

Union Pearson Express Electrification Transit Project Assessment

ENVIRONMENTAL PROJECT REPORT

April 1, 2014

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Appendix A - Natural Environment Assessment Report

Appendix B - Land Use Assessment Report

Appendix C - Cultural Heritage Assessment Report

Appendix D - Stage 1 Archaeological Assessment Report

Appendix E - Air Quality Assessment Report

Appendix F - Noise and Vibration Assessment Report

Appendix G - Visual Impact Assessment Report

Appendix H - Electromagnetic Compatibility (EMC) Report

Appendix I - Traffic Report

Appendix J - Consultation Record

Appendix K - Maintenance Facility Conceptual Design Report

Appendix L - Utilities Report

EPR Glossary of Terms

AREMA	The acronym for American Railway Engineering and Maintenance-of-Way Association. AREMA is the organization that represents the engineering function of the North American railroads.
Autotransformer	Apparatus which helps boost the overhead contact system (OCS) voltage and reduce the running rail return current in the 2 X 25 kV autotransformer feed configuration. It is a single winding transformer having three terminals. The intermediate terminal located at the midpoint of the winding is connected to the rail and the static wires, and the other two terminals are connected to the catenary and the negative feeder wires, respectively.
Bonding	A low impedance path obtained by permanently joining all normally-non-current-carrying conductive parts to ensure electrical continuity and having the capacity to conduct safely any current likely to be imposed on it.
Cantilever	A beam that is supported by a pole at only one end and carries the load of the electrification equipment on top of tracks. At multiple track locations where cantilever frames are not practical, portal structures should be utilized.
Catenary System	An assembly of overhead wires consisting of, as a minimum, a messenger wire, carrying vertical hangers that support a solid contact wire which is the contact interface with operating electric train pantographs, and which supplies power from a central power source to an electrically-powered vehicle, such as a train.
CEAA	The acronym for Canadian Environmental Assessment Act.
Cess	The area on either side of the railway immediately off the ballast shoulder, within the rail right of way. This area is considered a safe area for workers to stand when a train approaches.
Class EA	Under the Ontario Environmental Assessment Act (EA Act), Class Environmental Assessments are those projects that are approved subject to compliance with an approved class environmental assessment process (e.g., Class EA for Minor Transmission Facilities, GO Transit Class EA, etc.) with respect to a class of undertakings.
Contact Wire	A solid grooved, bare aerial, overhead electrical conductor of an OCS that is suspended above the rail vehicles and which supplies the electrically powered vehicles with electrical energy through roof-mounted current collection equipment - pantographs - and with which the current collectors make direct electrical contact.
Control Centre	The building or room location that is used to dispatch trains and control the train and maintenance operations over a designated section of track.
Cross Bonds	The method of tying tracks together electrically to equalize traction return currents between tracks. This is done to minimize touch potential.

Cross Feeding System	Overhead feeder lines are provided between the main gantry and strain gantry across the electrified track to feed power to the OCS wires.
Deadhead Movements	In the case of UP Express, deadhead movements are considered to be empty train movements required to reposition a train before or after revenue service. (Revenue service entails train movements that carry fare paying passengers). Deadhead movements are also referred to as “unproductive moves” as they incur the costs of train operations, but are not offset by any revenue from passengers.
Detailed Design	The detailed design phase of a project is defined as the last design stage before system implementation phase including software and hardware development starts.
DMU	Diesel Multiple Unit; a train comprising single self -propelled diesel units.
Double Stacked Freight (DSF)	Freight trains carrying double stack containers.
Duct Bank	A duct bank is an assembly of electrical conduits that are either directly buried or encased in concrete. The purpose of the duct bank and associated conduit is to protect and provide defined routing of electrical cables and wiring. It also provides a physical separation and isolation for the various types of cables.
Electrical Potential	A measurement of the voltage (or potential difference) between two points in a system. For UP Express electrification, electrical potential is the electrical charge difference between the electrified UP Express railway and the ground. The unit for electrical potential is expressed in volts.
Electrical Section	This is the entire section of the OCS which, during normal system operation, is powered from a TPS circuit breaker. The TPS feed section is demarcated by the phase breaks of the supplying TPS and by the phase breaks at the nearest SWS or line end. An electrical section may be subdivided into smaller elementary electrical sections.
Electric Traction Facility	A traction substation, paralleling station, or switching station.
EMC	The acronym for Electromagnetic Compatibility. Electromagnetic compatibility is the ability of a device, equipment, or system to function satisfactorily in its electromagnetic environment without introducing intolerable electromagnetic disturbances to anything in that environment.
EMF	The acronym for Electric and Magnetic Field. Electric and magnetic fields arise from natural forces and permeate our environment. In addition to natural background EMF, anthropogenic sources include electric fields which arise anywhere electricity or electrical components are used and magnetic fields which arise wherever there is a flow of electric current. Common manmade sources of EMF include: electronics, power stations, transmission lines, telecommunication infrastructure, electric motors, etc. The strength of man-made EMF depends on the characteristics of the source including amongst others, voltage, current strength and frequency.
EMI	The acronym for Electromagnetic Interference. Electromagnetic interference is a disturbance that affects an electrical circuit due to either electromagnetic

