



OFFICE OF THE
City Auditor

Street Light Poles – Powder Coating Investigation

May 28, 2007

The Office of the City Auditor conducted
this project in accordance with the
*International Standards for the
Professional Practice of Internal Auditing*

Street Light Poles – Powder Coating Investigation

Executive Summary

The Office of the City Auditor (OCA) conducted an investigation of powder-coated streetlight poles installed in newer subdivisions. The primary purpose of the investigation was to determine whether or not the City has approved installations of streetlight poles that are not compliant with City specifications.

The City specifications for streetlight system installations are detailed in the *Road and Walkway Lighting Manual* (the Manual) maintained by Traffic Operations Branch, Transportation Department. The Manual details the physical and installation requirements for streetlight poles. Powder-coated streetlight poles have been an approved product since January 1, 2004, but the powder coating must be applied by a vendor with a City-approved process. Between January 2004 and November 2006, only one powder coating company was using a City-approved process. During that time, approximately 2,000 non-compliant powder-coated streetlight poles have been installed by the development industry. The cost to remove and replace those poles with compliant poles could be as high as \$8 million.

During our investigation, we also noted that 91 concrete streetlight poles are specified in three subdivision stage drawings associated with servicing agreements signed in 2006 and installation is in process. The City has not approved concrete streetlight poles as an alternate material. These poles are also non-compliant. The cost to remove and replace 91 poles with compliant poles could be as high as \$364,000.

As long as the City does not release the developer's letters of credit until all deficiencies are corrected and the Final Acceptance Certificates are approved, the City's risk exposure is mitigated.

Our observations and recommendations address three strategies that the Traffic Operations Branch needs to implement in order to reduce the City's risk exposure and improve its working relationships with the development industry. These three strategies are: 1) go-forward strategies designed to systematically lower the City's risk exposure and dealings with the industry, 2) short-term risk reduction strategies, and 3) a process improvement strategy.

The Branch accepted all three recommendations and provided action plans (some already initiated; the others with short timeframes) to resolve each of them.

We also met with a representative of the Urban Development Institute Edmonton to discuss the findings and recommendations. The Urban Development Institute believes that the identified issues can all be resolved by working with the City to find mutually satisfactory solutions. We encourage Traffic Operations to continue to work closely with the industry to resolve issues identified in this report to their mutual benefit.

Street Light Poles – Powder Coating Investigation

1. Introduction

The Office of the City Auditor (OCA) received a tip in 2006 indicating that the City is at risk because some street light poles installed in subdivisions since January 1, 2004 do not meet City specifications. Following discussion with the tip reporter, the City Auditor decided to further investigate this tip. In subsequent discussions with Traffic Operations Branch, Transportation Department, the Branch invited us to not only investigate the tip, but to conduct a broader review of their procedures.

1.1. Background

In 1997, the City assumed responsibility for ownership, management, and operation of the City's street lighting program from EPCOR. In 1999, the City assumed responsibility for street light installation quality assurance activities from Eltec (a division of EPCOR). Also in 1999, the City worked with the development industry to complete the *Road and Walkway Lighting Manual* (the Manual). The Manual included specifications for street light poles and their installation. Later that year, the City advised the development industry that powder-coated street light poles were acceptable as decorative poles as long as they met the specifications in the manual.

The City's street light program is currently administered by the Traffic Operations Branch of Transportation Department. The Branch has approximately 70,000 street light poles in the City's street light inventory.

Since January 1, 2004, the Transportation Department has required that powder-coated street light poles be coated using a department-approved process. From January 2004 to November 2006, only one powder coating company's process was approved. Transportation Department approved a second powder coating company's process in November 2006.

1.2. Subdivision Construction and Approvals

Subdivisions are constructed by stages. In general, each stage of construction requires a separate servicing agreement between the developer and the City. Developers are required to construct roadway systems, sidewalk and walkway systems, drainage systems, electrical distribution systems, street lighting systems, etc. in accordance with City specifications and requirements. The year that the servicing agreement was executed (signed by all parties) determines which specifications are applicable. Until the City approves the Final Acceptance Certificate for each applicable infrastructure system, the developer is responsible to correct any deficiencies at no cost to the City.

The approval process for each infrastructure system has been formalized in a manner that is designed to lower the City's risk exposure. The first step in the process calls for the City to approve the developer's plans for each infrastructure system. After the developer has completed construction and is satisfied that construction meets the City's requirements, the developer's engineering consultant applies for a Construction Completion Certificate. The City then inspects the system to ensure compliance with applicable specifications and approves or rejects the Construction Completion Certificate application as appropriate. If the application is rejected, the developer must correct all identified deficiencies and reapply for approval.

