------------------|--|--|----------|
| 1 | Electric Utility Service | | | | |
| 1a | 1,000 kVA ONAN Pad mounted Transformer | Southwest Lawn | Insulating oil test, winding insulation test and general cleaning. | Performed by and coordinated with Utility Company | A |
| 1b | 13.8 kV Fused Disconnect Switch | Southwest Lawn | Ductor test on fuse and switch contacts. | Performed by and coordinated with Utility Company | A |
| | | | Insulation resistance test based on voltage level. | | |
| 2 | Generators | | | | |
| 2a | ONAN generator 600 kW | Electrical Room Main Floor | Operational testing and check of diesel fuel. | Performed by the Bridge Operators/ Contractor | W |
| | | | Load bank test and bridge operation test. | Performed by the Bridge Operators/ Contractor | M |
| | | | Minor maintenance: check batteries | Performed by Maintenance Contractor and coordinated with generator service company | SA |

| Item | Description | Location | Maintenance/Service | Remarks | Interval |
|----------|---|----------------------------|--|--|----------|
| 2b | NEWAGE Generator 37 kW | Electrical Room Main Floor | Functional testing and check of diesel fuel. | Performed by Maintenance Contractor and coordinated | W |
| | | | Load test and maintenance | Performed by Maintenance Contractor | M |
| | | | Minor maintenance: check batteries | Performed by Maintenance Contractor and coordinated with generator service company | SA |
| 2c | 600 kW Load Bank | South Compound | Inspect and test disconnect switch and load bank | Performed by Maintenance Contractor | A |
| | | | components, verify operation | | |
| 2d | Fuel System | Electrical Room Main Floor | Verify fuel tank system functions and test alarms. | Performed by Maintenance Contractor | M |
| 2e | ATS for 37 kW Generator | Electrical Room Main Floor | Verify all connections and function test | Performed by Maintenance Contractor | SA |
| 2f | Ventilation System for Emergency Generator 1st floor, Control House | Electrical Room Main Floor | Verify system settings and operation | Performed by Maintenance Contractor | M |
| 2g | Space Heaters | Electrical Room Main Floor | Verify proper operation | Performed by Maintenance Contractor | A |
| 3 | Switchboards & MCCs | | | | |
| 3a | Switchboard #1 | Electrical Room Main Floor | Inspect and test all feeder connections | Performed by Maintenance Contractor | A |
| | | | Maintain all air breakers | Performed by Maintenance Contractor | A |
| | | | Inspect and test switchboard components | Performed by Maintenance Contractor | A |

| Item | Description | Location | Maintenance/Service | Remarks | Interval |
|----------|--|---|---|-------------------------------------|----------|
| 3b | Switchboard #2 | Electrical Room Second Floor | Inspect and test all feeder connections | Performed by Maintenance Contractor | A |
| | | | Maintain all breakers | Performed by Maintenance Contractor | A |
| | | | Inspect and test switchboard components | Performed by Maintenance Contractor | A |
| 3c | Motor Control Center South Tower | South Tower Machinery Space | Inspect and test all feeder connections | Performed by Maintenance Contractor | A |
| 3d | Motor Control Center North Tower | North Tower Machinery Space | Inspect and test all feeder connections | Performed by Maintenance Contractor | A |
| 3e | UPS 10 kVA and UPS distribution Panel | Electrical Room Second Floor | Inspect and load test. Verify proper operation | Performed by Maintenance Contractor | SA |
| 4 | Cables, wiring and Aerial Cable ATS | | | | |
| 4a | South Power cables (6 #1/0) | Switchboard 2 to South Tower MCC | Inspect all feeder connections. Perform insulation resistance test. | Performed by Maintenance Contractor | SA |
| 4b | North Power cables (6 #1/0) | Switchboard 2 to South Tower Aerial cable termination Cabinet | Inspect all feeder connections. Perform insulation resistance test. | Performed by Maintenance Contractor | SA |
| 4c | East and west power aerial cables (6 #4/0) | From South Tower Aerial cable termination Cabinet to North Tower ATS | Inspect all feeder connections. Perform insulation resistance test. | Performed by Maintenance Contractor | SA |