	induction or radiation from an external source.
EMI Noise	Unwanted electrical signals that produce undesirable effects in the circuits of the control system in which they occur.
EMU	The acronym for Electric Multiple Unit; a train comprising single self-propelled electric units.
Elementary Electrical Section	The smallest section of the OCS power distribution system that can be isolated from other sections or feeders of the system by means of disconnect switches and/or circuit breakers.
EPR	The acronym for Environmental Project Report. The proponent is required to prepare an Environmental Project Report to document the Transit Project Assessment Process followed, including but not limited to: a description of the preferred transit project, a map of the project, a description of existing environmental conditions, an assessment of potential impacts, description of proposed mitigation measures, etc. The EPR is made available for public review and comment for a period of 30 calendar days. This is followed by a 35-day Minister's Decision Period.
ESR	The acronym for Environmental Study Report. Proponents are required to prepare an Environmental Study Report to document the planning process followed under the Class Environmental Assessment for Minor Transmission Facilities.
Feeder	A current-carrying electrical connection between the overhead contact system and a traction power facility (substation, paralleling station or switching station).
Gantry	Supporting structures parallel to the tracks, and on both sides of the tracks, at TSS, SWS, and PS used to connect the traction power feeders to the catenary.
Grounding	Connecting to earth through a ground connection or connections of sufficiently low impedance and having sufficient current-carrying capacity to limit the build-up of voltages to levels below that which may result in undue hazard to persons or to connected equipment.
Grounding Grid	A system of horizontal ground electrodes that consists of a number of interconnected, bare conductors buried in the earth, providing a common ground for electrical devices or metallic structures, usually in one specific location.
Heavy Maintenance	Heavy maintenance includes: replacement of engine traction motors, replacement of diesel engines on DMUs, replacement of transformers and ac propulsion systems on EMUs and replacement of wheel sets on engines. On railcars, heavy maintenance includes the replacement of wheel sets, repairs to windows and brake lines, and body repairs.
HV	Acronym for high voltages and refers to electrical energy at voltages high enough to cause injury and harm to human beings and living species. Voltages over 1000 V for alternating current, and 1500 V for direct current is considered high voltage.