Two years after the Construction Completion Certificate is approved for street lighting, the developer can apply for approval of the Final Acceptance Certificate. The City inspects the system to ensure that it is still in compliance with its specifications and either approves or rejects the application. The two-year interval allows time for latent deficiencies to become obvious without the City assuming responsibility to correct those deficiencies (e.g., street light poles that settle enough to no longer be vertical). The developer or its agents are responsible for all costs to correct deficiencies that are identified prior to approving the Final Acceptance Certificate. After the City approves the Final Acceptance Certificate, the City assumes all responsibility for maintaining the street light system.

In the event that a developer refuses to correct deficiencies, the City may choose to hire its own contractors to do the work and use the developer's letters of credit or other surety to reimburse the City for doing the work itself.

1.3. Street Lighting System Roles

As a part of subdivision construction, the developer contracts with a street lighting design consultant and a contractor to install street lights in the subdivision stage. The design consultant prepares the street lighting system design in accordance with the requirements of the Manual and submits it to Traffic Operations Branch for approval. Following design approval, the developer hires a contractor to install the street lighting system in accordance with the design and with the specifications in the Manual.

The Manual requires that the street lighting design consultant be an engineer or an engineering firm and assigns specific responsibilities to the consultant, including oversight of the actual construction. Once the consultant is satisfied that the construction has been completed in compliance with the specifications in the Manual, the consultant is responsible for submitting an application for approval of the Construction Completion Certificate to Traffic Operations Branch. The Branch then inspects the subdivision stage to identify any deficiencies and either approve or reject the application based on the results of that inspection.

Two years after the Construction Completion Certificate is approved, the developer, acting through the consultant, may apply for approval of the Final Acceptance Certificate for the street lighting system. The consultant is responsible for ensuring that the street lighting system is still in compliance with the Manual prior to submitting the

Final Acceptance Certificate application. Traffic Operations Branch then inspects the installation to identify any deficiencies to be corrected prior to approving the Final Acceptance Certificate.

2. Objectives

The objectives of this review were to:

1. Determine whether or not non-approved powder-coated street light poles were installed by contractors and accepted by the City.
2. Assess the effectiveness and efficiency of the Traffic Operations Branch inspection and approval processes.

3. Scope and Methodology

We originally limited the scope of this project to determining whether or not non-compliant powder-coated street light pole installations since January 2004 have been approved or are at risk of being approved by the Traffic Operations Branch. As the project progressed, we determined that we needed to expand our scope to include assessment of the current processes for inspection, approval of the subdivision lighting systems, and application of the City's specifications.

Our methodology included the following steps:

- Meeting with the tip reporter to clarify the nature of the complaint and identify the areas of concern
- Investigating the complaint to confirm or dispel the areas of concern
- Reviewing relevant documentation related to specifications for and installation of road and walkway lighting in subdivisions, including powder coating processes
- Meeting with Transportation Department staff members to explore and understand the issues related to street light installation and maintenance, including risks associated with using non-approved powder coating
- Attending meetings between development industry representatives and Traffic Operations Branch and holding discussions with development industry stakeholders and Law Branch to better understand the scope of street light installation issues from the perspective of different stakeholders
- Correspondence and discussions with the City of Calgary to understand their processes and requirements for streetlighting systems
- Conducting field observations to observe the types of issues that exist around streetlight installations and approvals, including observations in selected subdivision stages in each of the neighbourhoods identified by the tip reporter

- Reviewing available documentation to determine whether or not subdivision stages with servicing agreements executed since January 1, 2004 received Construction Completion Certificate or Final Acceptance Certificate approvals in error
- Reviewing available documentation and having discussions with interested stakeholders to identify operational areas where process improvements could be realized
- Reviewing and evaluating available streetlight data sources, including a comprehensive list of servicing agreements for subdivision stages, a list of pending certificate applications, and a data source that listed the outcomes of streetlight inspections that were conducted in 2006

4. Summary of Results

4.1. Non-approved Road and Walkway Light Poles

4.1.1. Risk exposure

The tip reporter alleged that the City may have erroneously approved applications for Construction Completion and Final Acceptance Certificates for street lighting in subdivision stages in which non-compliant powder-coated road and walkway light poles (streetlight poles) were installed. We reviewed available documentation for all subdivision stages with servicing agreements that were executed in 2004 or later to evaluate the City's risk exposure.

The City has not issued any Final Acceptance Certificates for street lighting for any servicing agreements executed since January 1, 2004. Therefore, the City's risk exposure at this time is limited as long as other controls function effectively as discussed later.

At the close of this investigation, there were 49 servicing agreements (out of 411 total servicing agreements reviewed) for which we were not able to examine records regarding the number and types of streetlight poles in the design. Of the 362 agreements for which we examined engineering drawings, 280 included streetlight installations.

