



Hamilton Rapid Transit Preliminary Design and Feasibility Study

B-LINE

PRELIMINARY OPERATIONS & MAINTENANCE PLAN

Version: 1.0



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An agency of the Government of Ontario



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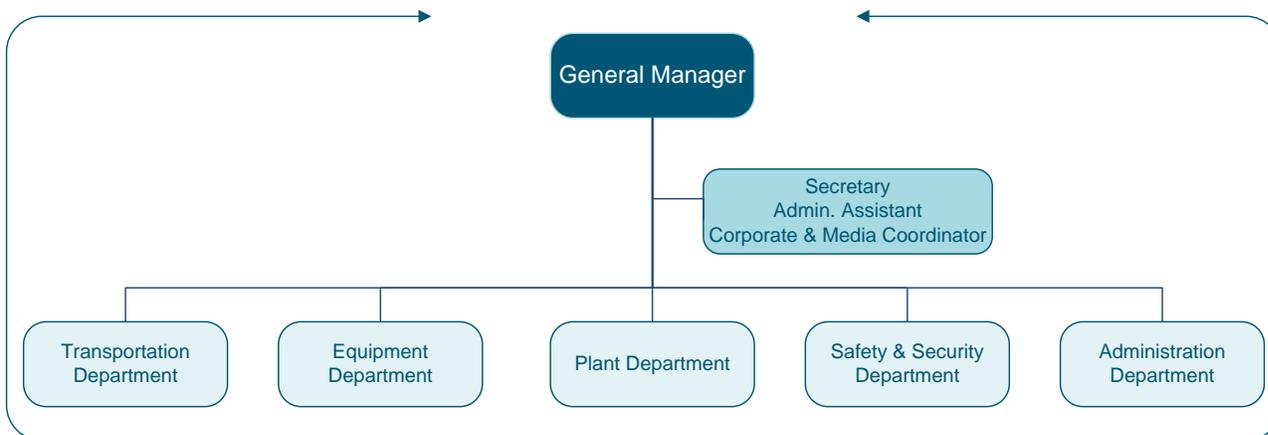
Executive Summary

The City of Hamilton’s proposed B-Line will require a new operations and maintenance organisation as well as additional equipment. Adequate coordination is required to establish the organisation, as well as prepare for future operational growth and challenges.

The Preliminary Operations and Maintenance Plan (POMP) establishes an organisation based on typical operations and maintenance practices used worldwide. Based on the Operations and Maintenance Plan, costs to operate the system have been derived and are listed towards the end of this report.

The organisation established herein assumes a standalone staffing structure which aligns with the existing City organisation. Some of the functions identified may be carried out by current city staff, therefore reducing the number of staff required for the LRT; however, staff will have to be identified to carry out all appropriate functions.

The general organisation and hierarchy is shown below.



The above organisation will be sizable, requiring an estimated 182 staff to carry out all of its functions. The combination of the labour, maintenance and power costs of the vehicles and of the LRT system account for approximately **\$14,459,522** in operating costs per year.

The estimated costs required per annum are listed in the table below:

Item	Per Annum
Labour Costs <i>(Admin, operation, maintenance)</i>	\$ 12,050,200.00
Vehicle Maintenance Costs	\$ 395,340.00
Track maintenance / rail replacement	\$ 84,260.00
Power Costs	\$ 488,900.00
Cost for parts for maintenance of Catenary and TPSS	\$ 60,000.00
Cost for parts for maintenance of Communication & fare collection equipment	\$ 30,000.00
Office supplies	\$ 36,320.00
10% insurance, rates, property taxes, etc.	\$ 1,314,502.00
TOTAL	\$ 14,459,522.00

1.0 Introduction

This Preliminary Operations and Maintenance Plan (POMP) is intended to illustrate ways in which the new organisation will structure itself, based on a primarily autonomous LRT Operations and Support structure. The discussions herein are restricted to the support requirements for the B-Line, but provide a framework which may be scaled to suit the expansion of the system.

The POMP provides a preliminary structure of the organization to operate the LRT system. It has been defined on the assumption that the LRT system is a direct operating division of the City of Hamilton. However, the operating structure has not yet been decided and alternatives including a concession arrangement are possible.

The POMP outlines the elements which will be included in the Final Operations and Maintenance Plan to be developed during the detailed design phase. This plan is necessary to ensure that the transit system will meet the requirements of the public with respect to:

- Safety
- Security
- Reliability
- Travel Time
- Convenience
- Comfort
- Reasonable Cost

At the time of writing this report, the location of the maintenance and storage facility (MSF) has not been confirmed. For the purposes of this study, the location of the MSF has been assumed to be approximately 1.5km from the B-Line alignment and that assumption will form the basis for the non-revenue distances travelled.

2.0 System Operations

In order for any transit system to operate smoothly the needs of the users and the restrictions on operations must be evaluated during the planning cycle. These needs and restrictions form the basis upon which an optimal system arrangement can be determined. During the preliminary design process for the B-Line significant data was gathered and analysed, and from this analysis the requirements for basic services, and staffing were determined.

2.1 Anticipated System Demand

The projected demand for the B-Line is given in the *Integrated Transit Systems Operations Plan*. This document also provides the initial and peak vehicles schedule whose numbers are used as a basis for this POMP.

2.2 System Operating Parameters

The analysis of the system requirements determined that to meet the present and future needs of the City of Hamilton, the B-Line must meet the following basic performance requirements:

Specification	Unit
Total Length of Service	13.9 km
Travel Time One Way	33 min
Operational Speed	25.3 km/h
Terminal Layover Time	6 min
Round Trip Time	76 min

Table 2-1 - System Performance Requirements

2.3 Operations Scenarios

The proposed initial Service Plan for the B-Line is shown in **Table 2-2**.

Period	Weekday Hours	Headway minutes	Saturday Hours	Headway minutes	Sunday/Holiday Hours	Headway minutes
Early	0500 - 0700	7.5	0500 - 0900	10.0	0500 - 1100	10.0
AM Peak	0700 - 1000	4.0	-	-	-	-
Midday	1000 - 1400	6.0	0900 - 1800	6.0	1100 - 1800	7.5
PM Peak	1400 - 1830	4.0	-	-	-	-
Evening	1830 - 0130	7.5	1800 - 0130	7.5	1800 - 0030	10.0

Table 2-2 - Operating Schedule and Headway Requirements

In order to achieve the system performance shown above the fleet required is 22 vehicles, including operational and stand-by vehicles. The number of vehicles in operation required based on the headways per the operating schedule is listed in **Table 2-3** below.

Headway minutes	Vehicles in Operation	Stand-by Spares
4.0	19	3
6.0	13	2
7.5	10	2
10.0	8	1

Table 2-3 - Fleet Deployment Requirements

Analysis of the operating parameters, operating schedule, and fleet size has indicated the anticipated vehicle trips, distances travelled, and operating hours both daily and annually. These results are summarized in **Table 2-4** below.

	Average Operating Day	Annual
1 Total Round Trips	213	77,813
2 Fleet Vehicle Distances Travelled		
Revenue Service (km)	5,644	2,060,021
Non-Revenue Service (km)*	80	97,571
Total (km)	5,723	2,157,592
3 Fleet Vehicle Operating Hours		
Revenue Service (hrs)	270	98,563
Non-Revenue Service (hrs)	3	3,252
Total (hrs)	273	101,815

* Maintenance circulation at MSF are not included, MSF assumed 1.5 km from main line

Table 2-4 - Estimated Trips, Distance travelled (in Kilometres), and Vehicle Hours Based on Preliminary Operations Schedule

3.0 Operations Plan

The objective of any System Operator is to provide a safe, reliable, clean and efficient transit service to its customers, as reflected in the Operators' organisational structure.

