

COMMITTEE OF THE WHOLE - (WORKING SESSION) – MAY 8, 2007

POLE AND STREETLIGHT MAINTENANCE AND REHABILITATION PROGRAM

Recommendation

The Commissioner of Engineering and Public Works in consultation with the Commissioner of Finance and Corporate Services recommends:

1. That the proposed Pole and Streetlight Maintenance and Rehabilitation Program, incorporating the following components:
 - a) Streetlight Pole Replacement
 - b) Group streetlight relamping
 - c) Streetlight upgradingbe approved in principle, and
2. That the proposed Pole and Streetlight Maintenance and Rehabilitation Program be incorporated in the City's Long Range Financial Planning Study.

Economic Impact

The Pole and Streetlight Maintenance and Rehabilitation Program could require an investment of up to \$13,190,000.00 over a 15 year period.

The Long Term optimization of resources can be achieved through City initiatives such as the Infrastructure Management System and modeling these figures within the Long Range Financial Planning Model so that future funding implications are known and can be planned for at the earliest possible point in time and budgetary and/or program changes implemented accordingly.

Communications Plan

There has not been public consultation to this point other than to advise residents inquiring about streetlighting that a City wide study was underway. Implementation of individual projects would be subject of the Engineering Services Department and Public Works Department standard communication with affected residents prior to and during maintenance or construction activities.

Purpose

The purpose of this report is to provide Council with the results of the Streetlight Inventory and Assessment study and obtain approval in principle of a Pole and Streetlight Maintenance and Rehabilitation Program. Project Level Program requirements will be brought forward annually for consideration as part of the Capital and Operating Budget deliberations.

Background - Analysis and Options

Streetlighting Inventory and Assessment Study Initiation

On October 28, 2002, Council approved the contract award for the Streetlighting Inventory and Assessment study. The purpose of this study is to identify the upgrading needs of the City's streetlighting network, establish cost-effective solutions, and develop a long-term implementation program that prioritizes the areas to be upgraded including benchmark cost estimates.

New Asset Management Methodology

On February 16, 2006, Council endorsed through resolution, InfraGuide and the best practices with respect to Asset Management. Through InfraGuide, a comprehensive business strategy

involves 3 pillars: People, Information and Technology.

The Essential Elements of an Asset Management Plan are:

1. *What do you have and where is it?*
2. *What is it worth?*
3. *What is its condition and its expected service life?*
4. *What is the level of service expectation, what needs to be done?*
5. *When do you need to do it?*
6. *How much will it cost and what is the acceptable level of risk?*
7. *How do you ensure long term affordability?*

People, Information and Technology in practice with the Essential Elements is the key to a successful implementation of an Asset Management Plan.

It is within this framework that the Pole and Streetlight Maintenance and Rehabilitation Program results are reported.

Pole and Streetlight Maintenance and Rehabilitation Program

The Infrastructure Management Division of the Engineering Services Department is responsible for infrastructure records, engineering related data and data management and strategic analysis related to the City's civil infrastructure. The Division maintains streetlight and pole related data.

The base data required for this program is generated as a regular function of the Infrastructure Management Division and is fully integrated with the Enterprise G.I.S. Database.

1. What do you have and where is it?

The inventory of City owned active streetlights are summarized in the following table by Ward:

Table No.1

Summary of Streetlight Network - By Ward		
Ward	Streetlight	Utility Pole
1	6009	5821
2	4285	3919
3	2977	2746
4	4999	4530
5	1927	1628
Total	20197	18644

Note: approximately 1553 City streetlights are mounted onto utility poles owned by other agencies such as PowerStream.

2. What is it worth?

Based on current industry costs for utility poles and streetlights, staff have estimated the replacement value of the City's entire streetlight network to be approximately **\$115 MILLION DOLLARS**. This figure does not include the value for underground wiring which is also required for streetlight system.

3. What is its condition and its expected service life?

Physical Condition

The gathering of condition assessment information is an integral part of an asset management plan. For an inventory, condition represents a “snap-shot” of the network for the period when the information was collected. The conditions recorded provide a base line for future condition surveys and the data may provide an indication of predominant modes of deterioration present or show patterns and/or trends.