4.1.2. Road and walkway light pole installations

As indicated in the following table, approximately 75 percent of the engineering drawings for servicing agreements that included streetlights and have been executed since the beginning of 2004 specified powder-coated poles. An additional 2 percent of the streetlight installations specified concrete poles. The other 23 percent of the poles specified were hot-dip galvanized steel poles, which have been the standard for several years.

Powder coating provides developers with the ability to better incorporate street light poles into the architectural design of their communities by providing a wide range of possible colours on poles that have a durable surface. Metal products were first powder coated in Australia in about 1967 and powder coating has since become the coating of choice in several industries because of its inherent ability to protect the underlying metal and to produce a smooth, durable finish under a wide variety of exposure conditions. Powder-coated street light poles that are produced to the City's specifications are first hot-dip galvanized, then prepared and powder-coated, resulting in an extra layer of protection on the exterior surfaces of the pole.

Applying powder coating over hot-dipped galvanized steel has become an industry-recognized method of protecting steel structures such as street lights, bridges, etc. The benefits of using these duplex coatings (powder coating over hot-dipped galvanized steel) are both aesthetic and economic. Aesthetically, powder coating allows steel structures to be incorporated as components that fit into overall neighbourhood designs because of the range of colour options available. Economically, powder coating and hot-dip galvanizing operate synergistically to extend the life expectancy of the steel well beyond the sum of each of the expected life cycle of the two protective measures alone (estimated at 1.5 to 2.5 times the sum of the life expectancies of each finish). In effect, the galvanizing protects the powder coating from being lifted off the steel by rust and the powder coating protects the galvanizing layer from being corroded away. The functional life for streetlight poles varies depending on exposure conditions. For example, a streetlight pole on an arterial roadway is subjected to much harsher conditions than a pole located on a walkway. For illustrative purposes, if the expected life cycle of a hot-dip galvanized street light pole is 40 years and the expected life cycle of a powder-coated, non-galvanized pole is 10 years, the galvanizing and powder coating should work together to provide a finish that should last 75 years or more (1.5 times the sum of the life expectancies of each coating). Powder-coated poles manufactured to the City's specifications are likely to have life expectancies on the order of 50 to 100 years, depending on their locations.

If powder coating is not applied using a method that accounts for the degree of weathering of the underlying galvanizing or if inadequate surface preparation occurs, powder coating failures are likely to result, reducing the life expectancy of the poles. The powder coating method specified by the City is in line with industry practices that have been shown to work in the long term.

Numbers of Road and Walkway Lighting Poles Specified ¹ for Subdivision Stage Servicing Agreements				
Year	Galvanized Poles	Powder-coated Poles	Concrete Poles	Total Poles
2004	414	1,113	0	1,527
2005	367	1,037	0	1,404
2006	232	1,120	91	1,443
2007	14	96	0	110
Totals	1,014	3,366	91	4,471

¹ This table shows the number of poles included in the electrical drawings – a significant number of these poles were not yet installed.

4.1.3. Non-compliant powder-coated poles

Based on information we were able to gather during this investigation, approximately 70 percent of the 2,800 powder-coated poles actually installed (not just planned) under the requirements of the January 1, 2004 specification (about 2,000 poles) were not coated using a City-approved process. Assuming they are all installed in subdivision stages with servicing agreements executed January 1, 2004 or later, those 2,000 powder-coated poles are not in compliance with the City's specifications.

Prior to receiving an application for Construction Completion Certificate approval, the Branch has no means of enforcing compliance with City standards and specifications. The Branch worked with the industry prior to implementing the new specification for powder-coated poles in January 2004, but those specifications were not always followed in subdivision stages with servicing agreements dated January 1, 2004 or later.

Traffic Operations Branch recently undertook a street light pole replacement project in which its contractor removed the existing standard galvanized poles and replaced them with new powder-coated decorative poles. That project cost approximately \$4,000 per pole. With approximately 2,000 non-approved powder-coated poles installed between 2004 and 2006, the total cost to *remove and replace* all the non-compliant powder-coated poles could reach \$8 million. Based on our conversations with experienced Transportation Department staff members, however, it might be possible to reduce that cost significantly if the poles were *removed, refurbished, and reinstalled* rather than removed and replaced.

4.1.4. Non-compliant concrete poles

During data collection, we also observed that 91 concrete poles were specified in three subdivision stages for which servicing agreements were signed in 2006. Those poles are not in compliance with the City specification. The City allows introduction of new structural materials for streetlight poles as long as the materials are approved prior to installation. New structural materials have to be accompanied by engineering evidence that they are at least as durable as materials already approved by the City and then pass the City's certification process. This process was not followed. Traffic Operations Branch has conditionally rejected four of the engineering designs provided by the developer's consultant because the specified poles are not in compliance with the City's specifications. Based on field observations by Traffic Operations Branch, installation of the 91 concrete poles identified on the engineering drawings is underway. The cost to *remove and replace* 91 concrete poles could be on the order of \$364,000.