Hydro One	Hydro One Incorporated delivers electricity across the province of Ontario. Hydro One has four subsidiaries, the largest being Hydro One Networks. They operate 97% of the high voltage transmission grid throughout Ontario.
Immunity	The ability of equipment to perform as intended without degradation in the presence of an electromagnetic disturbance.
Impedance Bonds	An electrical device located between the rails consisting of a coil with a centre tap used to bridge insulated rail joints in order to prevent track circuit energy from bridging the insulated joint while allowing the traction return current to bypass the insulated joint. The centre tap can also be used to provide a connection from the rails to the static wire and/or traction power facilities for the traction return current.
kV	Abbreviation for kilovolt (equal to 1000 volts).
LV	Acronym for low voltage and according to IEC voltages between 50-1000 V for alternating current, and between 120-1500 V for direct current is considered low voltage.
Main Gantry	These 25 kV feeders from the TPF will be connected to the OCS with the help of main and strain gantries and a cross feeder arrangement. The main gantry also referred to as the catenary feeding gantry is the one parallel to and toward the TPF side of the track.
Maintenance Facility	A mechanical facility for the maintenance, repair, and inspection of engines and railcars.
Messenger Wire	In catenary construction, the OCS Messenger Wire is a longitudinal bare stranded conductor that physically supports the contact wire or wires either directly or indirectly by means of hangers or hanger clips and is electrically common with the contact wire(s).
Mid-span	Area between two OCS registration points.
Minister	Ontario Minister of the Environment.
Mitigation Measure	Actions that remove or alleviate, to some degree, the negative effects associated with the implementation of an alternative.
MOE	The acronym for Ontario Ministry of the Environment.
MVA	The acronym for Megavolt-Ampere. This is a unit for measuring the apparent power in an electrical circuit equivalent of one million watts.
Negative Feeder	Negative feeder is an overhead conductor supported on the same structure as the catenary conductors, which is at a voltage of 25 kV with respect to ground but 1800 out-of-phase with respect to the voltage on the catenary. Therefore, the voltage between the catenary conductors and the negative feeder is 50 kV nominal. The negative feeder connects successive feeding points, and is connected to one terminal of an autotransformer in the traction power facilities via a circuit breaker or disconnect switch. At these facilities, the other terminal of the

	autotransformer is connected to a catenary section or sections via circuit breakers or disconnects.
Net Effect	The effect (positive or negative) associated with an alternative after the application of avoidance/mitigation/compensation/enhancement measures.
Notice of Commencement	The Proponent is required to prepare and distribute a Notice of Commencement, which “starts the clock ticking” for the 120-day portion of the transit project assessment process. Proponents must prepare and distribute a Notice of Commencement to indicate that the assessment of a transit project is proceeding under the transit project assessment process. Proponents must complete their documentation (the Environmental Project Report) of the transit project assessment process within 120 days of distributing the Notice of Commencement.
Notice of Completion	The Notice of Completion must be given within 120 days of the distribution of the Notice of Commencement (not including any “time outs” that might have been taken). The Notice of Completion of Environmental Project Report signals that the Environmental Project Report has been prepared in accordance with section 9 of the regulation and indicates that the Environmental Project Report is available for final review and comment (for 30 calendar days). Following the 30-day public review period, there is a 35-day Minister’s decision period.
Open Route	An area of tracks where there is no vertical conflicts to OCS.
Overhead Contact System (OCS)	OCS is comprised of: <ol style="list-style-type: none"> 1. The aerial supply system that delivers 2x25 kV traction power from traction power substations to the pantographs of Metrolinx electric trains, comprising the catenary system messenger and contact wires, hangers, associated supports and structures including poles, portals, head spans and their foundations), manual and/or motor operated disconnect switches, insulators, phase breaks, section insulators, conductor termination and tensioning devices, downguys, and other overhead line hardware and fittings. 2. Portions of the traction power return system consisting of the negative feeders and aerial static wires, and their associated connections and cabling.
Overhead Structure	A structure that allows a road to cross over a railway underneath.
Overpass	A structure that allows a railway to cross over a road or watercourse underneath.
Pantograph	Device on the top of a train that slides along the contact wire to transmit electric power from the catenary to the train.
Paralleling Station (PS)	An installation which helps boost the OCS voltage and reduce the running rail return current by means of the autotransformer feed configuration. The negative feeders and the catenary conductors are connected to the two outer terminals of the autotransformer winding at this location with the center terminal connected to the traction return system. The OCS sections can be connected in parallel at PS locations.
Performance Standards	General specifications and criteria that define the parameters and requirements of

	a particular system.
Phase Break	An arrangement of insulators and grounded or non-energized wires or insulated overlaps, forming a neutral section, which is located between two sections of OCS that are fed from different phases or at different frequencies or voltages, under which a pantograph may pass without shorting or bridging the phases, frequencies, or voltages.

