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# Hamilton Rapid Transit Preliminary Design and Feasibility Study

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## B-LINE

### COST ESTIMATE REPORT

Version: 1.0





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February 2012



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## 1.0 Introduction

The cost estimate report has been prepared for the preliminary engineering phase of the B-Line of the Hamilton LRT project. Results of the cost estimate are presented in the format denominated by Infrastructure Ontario – Request for Information Template, see Appendix A.

The project is the construction of an LRT on dedicated and shared right of way for an extension of nearly 14km from McMaster University to Eastgate Square, construction of power sub-station buildings, power distribution via a catenary system, guideway, construction of an LRT only bridge at the 403 crossing, modifications or removal as required of the skywalk pedestrian bridge and structural reconditioning of the Red Hill Valley parkway bridge and 18 LRT stops which include the terminal stops at the McMaster and Eastgate termini.

This report sets out the basis of the capital cost estimate. A summary of the operations and maintenance costs is also included, the build-up of the O&M costs is given in the Preliminary Operations and Maintenance Plan.

The costs presented in this report are at 2011 price base and are subject to a +/- 15% - 20% variation. An overall price contingency of around 25% is associated with the works excluding the cost of professional services and vehicles. Such contingency should be revised after further consultation with the utility companies as recommended in the Utility Relocation Strategy report.

## 2.0 Cost estimate basis

The cost estimate for the project is based on a quantity take off approach; this is feasible as preliminary engineering has been carried out for the entire corridor which identifies the required major works.

The quantity take off are as measured from the plan and profile drawings for the project dated September 2011 and submitted to the City of Hamilton.

## 3.0 Scope of estimation

For the determination of the cost for all the work items, unit cost charts were developed for each work category for the civil works, systems and buildings. The rates in this chart include all costs of materials supply, transportation and storage, installation testing and commissioning.

The estimation for private utilities such as hydro, telecommunications companies and gas includes the cost of moving the infrastructure such as duct banks, chambers, etc. However, the type of cables in place, and the complexity of their relocation is currently unknown and therefore their cost cannot be estimated. That said, it is expected that further costs arising would be covered by the contingency amount.

The following categories were developed in detail for the Cost estimate report.

### 10 Roadway Removals and Site works

This item includes the removal of all existing pavement surfaces along the corridor for the construction of the guideway (curbs, full depth pavement, grass median, etc). This item also includes the removal of 150 trees identified as being in conflict. It also includes the installation of temporary detouring and the maintenance of traffic control during the construction period.

### 20 Stops

This item includes all the civil works for the construction of all stops (side running and centre) it also includes the stop at the Eastgate Square terminal where a bus interface will be provided, although its actual design will be subject to further consultations with stakeholders. This item also includes the transit stop shelters, railings, seats and other accessories.

**30 Road Works**

This item includes the road and sidewalk works required, including any widening. . This item also includes the relocation cost of all signs, signal heads, light standards, Controllers, junctions boxes and pavement line painting.

**40 Guideway Structures**

This item includes the elements of the concrete guideway, guideway curb, track cross gutter drain and weep drain.

**45 Bridges and Retaining Walls**

This item includes the construction of the new bridge over the Highway 403 and the reconditioning of the bridge over the Red Hill Valley Parkway and all other structures currently identified as required.

**50 Right of Way electrical and system wide duct bank**

This item includes the installation of the guideway electrical cable, major modification of 69 existing signals, the construction of a system wide communications duct bank and street lighting.

**60 Utilities**

This item covers all costs to remove, relocate, abandon and install all structures for the municipal services (potable water distribution, waste water, storm water). It also includes the cost for relocation of infrastructure for hydro, communications and gas (duct banks, vaults, valves, chamber, etc).

**70 Track Work**

This item includes the cost for installation of embedded track for the guideway and all special trackwork for the system. The track item in the table 6-1 includes an allowance for the guideway connection from the MSF to the main line of approximately 1.25km.