4.1.5. Developer liability

As mentioned earlier, until Final Acceptance Certificates for street lighting are approved, the developer is responsible to correct all identified deficiencies. Under the terms of the servicing agreements, if the developer refuses to correct the deficiencies, the City can

choose to do the work itself and draw on the developer's letter of credit or other security to cover its costs. Obviously, this only works if the developer's letter of credit is sufficient to cover the cost of correcting the deficiencies.

Traffic Operations Branch would only draw on developers' letters of credit in exceptional circumstances. In the normal course of events, they would draw on letters of credit only after attempts to negotiate a resolution have failed.

A part of our investigation included comparing the value of letters of credit on file with the City against the potential cost of removing and replacing non-compliant powder-coated or concrete streetlight poles. As shown in the table below, if the City had to replace all the concrete and powder-coated streetlight poles installed since 2004, the letters of credit and other securities on file with the City for those subdivision stages would be approximately \$1 million less than the likely cost of replacement poles.

Subdivision Stages with Potential Letter of Credit Shortfalls for Streetlight Replacement				
Year of Servicing Agreement	No. of Stages Affected	Letters of Credit or Other Security¹	Allowance for Pole Replacement¹	Potential Shortfall
2004	30	\$1,688,625	\$2,108,000	\$419,375
2005	28	\$1,460,000	\$1,852,000	\$392,000
2006	6	\$372,500	\$524,000	\$151,500
2007 ²	–	–	–	–
Totals:	64	\$3,521,125	\$4,484,000	\$962,875

¹ Letters of credit and allowance for potential replacement of powder-coated and concrete poles only

² As of February 6, 2007

The letters of credit or other securities included in the above table are intended to lower the City's risk in case of developer default in the associated subdivision stages. The letters of credit held by the City for each subdivision stage can be accessed as necessary for any of the infrastructure improvements in the subdivision stage (e.g., roadways, drainage, parkland, power, water, streetlights). The amount of security required for each subdivision stage prior to 2007 was much less than the potential cost to the City of completing work started by a developer that defaults. Consequently, even in the subdivision stages where the letters of credit exceed the potential costs of streetlight pole replacement, in the event of a developer's default, other infrastructure programs may have already depleted the available funds well before all deficiencies are corrected. Changes to the letter of credit requirements that were implemented in 2007 should significantly lower the City's risk exposure in this area.

The servicing agreements contain provision for specific holdbacks of the letters of credit for such things as landscaping, interim storm water management lakes, interim dry ponds, and temporary emergency access. Given the number of non-compliant streetlight pole installations observed in this investigation, the City should consider including specific letter of credit requirements for streetlight installations. (See Recommendation 1a)

During our research, we observed that the City of Calgary has adopted the City of Edmonton specification for powder-coated hot-dip galvanized streetlight poles. The City of Calgary allows developers to install only City-supplied powder-coated hot-dip galvanized streetlight poles. The City of Calgary supplies five basic designs of powder-coated poles in a single colour (black) and charges developers a surcharge to cover the additional costs associated with incremental operating costs (e.g., decorative lighting usually requires more poles than does standard lighting) and ongoing incremental maintenance of the decorative poles (refinishing to repair chips, abrasions, etc.). We believe that it would be prudent for Traffic Operations Branch to determine what additional maintenance and operating costs are typically associated with decorative streetlight poles and alternative coatings and materials when compared to standard galvanized streetlight poles. The Branch could then establish an appropriate surcharge to be assessed when developers choose to use non-standard poles that are likely to incur additional maintenance costs. (See Recommendation 1a)

4.1.6. Approved Construction Completion Certificates

During our investigation, we identified 21 subdivision stages for which the City has issued approved Construction Completion Certificates for street lighting. Seven of those subdivision stages have only galvanized poles identified in the engineering drawings. The other 14 of those subdivision stages specified a total of 109 powder-coated poles on the engineering drawings. The engineering drawings do not include sufficient information to be able to confirm whether or not the powder-coated poles in those 14 subdivision stages are compliant with the January 1, 2004 specifications.

The current precedent servicing agreement requires the City's Engineer to issue a Construction Completion Certificate if only "minor deficiencies" are identified. The servicing agreement goes on to identify minor deficiencies as deficiencies that "...do not impair the operation of the Municipal Improvement and thus do not need to be rectified immediately." The precedent servicing agreement goes on to indicate that, "The final determination of what constitutes a minor deficiency is in the sole and exclusive discretion of the [City's] Engineer."