| Item | Description | Location | Maintenance/Service | Remarks | Interval |
|----------|--|------------------------------|--|-------------------------------------|----------|
| 4d | Automatic transfer switch (ATS) for aerial cables | North Tower Machinery Space | Verify all connections and function test | Performed by Maintenance Contractor | A |
| 4e | East and west control aerial cables (2) | CP-3 and CP-4 | Inspect all connections. Insulation resistance test for all cables. | Performed by Maintenance Contractor | A |
| 4f | Aerial Cable Manual Transfer Switches (2) | CP-3 and CP-4 | Verify proper operations | Performed by Maintenance Contractor | M |
| 4g | Cable Reels (2) | South and North Compound | Test and confirm proper operation, inspect brushes and collector rings, inspect cable and connections, test and confirm spring tension | Performed by Maintenance Contractor | M |
| 5 | Dry Type Transformers & Power Distribution Panels | | | | |
| 5a | 75 kVA Transformer 600-208/120 volts. | Second Floor Electrical Room | Winding insulation resistance, test, and general cleaning | Performed by Maintenance Contractor | A |
| 5b | 45kVA Transformer 600/208/120 volts | Electrical Room Main Floor | Winding insulation resistance, test, and general cleaning | Performed by Maintenance Contractor | A |
| 5c | 9kVA Transformer 600-208/120 volts Lighting Panel. | South Tower Machinery Space | Winding insulation resistance, test, and general cleaning | Performed by Maintenance Contractor | A |
| 5d | 9kVA Transformer 600-208/120 volts Emergency Lighting Panel. | South Tower Machinery Space | Winding insulation resistance, test, and general cleaning | Performed by Maintenance Contractor | A |
| 5e | Heating Panelboard and Heating Panel Controller | South Tower Machinery Space | Insulation resistance test and general cleaning | Performed by Maintenance Contractor | A |
| 5f | 6kVA Transformer 600-208/120 volts Lighting Panel. 4 | North Pier | Winding insulation resistance test and general cleaning | Performed by Maintenance Contractor | A |
| 5g | 15kVA Transformer 600-208/120 volts LP-6 Lighting Panel. | North Tower Machinery Space | Winding insulation resistance test and general cleaning | Performed by Maintenance Contractor | A |

| Item | Description | Location | Maintenance/Service | Remarks | Interval |
|----------|--|-------------------------------------|--|-------------------------------------|----------|
| 5h | 9kVA Transformer 600-208/120 volts Lighting Panel. | North Tower Machinery Space | Winding insulation resistance test and general cleaning | Performed by Maintenance Contractor | A |
| 5i | 9kVA Transformer 600-208/120 volts Emergency Lighting Panel. | North Tower Machinery Space | Winding insulation resistance test and general cleaning | Performed by Maintenance Contractor | A |
| 5j | Heating Panelboard and Heating Panel Controller | North Tower Machinery Space | Insulation resistance test and general cleaning | Performed by Maintenance Contractor | A |
| 6 | Main Drive System | | | | |
| 6a | VFD Drives (4) | South & North Tower Machinery Space | Insulation resistance test and general cleaning | Performed by Maintenance Contractor | A |
| 6b | Braking Resistors (4) | South & North Tower Machinery Space | Insulation resistance test and general cleaning | Performed by Maintenance Contractor | A |
| 6c | Span Motor Disconnects (4) | South & North Tower Machinery Space | Insulation resistance test and verify proper functions | Performed by Maintenance Contractor | A |
| 6d | Span Drive Motors (4) | South & North Tower Machinery Space | Insulation resistance test and general cleaning | Performed by Maintenance Contractor | A |
| 6e | Thrustor brakes (8) | South & North Tower Machinery Space | Insulation resistance test, verify proper operation and limit switch functions | Performed by Maintenance Contractor | A |
| 6f | Gearbox Limit Switches (12) | South & North Tower Machinery Space | Limit switch functional test | Performed by Maintenance Contractor | A |
| 6g | Gearbox Oil Reservoir (2) | South & North Tower Machinery Space | Sample oil and test | Performed by Maintenance Contractor | A |
| | | | for continued use. | | |