**80 Traction Power**

This item includes the installation of approximately 350 Overhead Catenary Poles and respective Overhead Catenary System (OCS)

**90 LRT Signalling and Communications**

This is a lump sum item for the signalling and communications and a lump sum item for the fare equipment (ticket vending/validation machines)

**100 Traction Power Sub Stations (TPSS) buildings.**

This items includes the construction and equipping of seven (7) TPSS, three (3) are assumed underground and four (4) are assumed at surface.

**Vehicles**

The cost of the vehicles includes the provision of 22 low floor light rail vehicles, it has been assumed based on recent information for the cost of procurement of light rail vehicles for Metrolinx.

**Property**

The cost of property required for the construction of the project has been determined based on area requirements of commercial, institutional and residential. An estimated average cost per metre is assumed. Such cost assumptions have to be confirmed by the City of Hamilton.

Design, project management, project insurances and operations preparation

As noted above an overall price contingency of around 25% of the cost of the work (excluding the cost of professional services and vehicles) has been included. The entire contingency is logged as Unallocated Contingency.

The cost estimate of the following works are included in the estimate, but are presented at higher level than preliminary engineering and will need to be confirmed in the next phase.

- Route survey
- Further Environmental investigations or additional identifiable mitigation requirements
- Site restoration beyond the works defined in the applicable cross sections
- Landscaping in addition to restoration of the identifiable works
- Utility relocations
- Community relations
- Maintenance and Storage Facility (not defined in the preliminary engineering phase)
- Environmental permitting

## 4.0 Source of data

The source of data is as follows:

Civil works:	The labour, plant and material costs are from SNC's historical data for similar projects in Canada. Parts of utility material prices are from vendor's published prices.
Systems:	The systems are factored on a cost per track meter from similar recent projects in Canada.
Tracks:	The track works are also based on a cost per track meter.
Property:	Based on actual areas measured for residential, commercial and institutional, unit cost is an estimate of property values in Hamilton (to be validated by City data base)
Vehicles:	based on recent acquisition of similar LRT vehicles for Toronto
Professional Services:	Consultant's estimate

## 5.0 Cost estimate limitations

The current cost estimate has inherent limitations which are further developed in the following sections.

### 5.1 Further cost efforts

It is recommended that the utility relocation strategy drawings be submitted for evaluation and comments from all the utility companies. Normally utility companies carry their own internal feasibility, preliminary engineering and cost estimate of relocation based on their own knowledge of their network complexity.

### 5.2 Issues exclusions limitations

The cost of the complexity of relocating the hydro and telecom plant is not included in this cost estimate, the current assumption to move/replace is the like-for-like approach. However it is known that network complexity plays a big role in feasibility and cost.

**Other Exclusions**

- Escalation in costs after Nov 2011 base date for the estimate
- Further studies and preliminary engineering
- Existing utility study and survey
- Geotechnical and surveying
- Environmental approval process
- All taxes
- Unforeseeable project financing costs including interest during construction
- Effects that currency fluctuation might have on foreign components
- Studies to confirm vibration isolation requirements
- Cost associated with mitigation of Electro Magnetic Interference (EMI)

**6.0 Cost estimate result**

Table 6-1 shows the construction cost and table 6-2 shows the operations cost.