Given the cost implications of replacing non-compliant streetlight poles, we believe that non-compliant materials and/or coatings should not be considered minor deficiencies. Since about 70 percent of *installed* powder-coated poles are not compliant with City specifications, it is likely that if this interpretation had been used at least some of the Construction Completion Certificate applications for the 14 subdivision stages mentioned above would have been rejected instead of approved. (See Recommendation 1b)

4.1.7. Outstanding certificate applications

In 2005 and 2006, Traffic Operations Branch met with representatives of the development industry to discuss the high rate of rejections being experienced with

Construction Completion Certificate and Final Acceptance Certificate applications. The outcome of those meetings was that the City agreed to hold certificate rejections in abeyance and to send lists of noted deficiencies that were to be repaired to the contractors and street lighting design consultants. The consultant would then notify the City when the deficiencies were corrected and the City would re-inspect and, if appropriate, issue an approved certificate.

That process did not work very well, resulting in a large backlog of inspections. Consequently, in mid-2006 the Traffic Operations Branch met with the industry and reached agreement that all outstanding certificate applications, including all deficiency reports issued in 2005 and all outstanding applications from 2003 onward would be subject to re-inspection based on the applicable specifications. Although some progress was made in the latter part of 2006, there are a large number of certificate applications yet to be processed.

Certificate Application Status for Servicing Agreements Executed between Jan 1, 2004 and Feb 6, 2007	
Application Inspection Category	CCC/FAC¹ Application Status
Inspected and Approved	21
Inspected and Rejected ²	60
Received; not yet inspected	79
Not yet received by the City ³	120
Total certificate applications	280
Remaining certificates to be approved	259

¹ CCC = Construction Completion Certificate; FAC = Final Acceptance Certificate

² These applications must be resubmitted after the deficiencies are corrected.

³ Construction is not yet complete in these subdivision stages, but applications are anticipated in 2007 for the majority of these subdivision stages.

As Traffic Operations Branch inspects or re-inspects those subdivision stages that have not yet received certificate approvals, the Branch needs to ensure that it does not grant either Construction Completion Certificate or Final Acceptance Certificate approvals to subdivision stages in which streetlight poles do not comply with the City's specifications. Since the Branch is well aware of the issue of non-compliant road and walkway lighting poles, we believe that the City's risk exposure is relatively low.

We limited our investigation to identifying the total numbers of streetlight poles of each type installed. Because powder-coated poles were supplied by more than one vendor and only one vendor used a City-approved process prior to November 2006, we did not identify the specific subdivisions in which non-compliant powder-coated poles were installed. We did, however, identify the specific subdivision stages in which concrete poles are installed. We were also able to obtain the total number of powder-coated poles supplied that were compliant with the City's specification. The Traffic Operations Branch needs to clearly identify the specific subdivision stages in which non-compliant powder-coated street light poles are installed. The Branch then needs to work with Law Branch and the development industry to resolve the issue of non-compliant poles (both powder-coated and concrete). Some developers have already indicated that they are

willing to work with the Branch to resolve the issue of non-compliant street light poles. (See Recommendation 2a)

The servicing agreements currently tie the start of the developer's warranty maintenance period to the approval of the Construction Completion Certificate for the related municipal improvement (e.g., streetlights). This may result in pressure to approve Construction Completion Certificates for street lighting for subdivision stages that aren't fully in compliance with the City's specifications (e.g., some poles installed with shims under the flange) with the understanding that the developer will correct deficiencies prior to submitting an application for Final Acceptance Certificate approval. This practice exposes the City to unnecessary risk by effectively removing one approval step from the process. We believe that this risk would be better managed by tying the start of the developer's warranty maintenance period to a formal inspection that results in a report noting the minor deficiencies that must be corrected prior to certificate approval. Disconnecting the Construction Completion Certificate from the warranty period would allow the engineering consultant's application for certificate approval to be founded (as it should be) on his or her professional opinion that the streetlight installation is in full compliance with the City's specifications.

In addition to the certificate applications yet to be approved for servicing agreements executed since January 1, 2004, Traffic Operations Branch has a significant number of applications and rejections in the queue for subdivision stages with servicing agreements executed prior to 2004. The Branch needs to eliminate its certificate application backlog as quickly as possible. In light of the timeframes defined in the servicing agreements, Traffic Operations Branch should consult with Law Branch to determine whether the City's legal risk exposure would be best minimized by focusing on: 1) older or newer applications and 2) new applications or those that have been rejected at least once. (See Recommendation 2b)

4.2. Operational Issues

In an attempt to better understand why non-compliant poles were installed in spite of Transportation Department's attempts to keep the development industry informed of the City's specifications, we expanded the scope of this review to include some of the other issues being discussed between the development industry and the department. We attended sessions that Traffic Operations Branch held with the development industry in late November 2006 and in late January 2007 and discussed outstanding issues with development industry representatives and Traffic Operations Branch staff members to obtain each of their perspectives.

4.2.1. Communications

Based on our attendance at meetings the Traffic Operations Branch held with the development industry and our conversations with industry contacts, we believe that the existing methods of communicating with the development industry need to be formalized to lessen the possibility of misunderstandings regarding specifications and inspection processes and to ensure that all development industry stakeholders receive

the same information. We believe that improved communications would also result in a clearer understanding of each party's role in the overall process.