Our data is circa 2003 and consists of the assessment of poles, arms and luminaires to document distresses and their respective severity, as observed by an inspector at ground level. The type is distresses found are:

- Cracking, splintering, crushing and shattering;
- Rust;
- Spalling;
- Loose connections;
- Non-verticality (leaning);
- Tree interference.

Severity of a distress is ranked by the following criteria:

- Light/Slight;
- Moderate;
- Severe.

The extent of distresses on our utility poles is summarized in the following tables:

Table No. 1

Utility Pole Visible Condition			
Distress	Severity	Quantity	Cost
Cracking	Light / Slight	167	\$751,500.00
	Moderate	125	\$562,500.00
	Severe	82	\$369,000.00
Cracking, splintering, crushing and shattering	Light / Slight	24	\$108,000.00
	Moderate	4	\$18,000.00
	Severe	2	\$9,000.00
Rust	Light / Slight	15	\$67,500.00
	Moderate	1	\$4,500.00
Spalling	Light / Slight	65	\$292,500.00
	Moderate	26	\$117,000.00
	Severe	2	\$9,000.00
Total		513	\$2,308,500.00

Table No. 2

Utility Pole Non-Verticality (Leaning)		
Severity	Quantity	Cost
Light / Slight	384	\$230,400.00
Moderate	72	\$43,200.00
Severe	2	\$1,200.00

Utility Pole Non-Verticality (Leaning)		
Severity	Quantity	Cost
Total	458	\$274,800.00

The extent of distresses on our streetlights is summarized in the following tables:

Table No. 3

Streetlight Arm Fixing Condition¹			
Distress	Severity	Quantity	Cost
Loose Connections	Light / Slight	1	\$500.00
	Moderate	13	\$6,500.00
	Severe	2	\$1,000.00
Rust	Light / Slight	51	\$25,500.00
	Moderate	37	\$18,500.00
	Severe	6	\$3,000.00
Total		110	\$55,000.00

Table No. 4

Streetlight Arm Visible Condition¹			
Distress	Severity	Quantity	Cost
Rust	Light / Slight	3	\$1,500.00
	Moderate	21	\$10,500.00
	Severe	7	\$3,500.00
Total		31	\$15,500.00

Table No. 5

Streetlight Luminaire Condition¹			
Distress	Severity	Quantity	Cost
Rust	Light / Slight	211	\$105,500.00
	Moderate	74	\$37,000.00
	Severe	8	\$4,000.00
Total		293	\$146,500.00

¹ - Staff calculated benchmark estimate for budget purposes only.

Table No. 6

Streetlight Tree Interference	
Distress	Quantity

Streetlight Tree Interference	
Distress	Quantity
Tree Interference	520
Total	520

Wattage Upgrade

A summary by Wattage of our Streetlight network can be summarized by the following table:

Table No. 7

Summary of Streetlight Network - By Wattage	
Wattage	Quantity
Unknown	3361
50	8
70	4624
100	5463
150	3005
200	631
250	2582
400	523
Total	20197

The Infrastructure Management Division has further refined and updated attribute information for the utility pole and streetlight datasets subsequent to the data delivery from our Consultant. This was accomplished through summer student resources researching indexed infrastructure records from HIRMS (Historical Infrastructure Records Management System) that was developed after the initial Streetlighting Inventory and Assessment study.

Based on our current standards, a streetlighting system is designed to meet an average maintained illumination level and minimum uniformity ratio for each type of road and walkway. To achieve this end within residential and industrial subdivisions, wattages of 100 and 150 are standard. On major right of ways external to subdivisions, wattages of 200, 250 and 400 may be utilized as required.

There have been 3 significant eras to our standards for streetlighting. These “eras” and their respective key factors are summarized below and are directly related to standard practice of the Illuminating Engineering Society of North America:

- Pre 1991 70, 100 and 150 watt widely used
- 1991 to 2002 - 70 – 400 watts widely used, minimum illumination levels increased which resulted in closer and more uniform design
- 2002 to present - 100 and 150 watts standard and 200, 250 and 400 watts used where required, minimum illumination levels superseded by average illumination levels of similar criteria of the previous era (current standard)

Since our current standard and that of the era from 1991 to 2002 end result are similar, we can

conclude that streetlights that are 70 watts or less and are constructed prior to 1991 are below current standards.