Although the planned transit service does not provide revenue service on a 24-hour basis, the organisation must be designed recognizing that certain activities, such as security and some maintenance if required, will have to be undertaken on a 24-hour basis. Also, certain functions can only be performed when the system is shut down, e.g. rail and overhead catenary maintenance.

Additionally, it is more efficient and cost effective to undertake vehicle inspections and maintenance in the periods when few or no vehicles are required for revenue service and the remainder of the fleet is available for maintenance such as during late evenings, nights and weekends. The organisational structure and staffing schedules need to be developed to reflect this type of maintenance.

3.1 Organisation

In order to operate efficiently, the organisation structure will be developed to clearly identify areas of responsibility and lines of authority. The organisation charts shown in the following Figures 3-1 - 3-6 reflect this important concept.

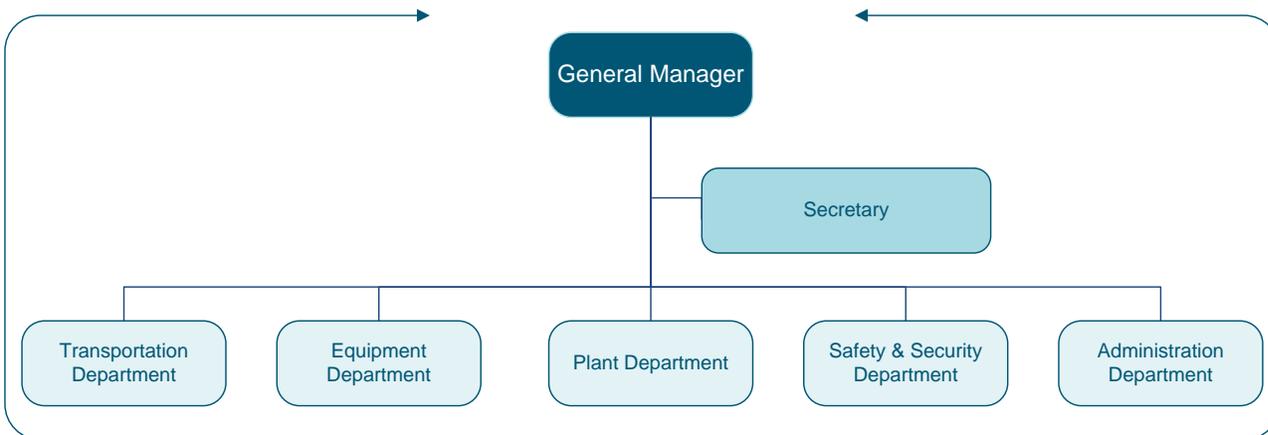


Figure 3-1 - Proposed Operations and Maintenance (O&M) Organisational Structure

3.1.1 General Manager's Office

The General Manager is responsible for organising and providing management direction to the transit staff. This office coordinates the activities of the Operations Departments and the Administration Department and is responsible for the performance of all aspects of the transit service.

3.1.2 Transportation Department

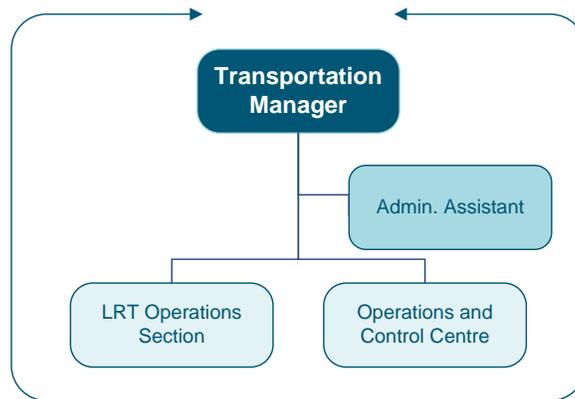


Figure 3-2 - Proposed Transportation Department Organisational Structure

The Transportation Department is responsible for the daily operation of the system and supplying service to its customers. This includes:

- Operating the LRT vehicles; and
- Monitoring, supervising, and controlling the service from Central Control.

The employees of this department are the representatives of the LRT B-Line Operator who deal with the customers and therefore should be easily identifiable, i.e. dressed in corporate uniforms.

These employees work in shifts, seven days a week. They provide varying levels of service, to meet the travelling demands of the public.

The organisational structure of the Transportation Department reflects the type of work to be undertaken, staffing requirements and the duration of service to be provided.

3.1.3 Equipment Department

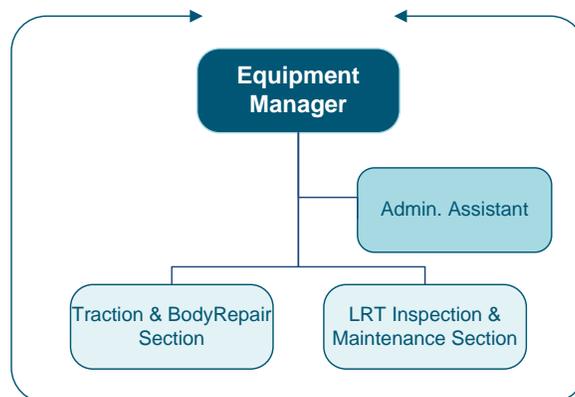


Figure 3-3 - Proposed Equipment Department Organisational Structure

The Equipment department is responsible for vehicles maintenance and servicing. This includes everything that is required to provide safe, reliable and clean vehicles for revenue service.

The maintenance schedule will be specified by the vehicle manufacturer and agreed as part of the procurement process. On a scheduled basis, all vehicles will undergo safety tests and inspections. Some tests and inspections will be carried out on a daily basis, while others will take place on a mileage-operated basis or calendar basis. On a daily basis, the inspection will include a visual check of all exposed components and sub-systems to verify that there are no obvious defects. Additionally, a functional test will be performed to verify that all vehicles systems are fully operational.

A preventative maintenance program will be developed based on mileage-operated or calendar basis and manufacturer's recommendations. There will be a number of schedules, i.e. monthly, quarterly and annually, when the vehicle will be put in the maintenance shop for various lengths of time.

A program for major overhauls will also be needed. This will be based on operational experience and manufacturer's recommendations. It will include major component replacement and a very intensive vehicle body inspection. The major overhaul program will also address the repair/rebuilding of the components replaced so that they can be re-used on another vehicle.

On-line maintenance staff will handle LRT vehicle problems during revenue service. If the problem cannot be solved by the line mechanics, the vehicle will be taken out of service and a replacement (change-off) will be arranged from the spares on standby. In the event of a major problem which causes a service delay the primary objective will be to safely remove the vehicle from the system. This could mean storing the vehicle in the tail tracks or on-line track storage until after revenue service, when it will be moved to the maintenance facilities.

Wheel turning, to restore the true profile and correct flat spots, will be done during one of the scheduled maintenance periods and on an as-required basis.

The organisational structure for the Equipment Department is developed recognizing the types of work to be undertaken: staffing requirements, facilities available, vehicle availability, and time of day the work is to be performed.

It is anticipated that engineering works related to the vehicles themselves will be a part of the manufacturer's services during the warranty period. Subsequent to the warranty period those engineering services are best contracted to the manufacturer on a retainer basis.