In the November 2006 and January 2007 meetings, it was apparent that, in general, earlier communication processes had not worked as effectively as they should. At the November meeting, developer representatives indicated that they were hearing of some of the installation deficiency issues for the first time. Traffic Operations Branch has met on a fairly regular basis since 1999 with the consultants and contractors to ensure that they understood the City's requirements, but at least some of that information was not formally communicated with the development industry as a whole.

Both development industry representatives and Traffic Operations Branch staff members acknowledged that communication breakdowns have occurred. As we explored the issues raised by each party, we concluded that both sides have a strong desire to work effectively and efficiently together. Until recently, the Branch has used a rather informal communication process regarding changes and adjustments to the specifications and inspection processes. The Branch frequently met with the consultants and contractors as agents of the developers, but had relatively limited communication directly with the developers. In November 2006, the Branch made changes to its processes to ensure that developers are directly involved in future discussions regarding street light pole inspection issues.

4.2.2. Role definitions

Although Traffic Operations Branch has met repeatedly with the contractors and consultants to communicate its expectations and has provided clear specifications and role definitions in the Manual to guide developers, consultants, and contractors, those role definitions have not been followed consistently. In particular, there is little evidence that the development industry has implemented effective quality control programs to oversee streetlight system installations, yet the Manual clearly assigns the development industry the responsibility to ensure that streetlight systems are installed in full compliance with the specifications in the Manual.

4.2.3. Specifications

The *City of Edmonton Road and Walkway Lighting Manual* (the Manual) and Volume 6, *Street Lighting*, of *The Design and Construction Standards for the City of Edmonton* detail the specifications for street lighting. The specifications range from required luminance levels to material and design specifications for the poles, bases, wiring, etc. Some specifications (e.g., verification that powder-coated poles were first hot-dip galvanized) can not be verified by Traffic Operations Branch after installation is complete. Ultimately, developers are identified as the party responsible to ensure that products are installed in compliance with the specifications. The Manual further assigns responsibility for ensuring compliance with all product and installation specifications to the street lighting consultant and contractors, acting as agents of the developer. (See Recommendation 1c)

4.3. Installation Issues

4.3.1. Streetlight installation

During our field observations, we observed a wide variety of product selection and installation issues such as powder-coated poles that did not have stickers indicating that they had been powder coated by an approved coater, leaning poles, leaning luminaires, and bubbles and other deficiencies in powder coatings (see examples in Figures 1 and 2). Industry literature indicates that bubbling and/or powder coating separation from the underlying material typically results from inadequate surface preparation and can be the cause of early powder coating failure. The literature also indicates that there are known solutions to these failures and that they should be preventable with an appropriate powder-coating process and an adequate quality assurance program in place.



Figure 1: Leaning light fixture



Figure 2: Bubbles in powder coating layer

4.3.2. Quality assurance

The high rate of certificate application rejection (about 95% of subdivision stages inspected from spring through the end of July 2006 were rejected) is contrary to what we would expect to find if streetlight installation processes actually incorporated effective quality assurance programs. At present, the Manual assigns that quality assurance role to the developer through its agents, the streetlight design consultant and the installation contractor. The Traffic Operations Branch needs to work with the development industry as a whole to ensure that an effective quality assurance program is implemented by the developers and their agents.

At the November 2006 and January 2007 meetings between Traffic Operations Branch and the development industry, we observed that there is no universally-understood quality assurance program defined for streetlight system design and installation.

Effective quality assurance programs require collection of sufficient data to ensure that substantial compliance with applicable specifications can be demonstrated both as work

is being conducted and after the fact when questions arise about the quality of work or materials at a later date. Capturing necessary data elements provides, for example, the ability to assess the potential impact of emerging streetlight pole coating failures with a particular product brand. It also provides the ability to develop meaningful performance data that can be used to improve design, installation, and inspection processes.

Developers should bear the responsibility for ensuring that only approved products are installed in subdivision stages and that they are installed in accordance with the City's specifications. Traffic Operations Branch should bear the responsibility through its quality assurance program for verifying the effectiveness of the developers' quality assurance programs. (See Recommendation 1c)

4.3.3. Measurement

The issue of determining compliance with City specifications was also discussed at the meetings between Traffic Operations Branch and the development industry. At present, there are no formally defined test methods and/or instruments for determining compliance with City specifications for streetlight systems. For example, an effective measurement program would include formal definitions of the tools and procedures used to determine compliance or non-compliance with the physical specifications contained in the Manual. Those definitions would include such elements as (note: this is not an exhaustive list):