Further query of the Infrastructure Database reveals the following number of streetlights that fall into this category are summarized in the following table including benchmark costs:

Table No. 8

Streetlight Upgrade Benchmark Cost¹				
Age	70 watt	Unknown wattage	Total Streetlights	Cost
Pre 1991	3275	294	3569	\$1,784,500.00
Unknown	935	2657	3592	\$1,796,000.00
Total	4210	2951	7161	\$3,580,500.00

Generally speaking, according to the Consultant's report, upgrading wattage from 70 to 100 watts would have little benefit based on cost other than streamlining stock control and order purposes and would serve to increase lighting intensity levels at the expense of greater energy consumption.

As noted in Table No. 6, 520 locations are subject to tree interference. Tree pruning at these locations through the City's regular program by our Parks and Forestry Operations Department will substantially remove light restrictions, better illuminating the roadway and reduce complaints. These locations have been formally identified and forwarded to the Parks and Forestry Operations Department for their consideration and action as budget allows.

Staff would caution that there is no technical merit to changing wattage and that there is a high degree of certainty that upgrading will introduce new criticisms from the public in the form of over/under illumination and non-uniformity.

Illumination Deficiencies

The study also undertook the initial analysis of illumination deficiency "windows" or gaps in the existing streetlighting system.

From the analysis, the Consultant identified 277 illumination deficiencies spread over some 118 streets have been identified. The Consultant identified 2 strategies that can be implemented to correct these deficiencies:

- A. Reconfigure all poles on the affected street to ensure that the lighting intensity and uniformity comply with current standards. Cost of this solution is estimated at **\$6,079,800**, not including engineering and administration costs; and
- B. Infill, add utility pole and streetlight to the specific, deficient areas only. Cost of this solution is estimated at **\$1,237,500**, not including engineering and administration costs.

4. What is the level of service expectation, what needs to be done?

The condition of our network is generally in good condition with approximately 5% of our utility poles and 2% of our streetlights having distresses. Furthermore, approximately 18% of the streetlight network (not including streetlights of unknown wattage and age) has a wattage of 70 and is older than 1991 and less and 1% of the streetlight network has illumination deficiencies.

A. Level of Service

The interest of public health and safety must take the highest priority in developing a program(s) to effectively and efficiently address the noted distresses and deficiencies from the Inventory and Assessment project. The secondary factor in developing a program(s) is to maximize the return on every dollar invested through maximizing the lifecycle of the asset and also conducting detailed value engineering exercises at specific locations to determine the best means to address deficiency issues.

B. What needs to be done?

Keeping the noted targets in mind, the Engineering Services Department and Public Works Department have collaborated to develop programs to deal with the distresses and deficiencies. They are as follows:

I. Streetlight Pole Replacement Program - Public Works Department

This program will focus on the replacement of existing utility poles and streetlights with visible distresses and/or undertake the upgrading of streetlights with 70 watt or less luminaires and are older than 1991 to 100 watts where said conditions co-exist.

This program recognizes that there are efficiencies in addressing distress based deficiencies for both utility poles and streetlights and performing upgrades simultaneously. Works are ranked primarily by the following criteria:

- Type of distress and severity
- Location (road class)
- Age
- Material

The program is aimed to be undertaken over a 5 year period and will address deficiencies that directly affect public health and safety.

II. Group Streetlight Re-lamping - Public Works Department

There are 3 main factors that affect the health and useful life of a streetlight's internal lamp. They are the manufacturer's Average Rated Life expectancy, Lamp Lumen Depreciation and Luminaire Dirt Depreciation.

Manufacturers rate all varieties of lamps in terms of average rated life. For most roadway applications, average rated life is based on standard life performance of a large representative group of lamps usually operating 11 hours per start under controlled electrical, thermal and mechanical conditions. Average rated life is based on the survival of 50 percent of the lamps and thus allows for individual lamps to vary considerably from this average. 24,000 hours is the industry's average rated life for lamps.