3.1.4 Plant Department

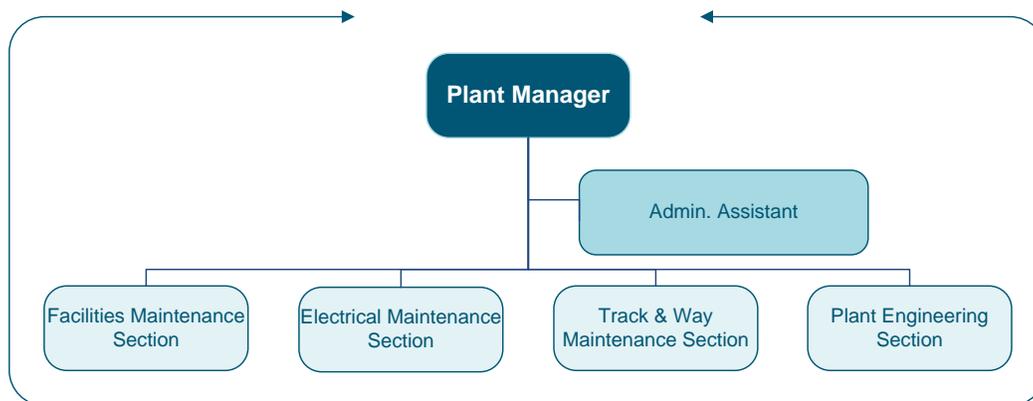


Figure 3-4 - Proposed Plant Department Organisational Structure

The Plant Department is responsible for the maintenance of the fixed assets. These includes:

- The stops;
- Tracks and right-of-way; and
- Shops, offices and yards.

The employees of this department include all the building trades; carpenters, plumbers, painters, electricians, etc., plus the specialized maintenance personnel to deal with communication systems, electronic equipment repair and traction power equipment.

Employees in this department also provide janitorial services at the stops, offices, workshops, etc.

Some of the work undertaken by this department is done on an as-required basis, such as plumbing repairs, while other work is done on a scheduled basis. The department therefore must be organized so that it can handle both emergency and scheduled work as well as have a management information system to track both.

The department will also have an engineering group, which will provide electrical, structural and architectural services, plus track and right-of-way engineering.

The organisational structure of the Plant Department has been developed recognizing the varied types of work to be undertaken: staffing requirements; facilities to be maintained and the time of day the work is to be performed.

Some groups within the plant department may be managed using contracted staff, with appropriate requirements written into the contract requirements for the tasks allocated.

3.1.5 Administration Department

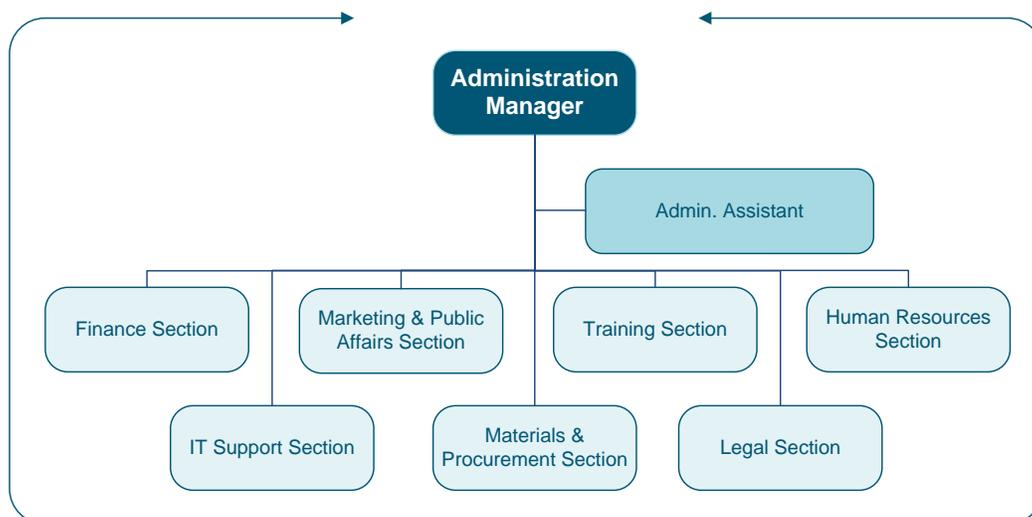


Figure 3-5 - Proposed Administration Department Organisational Structure

The Administration Department is responsible for providing the following functions:

- Financial management, revenue collection (counting and sorting);
- Legal;
- Human resources;
- Materials and procurement (including warehouse operation);
- Marketing and public affairs – service planning; and
- IT support services.

The organisational structure for this department is developed recognizing the administration functions necessary for a successful operator.

3.1.6 Safety & Security Department

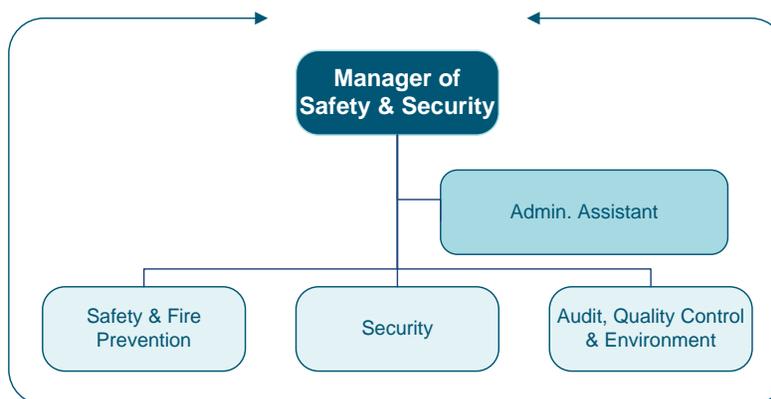


Figure 3-6 - Proposed Safety & Security Organisational Structure

The Safety and Security Department is responsible for the development and implementation of an effective program to ensure the safety and security of passengers and staff of the transit system and its facilities. The department will oversee the auditing, quality assurance and environmental monitoring for the transit system.

In addition, this department will be responsible for staffing the gates, yard patrol, the maintenance and storage facilities and the Administration building, thereby providing security to these facilities. The security staff will be responsible for security on the LRT vehicles.

The organisation structure has been developed to recognize the responsibilities of this department on a twenty-four hour, seven days a week basis.

3.2 Position Descriptions

3.2.1 General Manager's Office

General Manager

The General Manager will have the overall responsibility for the operation, maintenance and administration activities including:

- organizing and providing management direction to the operating, maintenance and administration functions;
- setting safety and performance goals and establishing procedures and guidelines to achieve them;
- corporate planning and budgeting;
- implementing and enforcing policy directives; and
- assessing challenges and trends and implementing corrective action where required.

This position requires a manager with experience in both an operating and administrative environment. The incumbent should have a University degree in Engineering or Business Administration.

3.2.2 Transportation Department

Transportation Manager

The Transportation Manager, reporting to the General Manager, will have the overall responsibility for operating the transit service. This includes the operation of LRVs and the Operations Control Centre. The duties of this position will include:

- coordinating LRV operations activities;

- developing and enforcing safety and operating rules and procedures to provide a safe and customer-oriented transit system;
- reviewing operating performance and identifying changes needed to solve problems and improve performance;
- ensuring that abnormal and emergency contingency plans have been formulated, are in place, and evaluating the effectiveness of the plans after an emergency situation has occurred;
- supervising all transportation personnel and evaluating performance; and
- overseeing the training programs developed for Transportation Department employees.

This position requires a person with operations experience, preferably in transit. The incumbent should have a University degree in Engineering or Business Administration.