- Verifying the thickness and composition of streetlight pole coatings (e.g., hot-dip galvanizing, powder coating)
- Verifying that streetlight poles are installed at 90 degrees from horizontal
- Verifying streetlight pole manufacturers and coaters, including manufacturing and coating dates
- Verifying that Fillcrete is in place as required
- Verifying that powder coating surface defects are at an acceptable level
- Verifying that streetlight bases are at the specified height above grade

Traffic Operations Branch needs to work with the development industry to define standardized measurement methods to determine compliance with City specifications. (See Recommendation 1c)

4.4. Data Accessibility

As indicated previously, the databases and spreadsheets used by Traffic Operations Branch contain limited information. Only information pertaining to application for and approval of subdivision stages is captured and maintained in these databases and spreadsheets. Each of the existing databases and spreadsheets has a specific function and contains information related to that function. A new database system was created in the summer of 2006 for tracking subdivision stage activities. This system works well, but it does not contain sufficient information to facilitate responses to queries that extend beyond the limited data that is currently captured.

We believe that existing databases in Traffic Operations Branch should be consolidated and modified to incorporate additional data fields that could assist the Branch with tracking and reporting on subdivision information. Some of this information is currently available in databases and spreadsheets, but some of it is available only in hardcopy records, limiting its usability, and some of it is not being captured.

A single comprehensive database of information related to subdivision stage streetlight construction approvals should include information that would enable automated queries and reporting of information that could be used for both quality management and performance monitoring purposes. For example, it would enable the Branch to identify the need to change its specifications or approval processes by allowing it to easily identify all poles manufactured by a specific manufacturer and date range if a particular problem is identified that could also be an issue with other poles from that manufacturer.

The existing Traffic Operations Branch databases include some or all of the following fields:

- Subdivision and stage identifier (consistent formatting is essential)
- Street lighting design consultant
- Street lighting contractor
- Construction Completion Certificate and Final Acceptance Certificate application(s) and reapplication(s) with associated status (received, rejected, approved) and associated dates (need to capture multiple submissions as individual records)

In addition to the above fields, the consolidated database should also include the following fields:

- Development neighbourhood
- Developer(s)
- Servicing agreement execution date(s)
- Letter of credit amount for road and walkway lighting system installation
- Year of road and walkway lighting construction
- Number of road and walkway lighting poles
- Street light inspector
- Approved pole composition and coating (yes/no)
- Pole composition (steel, concrete, etc.)
- Pole manufacturer
- Type of coating(s)
- Coating applicator(s) (galvanizer, powder coater, etc.)

The POSSE system is one of the City's pillar applications and is used to track many land-related matters, but it was not being used to track subdivision certificate applications and approvals until the beginning of 2007. There will be opportunity going forward to periodically verify the completeness and accuracy of Traffic Operations Branch's database by comparing it against entries in POSSE that are used to manage subdivision stage construction, application, inspection, and approval records. For information that is not captured in POSSE, periodic validation checks against hardcopy records should be conducted. (See Recommendation 3)

5. Recommendations

Our observations and recommendations address three strategies that the Traffic Operations Branch needs to implement in order to reduce the City's risk exposure and improve its working relationships with the development industry.

5.1. Recommendation 1

Recommendation 1 addresses go-forward strategies designed to systematically lower the City's financial risk exposure (1a), reduce the likelihood that non-compliant streetlight poles will be installed in the future (1b), and resolve issues related to implementation of effective quality assurance programs that would help avoid the problems identified in this report (1c).

Recommendation 1 – Go-Forward Strategies

The OCA recommends that Traffic Operations Branch:

- a) Work with Law Branch and the Office of Development Coordination to establish an appropriate security amount and holdback conditions for road and walkway lighting systems and an appropriate surcharge to cover additional maintenance and operating costs associated with decorative poles.
- b) Formally define non-compliant streetlight pole materials and coatings as significant deficiencies and reject all such certificate applications.
- c) Work with Law Branch and the development industry to resolve issues regarding the Branch conducting spot inspections during construction, ensure that appropriate quality assurance programs are implemented, and ensure that standardized compliance measurement methods are implemented.

Management Response and Action Plan to Recommendation 1**Accepted**

Comments:

- a) Traffic Operations Branch will develop a proposed security amount and holdback conditions and proposed surcharge for review by Law Branch and Office of Development Coordination and inclusion in the development precedent servicing agreement. **Planned Implementation:** January 2008 for security and holdback; surcharge will depend on negotiations with the development industry
- b) Traffic Operations Branch has already informally completed this recommendation. This decision will be formally communicated to the development industry at our planned meeting with them in June 2007.
- c) At the planned meeting with the development industry in June 2007, Traffic Operations Branch will ensure that the industry understands that each role and responsibility defined in the Manual must be fulfilled before certificate applications will be processed, begin to develop a structure that will allow inspections during construction, discuss the expected elements of an effective quality assurance program, and discuss standardized compliance measurement methods.