Table 6-1 Breakdown of construction cost as per base year 2011

	Totals
<b>GUIDEWAY &amp; TRACK ELEMENTS</b>	
Guideway: At-grade exclusive right-of-way	\$32,628,197
Guideway: At-grade semi-exclusive (allows cross-traffic)	\$32,628,197
Guideway: Aerial structure	\$14,555,300
Track: Embedded	\$95,210,065
Track: Vibration and noise dampening	\$7,880,000
<b>Subtotal—GUIDEWAY &amp; TRACK ELEMENTS</b>	<b>\$182,901,760</b>
<b>STATIONS, STOPS, TERMINALS, INTERMODAL</b>	
At-grade station, stop, shelter, mall, terminal, platform	\$12,496,400
<b>Subtotal—STATIONS, STOPS, TERMINALS, INTERMODAL</b>	<b>\$12,496,400</b>
<b>SUPPORT FACILITIES: YARDS, SHOPS, ADMIN. BLDGS</b>	
Light Maintenance Facility	\$48,480,143
<b>Subtotal—SUPPORT FACILITIES: YARDS, SHOPS, ADMIN. BLDGS</b>	<b>\$48,480,143</b>
<b>SITework &amp; SPECIAL CONDITIONS</b>	
Demolition, Clearing, Earthwork	\$16,122,381
Site Utilities, Utility Relocation	\$57,309,254
Environmental mitigation, e.g. wetlands, historic/archeologic, parks	\$5,261,654
Site structures including retaining walls, sound walls	\$160,000
Pedestrian / bike access and accommodation, landscaping	\$2,035,420
Automobile, bus, van accessways including roads, parking lots	\$14,689,313
Temporary Facilities and other indirect costs during construction	\$0
<b>Subtotal—SITework &amp; SPECIAL CONDITIONS</b>	<b>\$95,578,021</b>
<b>SYSTEMS</b>	
Traction power supply: substations	\$5,030,000
Traction power distribution: catenary and third rail	\$53,520,250
Communications	\$28,000,000
Fare collection system and equipment	\$4,200,000
<b>Subtotal—SYSTEMS</b>	<b>\$90,750,250</b>
<b>ROW, LAND, EXISTING IMPROVEMENTS</b>	
Purchase or lease of real estate	\$34,557,000
<b>Subtotal—ROW, LAND, EXISTING IMPROVEMENTS</b>	<b>\$34,557,000</b>
<b>VEHICLES (number)</b>	
Light Rail	\$110,000,000
<b>Subtotal—VEHICLES</b>	<b>\$110,000,000</b>
<b>PROFESSIONAL SERVICES</b>	
Final Design	\$30,731,493
Construction Administration & Management	\$55,000,000
Insurance	\$8,250,000
Legal; Permits; Review Fees by other agencies, cities, etc.	\$2,150,000
Surveys, Testing, Investigation, Inspection	\$4,300,000
Start up	\$20,000,000
<b>Subtotal—PROFESSIONAL SERVICES</b>	<b>\$120,431,493</b>
<b>UNALLOCATED CONTINGENCY</b>	<b>\$116,190,893</b>
<b>FINANCE CHARGES</b>	<b>N/A</b>
<b>TOTAL—ALL CATEGORIES</b>	<b>\$811,385,961</b>

Table 6-2 Breakdown of operations cost as per base year 2011

<b>OPERATIONS AND MAINTENANCE</b>	
<b>Rolling Stock</b>	
Custodial & Preventive Maintenance	\$296,505
Corrective Maintenance	\$98,835
Capital Maintenance & Rehabilitation	
<b>Total Rolling Stock</b>	<b>\$395,340</b>
<b>Structures</b>	
Maintenance	
Capital Maintenance & Rehabilitation	
Custodial & Preventive Maintenance	
<b>Total Structures</b>	<b>\$0</b>
<b>Facilities (tunnels, bridges, etc.)</b>	
Capital Maintenance & Rehabilitation	
<b>Total Facilities</b>	<b>\$0</b>
<b>Wayside (tracks, busway, systems, signals, fare collections, etc)</b>	
Preventive Maintenance	\$130,695
Corrective Maintenance	\$43,565
Capital Maintenance & Rehabilitation	
<b>Total Wayside</b>	<b>\$174,260</b>
<b>Operations &amp; Administration (Overhead)</b>	
Operations	\$9,435,600
Administration	\$3,965,422
<b>Total Operations &amp; Administration (Overhead)</b>	<b>\$13,401,022</b>
<b>Transit Energy and Power Cost</b>	
Electricity	\$488,900
Fuel	
Other	
<b>Total Transit Energy and Power Cost</b>	<b>\$488,900</b>
<b>TOTAL—ALL CATEGORIES</b>	<b>\$14,459,522</b>

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