LRT Operations Section

The drivers will report to the Operations Controller Console. The LRT system operators will be responsible for the actual on-line service, which will be provided twenty and a half (20.5) hours Mon-Sat and nineteen and a half (19.5) hours on Sunday.

The duties of the LRT Operations group include:

- ensuring safe and reliable operation of the vehicles;
- providing information and assistance to the customers;
- advising the Control Centre of any emergencies on the line;
- assisting in evacuating passengers during an emergency or should an extended delay be encountered. (This would be on the advice of the Operations Control Centre.); and
- providing support for crowd control during occasions of high demand in coordination with other external agencies (This would be on the advice of the Operations Control Centre);

Operations and Control Centre

The Operations and Control Centre will be staffed twenty-four (24) hours per day, seven (7) days a week. The duties of the Operations and Control Centre group include:

- dispatching LRVs into and out of service;
- monitoring service and taking corrective action when necessary;
- setting up turn-back operations for extended delays and arranging alternative services;
- controlling track switches;
- receiving and processing all calls regarding maintenance of the system;
- monitoring the power distribution system and making power cuts, and line changes as necessary;
- overseeing the security activities on the system and advising security personnel of potential security problems on any of the LRT B-Line property; and
- communications with emergency response agencies.

The positions of Supervisors and Controllers should be filled by persons with at least a College/Technical Education.

The Vehicle Operator positions should have a minimum of a High School education.

The Control Centre personnel should eventually come from the operations ranks, to provide the actual operations experience necessary to successfully undertake the duties of these positions. The education level should be a minimum of High School with encouragement to upgrade for future consideration for promotions.

3.2.3 Equipment Department

Equipment Manager

The Equipment Manager, reporting to the General Manager, will have the overall responsibility for directing all activities required to maintain the fleet of passenger vehicles. This includes a Maintenance and Storage Facility (MSF) with a major repair shop and yard operation, Equipment Engineering and running maintenance facilities for LRT vehicles. The duties of this position will include:

- developing and enforcing safety and maintenance rules and procedures;
- coordinating vehicle maintenance activity with the other operations departments to ensure that the required revenue and non-revenue vehicles are available when needed;
- reviewing vehicle operating performance and identifying changes needed to solve problems and improve performance;
- reviewing vehicle maintenance facilities to identify improved procedures, materials, equipment, etc.;
- supervising all equipment maintenance personnel and evaluating performance;
- overseeing the training programs developed for Equipment Department employees; and
- developing maintenance procedures for all equipment including scheduling and reporting systems.

This position requires a person with operations experience in heavy transit or manufacturing industry. The incumbent should have a University degree in Electrical or Mechanical Engineering.

LRT Inspection and Maintenance Section

This section through the Superintendent of LRT maintenance, reports to the Equipment Manager. This section is responsible for the inspection and maintenance of the vehicles on a scheduled and as required basis, including cleaning. The duties of this section include:

- carrying out, as per schedules and procedures, all inspections and maintenance work on the transit vehicles;
- carrying out all exterior and interior cleaning of the vehicles;
- keeping records of all inspections and work done for input to the maintenance management system;
- the delivery of vehicles between the yard and maintenance building, as required; and,
- making recommendations for improvement to procedures and materials.

Some of the Technician positions in the work force will require a College education. The minimum education requirements for all other positions should be a High School graduation.

Traction & Body Repair Section

The Traction and Body Repair Section reporting to the Manager of Equipment, will be responsible for the overhaul and repair to major subsystems of the LRT vehicles. This will include trucks, propulsion systems, pneumatics, air conditioners, doors, etc. The section will include a machine shop. The duties of this section will include:

- removing and replacing wheels;
- overhauling of trucks, motors, etc.;
- rebuilding subsystems such as brakes, pneumatic valves and controls;
- overhauling of air conditioning equipment, door controls and mechanisms;
- providing provisions or procurement for services of LRV body repairs;
- providing shop services to both Equipment and Plant Departments; and

- reviewing repair procedures and recommending improvements identified.

The Supervisor of this section should have at least a College education in Mechanical Technology preferably with shop machining knowledge. The Technicians should have a College education in Mechanical and Electrical Technology.

3.2.4 Plant Department

Plant Manager

The Plant Manager, reporting to the General Manager, will have overall responsibility for directing all activities required to maintain the right-of-way, structures and fixed facilities and equipment. The duties of this position will include:

- developing and enforcing safety and maintenance rules and procedures;
- coordinating the maintenance of the fixed facilities with the other operations departments to ensure that the facilities are available, when required;
- reviewing operating performance for the equipment maintained to identify changes needed to solve problems and improve service;
- reviewing the facilities and equipment to identify improved procedures, material, equipment, etc.;
- supervising all fixed asset maintenance personnel and evaluating performance; and
- overseeing the training programs developed for Plant Department employees.

This position requires a person with operating experience in heavy transit or manufacturing industry. The incumbent should have a University Degree in Electrical or Civil Engineering.

Facilities Maintenance Section

The Facilities Maintenance Section, reporting to the Plant Manager, will be responsible for the maintenance and upkeep of all buildings, structures, etc. This section will consist of building traders capable of plumbing, carpentry, painting and air conditioning. This section will also consist of cleaners. The duties of this section include:

- providing janitorial service for all stops;
- maintaining and upgrading of all stop facilities including the MSF;
- servicing all heating and air conditioning units in offices; and

The Supervisor of this section should have at least a College degree in Mechanical Technology.

As these trades are readily available from local specialist companies, it is here assumed that the services will be contracted out on as needed basis.

Electrical Maintenance Section

The Electrical Maintenance Section, reporting to the Plant Manager, will be responsible for the maintenance of all the electrical and electronic equipment at stops, buildings, right-of-ways, yards, substations, etc. The duties of this section include:

- maintaining the signal system;
- maintaining the traction power and stop service substations;
- maintaining the catenary;
- maintaining the wiring and cabling systems and building electrical services;
- maintaining the fare sales and validating equipment; and

- maintaining the communication and alarm systems.

The Supervisor of this section should have a University or College education in Electrical Engineering or Electrical Engineering Technology.

Track and Way Maintenance Section

The Track and Way Maintenance Section, reporting to the Plant Manager, will be responsible for the maintenance of the right-of-way, yards and grounds-keeping. The duties of this section include:

- maintaining all main-line track including rails, switches, frogs, fasteners, etc.;
- maintaining of all yard track including rails, switches, frogs, fasteners, etc.;
- cleaning at track level;
- grounds-keeping and landscaping; and,
- conducting safety and training of the Maintenance of Way section personnel.

The supervisor of the section should have at least a College education in Civil Technology.

Plant Engineering Section

The Plant Engineering Section, reporting to the Plant Manager, will be responsible for engineering studies as they relate to fixed assets. The duties and responsibilities of this section include:

- providing engineering support to Plant Operations for the maintenance and repair of all fixed facilities;
- reviewing preventative maintenance inspection reports to identify areas requiring attention;
- maintaining contact with equipment suppliers re: improvements, upgrades to existing equipment;
- assisting in troubleshooting for problems on major systems;
- assisting in developing preventative maintenance programs; and,
- undertaking periodic inspection of structures.

This section will include at least one Electrical Engineer and one Mechanical or Civil Engineer.