During their lifetime, the lumen output of most lamps gradually diminishes. This gradual reduction in light output with burning is called Lamp Lumen Depreciation. In addition to lamp lumen depreciation over time, dirt accumulates both on the inside and outside of the refractor, on the inside of the luminaire reflector and on the lamp. The dirt accumulation is responsible for additional reduction in luminaire light output and is known as Luminaire Dirt Depreciation.

The Group Streetlight Re-lamping Program aims to establish a "best time schedule" cyclical program to address the health of the Streetlight System and will engage specifically in the inspection, cleaning and repair of fixtures, replacement of streetlight lamps and upgrading of streetlights from 70 watts or less and are constructed prior to 1991 (considered below current

standards) where encountered, to 100 watts. This program recognizes that there are efficiencies in combining the maintenance of streetlighting and performing upgrades simultaneously.

The Level of Service for this program is to perform the maintenance on the streetlight lamp and components at the $\frac{3}{4}$ mark of the lamps useful service life. The resultant cycle calculated from this Level of Service is 4.48 years and is round up to 5 years for ease of management.

This program will reduce operating costs by reducing reactive works such as responding to outages, reducing complaints and increasing efficiencies by working within target areas.

III. Pre-Engineering Streetlight Upgrade Program - Engineering Services Department

This program supports the Streetlight Upgrade Program by engaging consulting services for the engineering study, design and tender document preparation of upgrade projects.

There are a number of locations throughout the City where the streetlighting network was constructed prior to 1991 but have not been identified as being deficient or substandard by the Consultant. As a part of the pre-engineering program, staff wish to further review and study these areas for inconsistencies in illumination and uniformity. Should it be determined that any of these areas require remedy, the Engineering Services Department will undertake a value engineering analysis to determine the solution that produces the greatest benefit per dollar investment. These projects will be brought forward through future capital budget deliberations under the title of the Streetlight Upgrade Program.

The Engineering Services Department completes design and tender documents for projects annually at the earliest possible time. Having early tenders produces savings to the City through lower unit rates from bidders and earlier project start and finish dates, resulting in reduced impact to citizens and the environment.

We have traditionally worked on Pre-Engineering under the auspices of projects one year advance of their proposed construction year. This methodology becomes restrictive when the annual budget approval process goes beyond February of the current calendar year.

We seek Council's support of Pre-Engineering for further study and producing design and tender documents beyond the traditional 1 year window. This will allow the City to have completed design and tender documents "on the shelf" for multiple projects, in multiple years ready for bidding. With projects in this state, the City can go out to tender at the earliest possible time and take advantage of lower rates and favorable construction timing.

IV. Streetlight Upgrade Program - Engineering Services Department

Following Pre-Engineering, this program aims to construct new utility poles and/or streetlights in those areas where illumination deficiency "windows" or gaps in the existing streetlighting network have been identified. From the study findings for illumination deficiencies, 2 separate strategies were identified by the Consultant being Reconfiguration and Infill.

The Engineering Services Department has further reviewed these strategies and recognize that it is not practical to engage in either of these strategies exclusively and that efficiencies can be gained through striking a balance between these two by undertaking further pre-engineering of site specific circumstances and implementing the most economic solution based in our findings. Works will be ranked primarily by their location (road class).

The Level of Service for Streetlight Upgrade Program and the accompanying Pre-Engineering is 15 years. The streetlight system as it exists today is constructed to a "standard of the day" though it may not conform to today's standard, however there is not regulatory requirement to upgrade the system in a specified period of time. Given the cost to perform this program, 15 years is

suggested as a balance between performing work funding increases.

5. When do you need to do it?

The Engineering Services and Public Works Departments propose to undertake the various programs as noted:

Program	Department	Duration
Streetlight Pole Replacement Program	Public Works Department	5 Years
Group Streetlight Re-lamping	Public Works Department	Unlimited
Streetlight Upgrade Program	Engineering Services Department	15 Years

6. How much will it cost and what is the acceptable level of risk?

Setting a **Level of Service (LOS)** or a target, is an important and critical step in a proper Asset Management Plan. Risk to public health and safety must take priority.