Portal	Portal is an OCS structure that spans over the tracks between two OCS support poles located on the sides of the tracks in order to support the electrification equipment. The portal structure is used at multiple track locations where cantilever frames are not practical.
Portal Boom	Top steel section or truss/lattice at the top of the portal structure, supported by two columns placed either side of the railway. The “portal boom” provides support points for the OCS conductors.
Positive Train Control	A signalling system using on board and wayside equipment to automatically reduce the speed, or stop a train depending on the conditions on the track ahead.
Potential Effect	A possible or probable effect of implementing a particular alternative.
Preliminary Design	The design of a proposed project (including a detailed cost estimate) to a level that demonstrates that the project is buildable within the given parameters of the design scope.
Preventive Maintenance	Preventive maintenance includes items such as: replacing brake pads, measuring wheels, inspection of running gear, inspection and repair of central air conditioning, check radios and repair/replace, repair broken windows and doors, etc.
Proponent	A person who carries out or proposes to carry out an undertaking or is the owner or person having charge, management or control of an undertaking.
Rail Potential	Rail Potential is defined as the voltage between running rails and ground occurring under operating conditions when the running rails are utilized for carrying the traction return current or under fault conditions.
Receptor	‘Receptor’ or ‘point of reception’ generally refers to any point on the premises of a person where sound or vibration is received which originated from somewhere else. Examples of receptors or points of reception include: permanent or seasonal residences, hotels/motels, nursing/retirement homes, rental residence, hospitals, camp grounds, noise sensitive buildings such as schools and places of worship.
Resilient Arm	A combined registration and support assembly with vertical resilience, used for support of catenary conductors in situations with restricted clearance such as tunnels and overhead bridges.
Running Rails	Rails that act as a running surface for the flanged wheels of a car or locomotive.
SCADA	The acronym for System Control And Data Acquisition. SCADA is a control system that controls and monitors the status of the industrial processes and devices for the electrification system. These devices may include motor operated disconnect switch, relay, meter and circuit break, of the Electrification System.
Screening	The process of applying criteria to a set of alternatives in order to eliminate those that do not meet minimum conditions or requirements.
Service Maintenance	Service maintenance is the light maintenance of engines (i.e., window cleaning, check oil levels and sand levels, clean engine cab, refill potable water, and empty

	washroom holding tanks).
Shield	As normally applied to instrumentation cables, refers to a conductive sheath (usually metallic) applied, over the insulation of a conductor or conductors, for the purpose of providing means to reduce coupling between the conductors so shielded and other conductors that may be susceptible to, or which may be generating, unwanted electrostatic or electromagnetic fields (noise).
Shielding	<p>Shielding is the use of the conducting and/or ferromagnetic barrier between a potentially disturbing noise source and sensitive circuitry. Shields are used to protect cables (data and power) and electronic circuits. They may be in the form of metal barriers, enclosures, or wrappings around source circuits and receiving circuits.</p> <p>Additionally shielding is used to protect overhead transmission lines or OCS from incidents of lightning, in regions of high Isokeraunic activity. Shield wire is located above the exposed current carrying wires to provide a 45 degree angle of protection. In sensitive applications, the angle is reduced to 30 degrees for more conservative design.</p>
Signal System	The rail signal system is a combination of wayside and on board equipment and/or software to provide for the routing and safe spacing of trains or rail vehicles.
Spur	A railroad track that diverges from the main track to service a specific location or industry.
Static Wire (Aerial Ground Wire)	A wire, usually installed aerially adjacent to or above the catenary conductors and negative feeders, that connects OCS supports collectively to ground or to the grounded running rails to protect people and installations in case of an electrical fault.
Strain Gantry	These 25 kV feeders from the TPF will be connected to the OCS with the help of main and strain gantries and a cross feeder arrangement. The strain gantry is located within the railroad right-of-way (ROW) parallel to and on the opposite side of the track from the TPF, with footprints exactly equal to that of the main gantry.
Traction Power Substation	Electric Traction Facility that transforms the utility supply voltage of 230 kV to 50 kV and 25 kV for distribution to the trains via catenary and negative feeders.
Switching Station (SWS)	SWS is an installation where the supplies from two adjacent traction power substations are electrically separated and where electrical energy can be supplied to an adjacent but normally separated electrical section during contingency power supply conditions. It also acts as a paralleling station.
Touch/Step Potential	Touch potential is defined as the voltage between the energized object and the feet of a person in contact with the object. Step potential is defined as the voltage between the feet of a person standing near an energized grounded object.
Top of Rail	Top of Rail is defined as the highest point in a running rail profile.
Traction Electrification System (TES)	TES is the combination of the traction power supply system (TPSS), the overhead contact system (OCS), and the traction power return system, together with