3.2.5 Administration Department

Administration Manager

The Administration Manager, reporting to the General Manager, will have the overall responsibilities for the financial management, legal administration, human resources administration, training materials and procurement, marketing, public affairs, service planning, revenue operations and computer services, and will serve as the Controller for the organisation. The duties of this position will include:

- developing and maintaining the corporate financial system;
- issuing payment and other account transactions;
- reviewing accounts receivable and payable, and monitoring cash flow;
- overseeing recruiting and training programs;
- overseeing the materials procurement process and warehousing of materials;
- overseeing the revenue collection, counting and sorting functions;
- overseeing the legal and computer services functions; and,
- overseeing the negotiations of a collective agreement and monitoring adherence to the labour agreement during its term.

This position requires a person with a financial and business background. The incumbent should have a University degree in Finance or Business Administration.

Finance Section

The Finance Superintendent will report directly to the Manager of Administration and will have overall financial management responsibility for the LRT B-Line Operator. The duties of this position will include:

- developing and maintaining a balance sheet and general ledger system;
- issuing payment and other account transactions;
- supervising accounts receivable and payable and monitoring cash flow;
- publishing the annual report for the LRT B-Line Operator; and
- monitoring pay disbursements.

This position requires a person with experience in the Corporate Finance field. The incumbent should have a University Degree in Business Administration and be a Chartered Accountant.

Fare Collection & Distribution

The Fare Distribution Head Cashier will work within the Finance Section, reporting directly to the Finance Superintendent and will be responsible for duties including:

- coordinating ticket distribution and collection system, through the Fare Distributions and teller personnel;
- coordinating the computerized ticket data processing system; and
- maintaining ledger entries and other bookkeeping activities.

This position requires a person with a University or College Degree in Business Administration or Computer Science.

Marketing & Public Affairs

The Marketing & Public Affairs, Service Planning position reporting to the Manager of Administration will be responsible for the overall marketing programs for the LRT B-Line Operator including:

- monitoring coordination with The City of Hamilton and other authorities such as GO Transit/Metrolinx as well as the responsible/designated person at the Hamilton Street Railway (HSR) and the Public Works Department.
- soliciting advertising to be placed in LRT B-Line vehicles and stops, thereby generating revenue.

These positions will require persons with a college/university education in marketing or public affairs.

Human Resources

The Human Resources section position reporting to the Manager of Administration will be responsible for Human Resources for the LRT B-Line including:

- sourcing and hiring of new staff with approval of the General Manager;
- employee personnel development and labour compliance;
- keep personnel records for all employees; and
- establishing an industrial health service program and provide first aid type attention for minor injuries, etc. to employees.

These positions will require persons with training in recruiting and Human Resources. The clerk requires experience in record system management.

These services may be centralised within the larger City Human Resources Organisation.

IT Support Section

The IT Support section, reporting to the Administration Manager will be responsible for the in-house business computer systems. These duties will include:

- in conjunction with the user, selecting the necessary computer systems along with appropriate hardware and software to complete the systems tasks;
- analyzing and upgrade the computer systems and programs as necessary; and
- instructing users when upgrading is undertaken.
- providing day to day support to users for IT systems issues.

The persons filling these positions should have a University or College Degree in Computer Science and some years of business experience in this field.

These services may be centralised within the larger City IT Services organisation; however, some degree of immediate local support is desirable.

Materials & Procurement

The Materials & Procurement Section, reporting to the Administration Manager will be responsible for purchasing, receiving and warehousing (storing) all materials needed for the operation, maintenance and administration functions of the LRT B-Line Operator.

The section consists of a Senior Buyer (section head), Buyer and a Warehouse Clerk. The duties of the persons in this section include:

- issuing purchase orders for materials being purchased by the LRT B-Line Operator;
- expediting all purchase orders;
- receiving all materials ordered, checking for correctness and storing the material;
- notifying the department requesting the material when it arrives; and
- arranging for the sale of unwanted materials i.e. scrap, obsolete, etc.

These positions will require persons with previous purchasing and warehousing experience while other persons can be trained on the job i.e. warehouse persons. It would be preferred to have persons with a mix of University or College and High School education.

Some aspects of this section may be centralised within the City's larger Materials & Procurement organisation; however, the warehousing and shipping and receiving functions must be conducted locally.

Legal Section

The Legal Section, reporting to the Administration Manager will be responsible for all legal actions taken by or actions against the LRT B-Line Operator.. The duties will include:

- advising the General Manager on all legal actions involving the LRT B-Line Operator.;
- preparing cases and representing the LRT B-Line Operator. in court;
- reviewing the wording on all contracts, both labour relations and contracts for equipment and services from a legal point of view; and
- reviewing all claims against the LRT B-Line Operator. and making recommendations on the handling of same.

The senior position requires a professional lawyer.

This service may be provided by the City's existing legal department.

Training Section

The training section, reporting to the Administration Manager will be responsible for identifying the training needs of the HSR, implementing the training programs and recording their efficiency as per the objectives. Trainer will be assigned as per the following disciplines.

Transportation trainer: The trainer of this discipline will, in coordination with the manager of the transportation department, develop and implement training sessions to address the needs of the department aimed at improving operational efficiency.

Equipment and Plant trainer: The trainer of this discipline will, in coordination with the manager of the Plant department, develop and implement training sessions to address the needs of the department aimed at improving maintenance and procedures efficiency.

Security trainer: The trainer of this discipline will, in coordination with the manager of the safety and security department, develop and implement training sessions to address the needs of the department aimed at maintaining and improving the system safety and facilities security to the highest standards.

3.2.6 Safety and Security

Manager of Safety and Security

The Safety and Security Manager, reporting to the General Manager, will have the overall responsibility for safety monitoring, fire prevention, security activities, audit, quality assurance, and environmental monitoring. The duties of this position will include:

- developing and maintaining a monitoring system to track employee and customer accidents;
- developing a safety incentive program to recognize good safety efforts and results;
- developing and maintaining a fire prevention inspection, monitoring and recording system;
- reviewing the performance of the security forces and identifying problem areas and solutions;
- liaising with municipal police, fire and ambulance departments;
- directing the audit and quality assurance activities for the LRT B-Line Operator;
- directing the programs to monitor the environmental impacts of all LRT B-Line Operator activities and the action needed should environmental threats be discovered; and
- overseeing the training programs developed for Security Department employees.

This position requires a person with experience in the security or health field. The incumbent should have a University Degree in Science, Business Administration or Engineering.

Safety and Fire Prevention Section

The Safety and Fire Prevention Section, reporting to the Safety and Security Manager, is responsible for customer safety programs and fire safety within the transit system. The duties and responsibilities of this section includes:

- implementing and communicating passenger safety programs;
- monitoring employee safety programs;
- inspecting and testing related to the fire prevention program;
- providing constant surveillance of the company's properties and equipment; and
- compiling summaries of safety and fire incidents and issuing reports to management.

The safety and fire prevention manager should have a College education, as well as practical training in fire prevention.

Superintendent of Security

The Superintendent of Security, reporting to the Safety and Security Manager, will be responsible for the day to day operation of the Security Group. The duties of this position will include:

- liaising with the Police and Emergency services;
- investigating special assignments;
- recording all security incidents; and
- investigating security problems and/or concerns and recommending solutions for corrective action.

This position requires a person with a College education, preferably in law enforcement.

Audit, Quality Control, Environment

The Audit, Quality Control and Environment Section reporting directly to the Safety and Security Manager, will be responsible for monitoring departmental and corporate compliance. The duties of these positions will include:

- ensuring departments are fulfilling their mandate;
- ensuring suppliers are providing items equal to or better than specified and acceptable to end user; and
- ensuring the transit system is aware of changes to legislation regarding the environment and is complying with the requirements.

These positions require a person with a College education.