| Item | Description | Location | Maintenance/Service | Remarks | Interval |
|----------|-------------------------------------|---|---|-------------------------------------|----------|
| 7 | Auxiliary Drive System | | | | |
| 7a | Auxiliary Drive Motor and Brake (2) | South & North Tower Machinery Space | Insulation resistance test and general cleaning | Performed by Maintenance Contractor | A |
| 7b | Auxiliary Drive Controller (2) | South & North Tower Machinery Space | General cleaning and verify proper operation | Performed by Maintenance Contractor | A |
| 7c | Auxiliary Drive Test | South & North Tower Machinery Space | 6 hour test (off hours), monitor electrical systems during testing/operation; winding insulation test | Performed by Maintenance Contractor | A |
| 7d | Emergency Lighting | South & North Tower Machinery Space, bridge control house | Test and confirm operation | Performed by Maintenance Contractor | M |
| 7e | Manual Transfer Switches (2) | South & North Tower Machinery Space | Test and confirm operation | Performed by Maintenance Contractor | SA |
| 7f | Gearbox Levers and Limit Switches | South & North Tower Machinery Space | Test and confirm operation | Performed by Maintenance Contractor | SA |
| 7g | Mobile Generator Disconnects(2) | Foot of South & North Tower | Inspect and test all associated disconnect switches | Performed by Maintenance Contractor | SA |

| Item | Description | Location | Maintenance/Service | Remarks | Interval |
|----------|--|--|---|-------------------------------------|----------|
| 8 | Field Devices and Safety Interlocks | | | | |
| 8a | Span Limit Switches | South Tower Along the counter weight path | Verify for proper operations | Performed by Maintenance Contractor | M |
| 8b | Resolvers (4) | Two in each tower | Verify for proper operations | Performed by Maintenance Contractor | M |
| 8c | Speed Switches (2) | One in each tower | Verify for proper operations | Performed by Maintenance Contractor | M |
| 8d | Inclinometer & wireless modules | South side under the moving span | Verify for proper operations | Performed by Maintenance Contractor | M |
| 8e | Seated Limit Switches (4) | Two on each pier | Verify for proper operations | Performed by Maintenance Contractor | M |
| 8f | Other limit switches throughout the bridge | Bridge | Verify for proper operations | Performed by Maintenance Contractor | M |
| 8g | Brake Limit Switches | South & North Tower Machinery Space | Test and confirm operation | Performed by Maintenance Contractor | |
| 8h | Safety Interlock Throughout | Bridge | Verify for proper operations | Performed by Maintenance Contractor | M |
| 9 | Span Locks | | | | |
| 9a | Span Lock Motors and brakes (2) | North and South Pier | Inspect and test winding insulation Inspect and test motor brakes | Performed by Maintenance Contractor | M |
| 9b | Span Lock Limit Switches (10) | North and South Compound | Verify for proper operations | Performed by Maintenance Contractor | M |
| 9c | Span Lock Motor Disconnects(2) | North and South Compound | Verify for proper operations | Performed by Maintenance Contractor | M |
| 9d | Span Lock Machinery room lighting | North and South Compound | Verify for proper operations | Performed by Maintenance Contractor | M |
| 9e | Span Lock Machinery | North and South Compound | Sample oil and test | Performed by Maintenance Contractor | A |
| | Gearbox Oil Reservoir (2) | | for continued use. | | |