	appropriate interfaces to the TES related supervisory control and data acquisition (SCADA) system. It forms a fully functional 2x25 kV ac traction power supply and distribution system and provides the traction power to the electrically powered vehicles on the Metrolinx electrified railway line.
Traction Power Facilities (TPF)	TPFs include: traction power substations (TPS), switching stations (SWS), and paralleling stations (PS).
Traction Power Return System	<p>The traction power return system includes all conductors (including the grounding system) for the electrified railway tracks, which form the intended path of the traction return current from the electrified rolling stock to the traction power substations. Conductors may include:</p> <ul style="list-style-type: none"> • Running rails • Impedance bonds • Static wires, and buried ground or return conductors • Rail and track bonds, • Return cables, including all return circuit bonding and grounding interconnections • Ground • Negative feeders due to the configuration of autotransformer connections

Traction Power Supply System (TPSS)	TPSS is the railway traction distribution network used to provide energy to Metrolinx electric trains, which comprises incoming high voltage supplies, traction power substations (TPS); at which power is converted from high voltage to nominal 2x25 kV railway traction voltage to the overhead contact system (OCS), other traction switching facilities including switching stations (SWS) and paralleling stations (PS), and connections to the OCS and the traction return and grounding system.
TPAP	The acronym for Transit Project Assessment Process. The transit project assessment process is defined in sections 6 – 17 in Ontario Regulation 231/08: Transit projects and Metrolinx Undertakings. Proponents must complete the prescribed steps of the transit project assessment process within specified time frames. The process allows for a six month assessment process whereby potential environmental effects of the transit project are identified, assessed and documented. The proponent must issue a Notice of Completion within 120 days of issuing the Notice of Commencement.
Traction Power Substation (TPS)	TPS is an electrical installation where power is received at high voltage and transformed to the voltage and characteristics required at the OCS for the nominal 2x25 kV system, containing equipment such as transformers, circuit breakers and sectionalizing switches. It also includes the incoming high voltage lines from the power supply utility.
TS	The Acronym for Transformer Station.
Transit Project	Defined as an undertaking consisting of: <ul style="list-style-type: none"> (a) An enterprise or activity that is the planning, designing, establishing, constructing, operating, changing or retiring of a facility or service that, aside from any incidental use for walking, bicycling or other means of transporting people by human power, is used exclusively for the transportation of passengers by bus or rail, or anything that is ancillary to a facility or service that is used to support or facilitate the transportation of passengers by bus or rail; or, (b) A proposal, plan, or program in respect of an enterprise or activity described in clause (a) above.
Transmission Line	Transmission lines electrically interconnect generating power plants and electrical substations located near demand centers for bulk transfer of electrical energy over long distances, at a high voltage generally 115 kV or higher. Transmission of power at high voltage is distinct from the local wiring between high-voltage substations and customers, which is typically referred to as electric power distribution. Transmission lines, when interconnected with each other, are called transmission network or electric grid.
Tunnel Arm	A combined registration and support assembly used for support of catenary conductors within a tunnel where there is not enough clearance for OCS portal and cantilever structures.
Underground Cable	A current-carrying electrical connection between the overhead contact system and a traction power facility (substation, paralleling station or switching station.