3.3 Preliminary Staff Requirements

The preliminary number of employees needed to initially operate the B-Line and their associated estimated manpower requirements and costs based on prevailing salary scales of the City of Hamilton are shown in Table 3-1.

Hamilton LRT

Preliminary Operations and Maintenance Plan

Department	Staff (2011)		Annual Salary (\$CA)				
	Avg. Per Shift	Total	Per Employee				Total Salary & Overhead *(Subject to discussion with COH)
			Base (incl. Taxes)		Total Salary Burden	Total	
			Monthly	Per Annum	30%		
GENERAL MANAGER'S OFFICE							
General Manager	1	1	\$ 10,500.00	\$ 126,000.00	\$ 37,800.00	\$ 163,800.00	\$ 163,800.00
Secretary	1	1	\$ 3,500.00	\$ 42,000.00	\$ 12,600.00	\$ 54,600.00	\$ 54,600.00
Sub-total General Manager's Office	2	2					\$ 218,400.00
TRANSPORTATION DEPARTMENT							
Manager	1	1	\$ 7,000.00	\$ 84,000.00	\$ 25,200.00	\$ 109,200.00	\$ 109,200.00
Administrative Assistant	1	1	\$ 2,500.00	\$ 30,000.00	\$ 9,000.00	\$ 39,000.00	\$ 39,000.00
LRT Operations Section							
Operators (based on 6.5h per shift)	19	72	\$ 4,500.00	\$ 54,000.00	\$ 16,200.00	\$ 70,200.00	\$ 5,054,400.00
Operations & Control Centre							
Supervisor	1	3	\$ 6,000.00	\$ 72,000.00	\$ 21,600.00	\$ 93,600.00	\$ 280,800.00
Controllers	3	9	\$ 4,000.00	\$ 48,000.00	\$ 14,400.00	\$ 62,400.00	\$ 561,600.00
Sub-Total Transportation Department	25	86					\$ 6,045,000.00

Table 3-1 - Manpower Requirements and Cost

Hamilton LRT

Preliminary Operations and Maintenance Plan

Department	Staff (2011)		Annual Salary (\$CA)				Total Salary & Overhead *(Subject to discussion with COH)
	Avg. Per Shift	Total	Per Employee			Total	
			Base (incl. Taxes)		Total Salary Burden		
			Monthly	Per Annum	30%		
EQUIPMENT DEPARTMENT							
Manager	1	1	\$ 7,000.00	\$ 84,000.00	\$ 25,200.00	\$ 109,200.00	\$ 109,200.00
Administrative Assistant	1	1	\$ 2,500.00	\$ 30,000.00	\$ 9,000.00	\$ 39,000.00	\$ 39,000.00
LRT Repair Section							
Superintendent	1	1	\$ 6,500.00	\$ 78,000.00	\$ 23,400.00	\$ 101,400.00	\$ 101,400.00
Inspectors	1	2	\$ 4,500.00	\$ 54,000.00	\$ 16,200.00	\$ 70,200.00	\$ 140,400.00
Technicians	2	6	\$ 3,500.00	\$ 42,000.00	\$ 12,600.00	\$ 54,600.00	\$ 327,600.00
Mechanics	2	4	\$ 3,500.00	\$ 42,000.00	\$ 12,600.00	\$ 54,600.00	\$ 218,400.00
Cleaner (night shift only)	4	4	\$ 2,500.00	\$ 30,000.00	\$ 9,000.00	\$ 39,000.00	\$ 156,000.00
Operators	1	2	\$ 4,500.00	\$ 54,000.00	\$ 16,200.00	\$ 70,200.00	\$ 140,400.00
Traction & Body Repair Section							
Supervisor	1	2	\$ 6,000.00	\$ 72,000.00	\$ 21,600.00	\$ 93,600.00	\$ 187,200.00
Technicians/Mechanics	2	4	\$ 3,500.00	\$ 42,000.00	\$ 12,600.00	\$ 54,600.00	\$ 218,400.00
Sub-Total Equipment Department	16	27					\$ 1,638,000.00
(*) Vehicle Manufacturer Engineering services on a retainer basis will be utilized after warranty period (cost are included in the vehicle and plant maintenance cost Table 4-1)							

Table 3-1 - Manpower Requirements and Cost (cont)

Hamilton LRT

Preliminary Operations and Maintenance Plan

Department	Staff (2011)		Annual Salary (\$CA)				Total Salary & Overhead *(Subject to discussion with COH)
	Avg. Per Shift	Total	Per Employee			Total	
			Base (incl. Taxes)		Total Salary Burden		
			Monthly	Per Annum	30%		
PLANT DEPARTMENT							
Manager	1	1	\$ 7,000.00	\$ 84,000.00	\$ 25,200.00	\$ 109,200.00	\$ 109,200.00
Administrative Assistant	1	1	\$ 2,500.00	\$ 30,000.00	\$ 9,000.00	\$ 39,000.00	\$ 39,000.00
<i>Facilities Section</i>							
Supervisor	1	1	\$ 6,000.00	\$ 72,000.00	\$ 21,600.00	\$ 93,600.00	\$ 93,600.00
(¹) Plumber	0	0.7	\$ -	\$ 52,000.00	\$ -	\$ 36,400.00	\$ 36,400.00
(¹) A/C Technician	0	0.7	\$ -	\$ 52,000.00	\$ -	\$ 36,400.00	\$ 36,400.00
(¹) Electrician	0	0.7	\$ -	\$ 52,000.00	\$ -	\$ 36,400.00	\$ 36,400.00
Cleaner	4	4	\$ 2,500.00	\$ 30,000.00	\$ 9,000.00	\$ 39,000.00	\$ 156,000.00
<i>Electrical Systems Section</i>							
Supervisor	1	1	\$ 6,000.00	\$ 72,000.00	\$ 21,600.00	\$ 93,600.00	\$ 93,600.00
Signals Technicians	1	3	\$ 4,000.00	\$ 48,000.00	\$ 14,400.00	\$ 62,400.00	\$ 187,200.00
Substation, O/H Electricians	1	3	\$ 4,000.00	\$ 48,000.00	\$ 14,400.00	\$ 62,400.00	\$ 187,200.00
Communications Technicians	1	3	\$ 4,000.00	\$ 48,000.00	\$ 14,400.00	\$ 62,400.00	\$ 187,200.00
<i>Track & Way Section</i>							
Supervisor	1	1	\$ 6,000.00	\$ 72,000.00	\$ 21,600.00	\$ 93,600.00	\$ 93,600.00
Roadmaster (by city)	0	0	\$ 6,000.00	\$ 72,000.00	\$ 21,600.00	\$ 93,600.00	\$ -
Track Maintainers	2	4	\$ 4,000.00	\$ 48,000.00	\$ 14,400.00	\$ 62,400.00	\$ 249,600.00
Equipment Operators	1	3	\$ 4,000.00	\$ 48,000.00	\$ 14,400.00	\$ 62,400.00	\$ 187,200.00
<i>Engineering Section</i>							
(¹) Structural/Architectural/Track	0	1	\$ -	\$ 30,000.00	\$ -	\$ 30,000.00	\$ 30,000.00
(¹) Electrical Engineer	0	1	\$ -	\$ 30,000.00	\$ -	\$ 30,000.00	\$ 30,000.00
Sub-Total Plant Department	15	29.1					\$ 1,752,600.00

Table 3-1 - Manpower Requirements and Cost (cont.)