| Item | Description | Location | Maintenance/Service | Remarks | Interval |
|-----------|--|-----------------------------|--|-------------------------------------|----------|
| 10 | Traffic Control Equipment | | | | |
| 10a | Traffic Gates and gongs (4) | Bridge Roadway Level | Test and confirm proper operation. Verify connections, contactors and limits | Performed by Maintenance Contractor | M |
| 10b | Barrier Gates and gongs (2) | Bridge Roadway Level | Test and confirm proper operation. Verify connections, contactors and limits | Performed by Maintenance Contractor | M |
| 10c | Pedestrian Gates (2) | Bridge Roadway Level | Test and confirm proper operation. Verify connections, contactors and limits | Performed by Maintenance Contractor | M |
| 10d | Traffic Lights (4) | Bridge Roadway Level | Test and confirm proper operation | Performed by Maintenance Contractor | M |
| 10e | Pedestrian Lights (4) | Bridge Roadway Level | Test and confirm proper operation | Performed by Maintenance Contractor | M |
| 10f | Span Navigation Lights (2) and Span lights | Moving Span | Test and confirm proper operation | Performed by Maintenance Contractor | M |
| 10g | Small Craft Lights (2) | South Pier | Test and confirm proper operation | Performed by Maintenance Contractor | M |
| 10h | Pier Tip Lights (4) | End of North and South Pier | Test and confirm proper operation | Performed by Maintenance Contractor | M |
| 10i | Pedestrian Bells (2) | North and South Approach | Test and confirm proper operation | Performed by Maintenance Contractor | M |
| 10j | Air Horn, Siren and Loudspeakers | Bridge Span | Test and confirm proper operation | Performed by Maintenance Contractor | M |
| 10k | Air Compressor and Dryer | Control House Main Floor | Confirm all connections | Performed by Maintenance Contractor | M |
| 10l | Span and Roadway Lighting | Bridge Roadway | Test and confirm proper operation | Performed by Maintenance Contractor | M |
| 11 | Control Panels | | | | |
| 11a | Main Control Console CP-1 | Control House 3rd Floor | Test and verify all components and operation | Performed by Maintenance Contractor | M |
| 11b | Traffic Control Console CP-5 | Control House 3rd Floor | Test and verify all components and operation | Performed by Maintenance Contractor | M |

| Item | Description | Location | Maintenance/Service | Remarks | Interval |
|-----------|--------------------------------------|-----------------------------------|--|-------------------------------------|----------|
| 11c | CP-2 | Control House 2nd Floor | Inspect and test all contactors and relays, verify all connections | Performed by Maintenance Contractor | M |
| 11d | CP-3 | South Tower Machinery Space | Inspect and test all contactors and relays, verify all connections | Performed by Maintenance Contractor | M |
| 11e | CP-4 | North Tower Machinery Space | Inspect and test all contactors and relays, verify all connections | Performed by Maintenance Contractor | M |
| 11f | CP-8 | South Tower Machinery Space | Inspect and test all contactors and relays, verify all connections | Performed by Maintenance Contractor | M |
| 11g | CP-9 | North Tower Machinery Space | Inspect and test all contactors and relays, verify all connections | Performed by Maintenance Contractor | M |
| 11h | Aerial Cable Termination Cabinet | South Tower Machinery Space | General cleaning, inspect connections | Performed by Maintenance Contractor | M |
| 12 | Bridge CCTV System | | | | |
| 12a | CCTV System | Distributed throughout the bridge | General cleaning, inspection and performance testing | Performed by Maintenance Contractor | M |
| 13 | Other Equipment | | | | |
| 13a | Radar | Control house, 3rd floor. | Inspect and test for proper function | Performed by Maintenance Contractor | A |
| 13b | Anemometer | Control house, 3rd floor. | Inspect and test for proper function | Performed by Maintenance Contractor | A |
| 13c | HVAC | Distributed throughout the bridge | Inspect and test for proper function | Performed by Maintenance Contractor | A |
| 13d | Card Access System | Distributed throughout the bridge | Inspect and test for proper function | Performed by Maintenance Contractor | A |
| 13e | Electric/Gas Powered Heating Systems | Distributed throughout the bridge | Inspect and test for proper function | Performed by Maintenance Contractor | A |
| 13f | Wordmark Signs | Throughout Facility | Inspect signs for illumination. Replace lamps as needed. | Performed by Maintenance Contractor | M |
| 13g | Fire Extinguisher | Throughout Facility | Inspect fire extinguisher for compliance with rules and regulations. | Performed by Maintenance Contractor | M |