Based on the target Level of Service as previously described under section 4A, investment required including financing costs over the next 5 years within the proposed programs described in section 4B are as follows:

Year	Public Works Department		Engineering Services Department		Total
	Streetlight Pole Replacement Program	Group Streetlight Re-lamping	Streetlight Upgrade Program	Pre-Engineering Streetlight Upgrade Program	
2007	\$275,000.00				\$275,000.00
2008	\$652,500.00	\$206,000.00	\$418,000.00	\$42,000.00	\$1,318,500.00
2009	\$652,500.00	\$209,000.00	\$418,000.00	\$42,000.00	\$1,321,500.00
2010	\$652,500.00	\$212,000.00	\$418,000.00	\$42,000.00	\$1,324,500.00
2011	\$652,500.00	\$215,000.00	\$418,000.00	\$42,000.00	\$1,327,500.00
2012		\$218,000.00	\$418,000.00	\$42,000.00	\$678,000.00
2013		\$221,000.00	\$418,000.00	\$42,000.00	\$681,000.00
2014		\$224,000.00	\$418,000.00	\$42,000.00	\$684,000.00
2015		\$227,000.00	\$418,000.00	\$42,000.00	\$687,000.00
2016		\$230,000.00	\$418,000.00	\$42,000.00	\$690,000.00
2017		\$233,000.00	\$418,000.00	\$42,000.00	\$693,000.00
2018		\$236,000.00	\$418,000.00	\$42,000.00	\$696,000.00
2019		\$239,000.00	\$418,000.00	\$42,000.00	\$699,000.00
2020		\$242,000.00	\$418,000.00	\$42,000.00	\$702,000.00
2021		\$245,000.00	\$418,000.00	\$42,000.00	\$705,000.00
2022		\$248,000.00	\$418,000.00	\$42,000.00	\$708,000.00
	\$2,885,000.00	\$3,405,000.00	\$6,270,000.00	\$630,000.00	\$13,190,000.00

7. How do you ensure long term affordability?

As the City's infrastructure, information, systems and technology matures, multi-faceted integration across all asset classes such as roads, structures, pipes and amenities will be realized. This is a natural path not only from an engineering technical analysis but should also be embraced from a financial perspective.

Ensuring that the funding requirements are captured in the long range financial planning model and that any increases to proposed funding requirements are supported, will ensure that the streetlight network is maintained at our target Level of Service.

Meeting the target level of service is critical to maximize the benefit for every dollar we invested in maintenance and rehabilitation which will directly reduce costly future reactive works and will reduce complaints from the public. Should current and future funding levels not be supported, we risk further deterioration of the streetlight network, a reduced level of serviceability and increase long term maintenance costs.

Regional Implications

There are no Regional implications.

Relationship to Vaughan Vision 2007

This report is consistent with the priorities previously set by Council.

Service Delivery Excellence

We are able to develop and establish service level standards that are sustainable and provide effective and efficient delivery of service.

Manage our Resources

The City has a significant investment in infrastructure that requires a process and a plan to ensure that its repair and eventual replacement is properly managed.

Communications and Public Relations

Through endorsement of the InfraGuide Best Practices, we strengthen Corporate Image and identity.

Technology and Innovation

The system conforms to the policies, standards and procedures as defined through the Corporate G.I.S. Initiative. The Pole and Streetlight Maintenance and Rehabilitation Program achieves the Corporate Strategic Plan to develop and implement an Infrastructure Management System to enhance safety through proactive repair and replacement and improve financial efficiency and return on investment through life cycle costing.

Conclusion

The purpose of this report is to provide Council with the results of the Streetlight Inventory and Assessment study and to set out a Pole and Streetlight Maintenance and Rehabilitation Program. Project Level Program requirements will be brought forward annually for consideration as part of the Capital and Operating Budget deliberations.

Attachments

None.

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Respectfully submitted,

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