Hamilton LRT

Preliminary Operations and Maintenance Plan

Department	Staff (2011)		Annual Salary (\$CA)				Total Salary & Overhead *(Subject to discussion with COH)
	Avg. Per Shift	Total	Per Employee			Total	
			Base (incl. Taxes)		Total Salary Burden		
			Monthly	Per Annum	30%		
ADMINISTRATION DEPARTMENT							
Manager	1	1	\$ 7,000.00	\$ 84,000.00	\$ 25,200.00	\$ 109,200.00	\$ 109,200.00
Administrative Assistant	1	1	\$ 2,500.00	\$ 30,000.00	\$ 9,000.00	\$ 39,000.00	\$ 39,000.00
<i>Finance</i>							
Superintendent	1	1	\$ 6,500.00	\$ 78,000.00	\$ 23,400.00	\$ 101,400.00	\$ 101,400.00
Budget	1	1	\$ 3,000.00	\$ 36,000.00	\$ 10,800.00	\$ 46,800.00	\$ 46,800.00
Accounts Payable/Receivable	1	1	\$ 3,000.00	\$ 36,000.00	\$ 10,800.00	\$ 46,800.00	\$ 46,800.00
Accountant	1	1	\$ 6,500.00	\$ 78,000.00	\$ 23,400.00	\$ 101,400.00	\$ 101,400.00
Pay Office	1	1	\$ 3,000.00	\$ 36,000.00	\$ 10,800.00	\$ 46,800.00	\$ 46,800.00
Clerical	1	1	\$ 2,000.00	\$ 24,000.00	\$ 7,200.00	\$ 31,200.00	\$ 31,200.00
Fare Clerk	1	1	\$ 3,500.00	\$ 42,000.00	\$ 12,600.00	\$ 54,600.00	\$ 54,600.00
<i>Legal</i>							
(*) Solicitor	0	0.5	\$ -	\$ 50,000.00	\$ -	\$ 25,000.00	\$ 25,000.00
<i>Human Resources</i>							
Recruiter	1	1	\$ 6,000.00	\$ 72,000.00	\$ 21,600.00	\$ 93,600.00	\$ 93,600.00
Health Services	1	1	\$ 3,000.00	\$ 36,000.00	\$ 10,800.00	\$ 46,800.00	\$ 46,800.00
Clerk	1	1	\$ 2,000.00	\$ 24,000.00	\$ 7,200.00	\$ 31,200.00	\$ 31,200.00

continued on next page...

(*) Budget for external service

Table 3-1 - Manpower Requirements and Cost (cont.)

Hamilton LRT

Preliminary Operations and Maintenance Plan

Department	Staff (2011)		Annual Salary (\$CA)				Total Salary & Overhead *(Subject to discussion with COH)
	Avg. Per Shift	Total	Per Employee			Total	
			Base (incl. Taxes)		Total Salary Burden		
			Monthly	Per Annum	30%		
<i>Training</i>							
Supervisor	1	1	\$ 6,000.00	\$ 72,000.00	\$ 21,600.00	\$ 93,600.00	\$ 93,600.00
Trainers (Transp.)	1	1	\$ 4,000.00	\$ 48,000.00	\$ 14,400.00	\$ 62,400.00	\$ 62,400.00
Trainers (Equip. & Plant)	1	1	\$ 4,000.00	\$ 48,000.00	\$ 14,400.00	\$ 62,400.00	\$ 62,400.00
Trainers (Security)	1	1	\$ 4,000.00	\$ 48,000.00	\$ 14,400.00	\$ 62,400.00	\$ 62,400.00
<i>Materials & Procurement</i>							
Buyer	1	1	\$ 6,000.00	\$ 72,000.00	\$ 21,600.00	\$ 93,600.00	\$ 93,600.00
Stores Clerk	1	1	\$ 3,000.00	\$ 36,000.00	\$ 10,800.00	\$ 46,800.00	\$ 46,800.00
<i>Marketing, Public Affairs</i>							
Marketing & PA Representative	1	1	\$ 6,000.00	\$ 72,000.00	\$ 21,600.00	\$ 93,600.00	\$ 93,600.00
<i>IT Support</i>							
IT Support Staff	1	1	\$ 4,000.00	\$ 48,000.00	\$ 14,400.00	\$ 62,400.00	\$ 62,400.00
Sub-Total Administration Department	20	20.5					\$ 1,351,000.00

Table 3-1 - Manpower Requirements and Cost (cont.)

Hamilton LRT

Preliminary Operations and Maintenance Plan

Department	Staff (2011)		Annual Salary (\$CA)				Total Salary & Overhead *(Subject to discussion with COH)
	Avg. Per Shift	Total	Per Employee				
			Base (incl. Taxes)		Total Salary Burden		
			Monthly	Per Annum	30%		
<i>SAFETY & SECURITY DEPARTMENT</i>							
Manager	1	1	\$ 7,000.00	\$ 84,000.00	\$ 25,200.00	\$ 109,200.00	\$ 109,200.00
Administrative Assistant	1	1	\$ 2,500.00	\$ 30,000.00	\$ 9,000.00	\$ 39,000.00	\$ 39,000.00
<i>Safety & Fire Prevention</i>							
Safety Coordinator	1	1	\$ 4,000.00	\$ 48,000.00	\$ 14,400.00	\$ 62,400.00	\$ 62,400.00
Safety and Fire Prevention Technician	1	3	\$ 4,000.00	\$ 48,000.00	\$ 14,400.00	\$ 62,400.00	\$ 187,200.00
<i>Security</i>							
Supervisor	1	3	\$ 6,000.00	\$ 72,000.00	\$ 21,600.00	\$ 93,600.00	\$ 280,800.00
Building & Gate Attendants	2	6	\$ 2,500.00	\$ 30,000.00	\$ 9,000.00	\$ 39,000.00	\$ 234,000.00
Audit/Quality Assurance	1	1	\$ 4,000.00	\$ 48,000.00	\$ 14,400.00	\$ 62,400.00	\$ 62,400.00
Environment	1	1	\$ 4,500.00	\$ 54,000.00	\$ 16,200.00	\$ 70,200.00	\$ 70,200.00
Sub-Total Safety & Security Department	9	17					\$ 1,045,200.00
GRAND TOTAL	87	182					\$ 12,050,200.00

Note: A nominal three shifts are noted for round the clock operations; however, this accounts for 2 1/2 shifts over a seven day period and includes for absenteeism

Table 3-1 - Manpower Requirements and Cost

Hamilton LRT

Preliminary Operations and Maintenance Plan

	Required Staff	Labour Cost, Per Annum \$CA	Burden for permant staff		Total
			%	\$CA	
GENERAL MANAGER'S OFFICE	2	\$ 168,000.00	30%	\$ 50,400.00	\$ 218,400.00
TRANSPORTATION DEPARTMENT	86	\$ 4,650,000.00	30%	\$ 1,395,000.00	\$ 6,045,000.00
EQUIPMENT DEPARTMENT	27	\$ 1,260,000.00	30%	\$ 378,000.00	\$ 1,638,000.00
PLANT DEPARTMENT	29	\$ 1,387,200.00	30%	\$ 365,400.00	\$ 1,752,600.00
ADMINISTRATION DEPARTMENT	21	\$ 1,045,000.00	30%	\$ 306,000.00	\$ 1,351,000.00
SAFETY & SECURITY DEPARTMENT	17	\$ 804,000.00	30%	\$ 241,200.00	\$ 1,045,200.00
TOTAL	182	\$ 9,314,200.00	30%	\$ 2,736,000.00	\$ 12,050,200.00

Table 3-1 - Manpower Cost Summary

Figures are approximate

4.0 Maintenance Plan

The objective of the Operations and Maintenance Plan is to provide its Transportation Department with safe, reliable and clean LRT vehicles for transportation of its customers. Additionally, the Plan will provide for the proper maintenance of all fixed facilities, guide-ways, maintenance shops and yards and office facilities for its staff. Some activities which will jointly support the LRT and road operation are assumed to be undertaken by the current city structure, such approach does require further coordination with the city to ascertain its applicability.

Normally all systems, when new, are procured with spares parts for the envisaged normal wear and tear of the system for a period of three years. The costs hereby noted for parts are an average for budgeting purposes.

4.1 Maintenance Costs

Maintenance costs have two components, labour and non-labour costs such as materials, office supplies, uniforms, work clothing and other consumables.

The labour part of maintenance costs are carried primarily in the previous sections (Tables 3.1 and 3.2).

4.1.1 Vehicle and Plant Maintenance Cost

The estimated costs of Equipment Department, for maintenance of all revenue and non-revenue vehicles and the Plant Department, for fixed facilities are shown in the Table 4.1

No. of LRT Cars	22
Normal operating maintenance per vehicle per annum	\$ 14,140.00
Allowance for interior rehabilitation and body paint per vehicle per annum	\$ 3,830.00
Sub-Total cost per vehicle per annum	\$ 17,970.00
TOTAL FOR THE FLEET	\$ 395,340.00
Allowance for track overhaul program (Sch. In Table 4-2)	\$ 84,260.00
Cost for parts for maintenance of Catenary and TPSS per annum	\$ 60,000.00
Cost for parts for maintenance of Communication & fare collection equipment per annum	\$ 30,000.00
Total Fleet Maintenance cost	\$ 569,600.00

Table 4-1 - Non-labour LRT Costs

4.1.2 Track and Catenary Maintenance Schedule

A Table with the projected Rail and Special Trackwork Replacements has been prepared to show the approximate years, within a typical 30-year O & M period, in which various components of the track system will need replacing. If track is neglected and maintenance deferred then larger segments will have to be replaced within a shorter time frame. Then, replacement costs may have to be capitalized.

The contact wire of the overhead catenary system will require scheduled inspections and periodic replacements. If the system is well maintained on an annual basis then replacement costs can be accommodated within the operations and maintenance budgets. The hereby presented POMP allows for staffing for such periodic inspections and allowance is made for materials costs under a separate item for overhead catenary and TPSS.

MATERIAL TO BE REPLACED	REPLACEMENT YEAR						
	7	10	13	16	20	25	30
Tangent Track Mainline						●	
Tangent Track stop Areas				●			
Tangent in Special Track Work			●			●	
Tangent Track Storage Yard							●
Curved Track Mainline	●		●		●		●
Curved Track Storage Yard					●		
Switch Points & Stock Rails Storage Yard				●			
Switch Points & Stock Rails Inline Locations			●			●	
Switch Points & Stock Rails Terminal	●			●		●	
Yard Turnouts		●			●		●
Frog's - Terminal S.T.W.	●		●		●		●
Frog's - Yard Turnouts		●			●		●
Frog's - Inline Locations			●			●	
Frog's - Yard				●			

Note:

The renewal year will vary +/- one/two years dependant on vehicle loading and service frequency

Table 4-2 - Replacement Timeline for Trackwork Components

4.2 Estimated Traction Power Costs

The estimated annual power consumption for operation of the LRT system were calculated for the following components:

- Traction Power Consumption (Table 4-3)
- Stop Power Consumption (Table 4-4)
- Depot (MSF) Power Consumption (Table 4-5)

A summary of estimated annual power consumption are shown in Table 4-6 and costs are shown in the Table 4-7.

Item	Unit	Qty
Vehicles in Operation	ea.	19
Annual Vehicle Distance Travelled	km	2,157,592
Rate of Energy Consumption	kWh/veh-km	7
Total Vehicle Consumption Per Annum	kWh	15,274,000

Table 4-3 - Traction Power Consumption

Item	Unit	Qty
Stops	ea.	17
Stop Power Consumption Per Day	kWh/day/stop	34
Rate of Energy Consumption Per Annum	kWh/yr/stop	12,264
Total Vehicle Consumption Per Annum	kWh	208,488

Note: Stop power based on ticket vending and 300W of lighting per stop only
All numbers are approximate

Table 4-4 - Stop Power Consumption

Item	Unit	Qty
MSF Power Consumption/Day	kWh	4,875
MSF Power Consumption/Year	kWh	1,779,375

Table 4-5 – Maintenance and Storage Facility (MSF) Power Consumption

Item	Unit	Qty
Annual Traction Power Consumption*	kWh	15,274,000
Annual Stop Power Consumption	kWh	208,488
Annual MSF Power Consumption	kWh	1,779,375
Total Annual Power Consumption	kWh	17,261,863

*Power derived from load calculation based on flat surface operations

Table 4-6 - Total Annual System Power Consumption

Hamilton LRT

Preliminary Operations and Maintenance Plan

Item	Per Annum
Monthly Charges	\$ 3,065.64
kWh Charges	\$ 249,401.90
kW	\$ 236,412.62
Total	\$ 488,900.00

Note - charges based on published rates from Horizon power for clients General Service over 50kW published 2011-08-01

Table 4-7 - System Annual Power Costs

5.0 Summary of Annual Operating Costs

The estimated initial service annual operating costs for the proposed Hamilton LRT system are summarized in **Table 5-1** below.

A surcharge of 10% is added to the sum of all annual operating costs as a contingency to account for insurances, property taxes etc.

Item	Per Annum
Labour Costs (<i>Admin, operation, maintenance</i>)	\$ 12,050,200.00
Vehicle Maintenance Costs	\$ 395,340.00
Track maintenance / rail replacement	\$ 84,260.00
Power Costs	\$ 488,900.00
Cost for parts for maintenance of Catenary and TPSS	\$ 60,000.00
Cost for parts for maintenance of Communication & fare collection equipment	\$ 30,000.00
Office supplies	\$ 36,320.00
10% insurance, rates, property taxes, etc.	\$ 1,314,502.00
TOTAL	\$ 14,459,522.00

Table 5-1 - Summary of Annual Operating Costs

Disclaimer

This document contains the expression of the professional opinion of Steer Davies Gleave North America Inc. and/or its sub-consultants (hereinafter referred to collectively as “the Consultant Team”) as to the matters set out herein, using their professional judgment and reasonable care. It is to be read in the context of the agreement (the “Agreement”) between Steer Davies Gleave North America Inc. and the City of Hamilton (the “Client”) for the Rapid Transit Preliminary Design and Feasibility Study (reference C11-12-10), and the methodology, procedures, techniques and assumptions used, and the circumstances and constraints under which its mandate was performed. This document is written solely for the purpose stated in the Agreement, and for the sole and exclusive benefit of the Client, whose remedies are limited to those set out in the Agreement. This document is meant to be read as a whole, and sections or parts thereof should thus not be read or relied upon out of context.

The consultant team has, in preparing the Agreement outputs, followed methodology and procedures, and exercised due care consistent with the intended level of accuracy, using professional judgment and reasonable care.

However, no warranty should be implied as to the accuracy of the Agreement outputs, forecasts and estimates. This analysis is based on data supplied by the client/collected by third parties. This has been checked whenever possible; however the consultant team cannot guarantee the accuracy of such data and does not take responsibility for estimates in so far as they are based on such data.

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