Responsible Party: Director, Signals and Street Lighting

5.2. Recommendation 2

Recommendation 2 addresses risk reduction strategies that need to be implemented in the short term. These strategies include resolving the current issue with non-compliant streetlight poles that were wrongly installed (2a) and finding ways to eliminate the current application backlog without compromising the Branch's ability to process new applications (2b).

Recommendation 2 – Risk Reduction Strategies

The OCA recommends that Traffic Operations Branch work with Law Branch and the development industry to

- a) Ensure that the issue of non-compliant street light pole installations is resolved in a manner that does not expose the City to undue risk.
- b) Take immediate action to address the large number of outstanding plan reviews and inspections.

Management Response and Action Plan to Recommendation 2**Accepted**

Comments:

- a) Traffic Operations Branch has held preliminary meetings with Law Branch to discuss preferred options and alternatives. We will meet with UDI-appointed representatives of the development industry to resolve the issue of non-compliant pole installations. **Planned Implementation:** July to September 2007
- b) Traffic Operations Branch has identified and received approval to hire two additional staff to address the review and inspection workload. **Planned Implementation:** Underway

Responsible Party: Director, Signals and Street Lighting**5.3. Recommendation 3**

Recommendation 3 addresses the issue of being able to track details related to streetlight system construction and inspection. Without such ability, it is difficult for the Traffic Operations Branch to develop meaningful performance criteria, proactively identify potentially faulty materials, identify emerging issues that need to be resolved, etc.

Recommendation 3 – Process Improvement Strategy

The OCA recommends that Traffic Operations Branch modify its electronic database systems to enable quality management and performance reporting.

Management Response and Action Plan to Recommendation 3**Accepted**

Comments:

Traffic Operations Branch will incorporate the suggested data fields into a single database and schedule periodic validation checks as appropriate. **Planned Implementation:** September 2007

Responsible Party: Director, Signals and Street Lighting**6. Conclusions**

We were able to confirm the tip reporter's allegation that streetlight poles that are not compliant with the City's specifications have been installed. However, since the City has not issued Final Acceptance Certificates for street lighting for any of the subdivision

stages for which servicing agreements were executed since January 1, 2004, the City's risk is at least somewhat mitigated.

As long as the City does not release the developer's letters of credit until all deficiencies are corrected and the Final Acceptance Certificates are approved, the City's risk exposure is mitigated. Based on the subdivision stages reviewed as a part of this project, the City's risk of having to pay for the replacement of non-compliant powder-coated street light poles installed in subdivision stages with servicing agreements signed since January 1, 2004 has been reasonably mitigated.

In our opinion, the recommendations in this report will improve Traffic Operations Branch's inspection process and related internal procedures. We found no evidence of irregularities in any of the records we reviewed.

We noted that a substantial backlog of applications built up during a period when the Branch was working closely with the industry to resolve ongoing issues with high rates of rejection of certificate applications. We believe that the Branch's actions to implement the recommendations in this report will resolve the backlog issue.

With 21 exceptions, applications for Construction Completion or Final Acceptance Certificates for street lighting are either pending or have been rejected pending correction of deficiencies. Fourteen of those 21 Construction Completion Certificates for street lighting were approved in subdivision stages with powder-coated streetlight poles. Transportation Operations Branch needs to be particularly vigilant to ensure that Final Acceptance Certificates for street lighting are not approved for those subdivision stages until the non-compliant pole deficiencies are resolved.

We found that approximately 2,000 non-compliant powder-coated street light poles have been installed by developers since 2004. That was the first year in which powder-coated street light poles were required to be coated by an approved powder coating company using a City-approved process. We also found that 91 non-compliant concrete poles are specified (52 were installed at the time of this report) in three subdivision stages. The total cost of remedying these deficiencies would likely be in the order of \$8.4 million. The Traffic Operations Branch needs to work with both Law Branch and the development industry to ensure that the City does not incur the costs of correcting those deficiencies.

We also determined that previous methodologies used to determine the required values of developer letters of credit may be insufficient to cover the cost of developer default with regard to streetlight installation alone. The potential shortfall (should all developers default) could be as high as \$1 million. Recent changes in the calculation and application of letter of credit requirements should reduce this risk significantly in the future.

Recent process changes have resulted from Traffic Operations Branch working with the development industry to resolve issues of mutual concern such as application backlogs,

inspection criteria, etc. We believe that there are opportunities to further enhance this cooperation; especially in the areas of quality assurance programs and compliance measurement. We also believe that the enhancements discussed in this report will benefit all stakeholders.

We also met with a representative of the Urban Development Institute Edmonton to discuss the findings and recommendations. The Urban Development Institute believes that the identified issues can all be resolved by working with the City to find mutually satisfactory solutions. We encourage Traffic Operations to continue to work closely with the industry to resolve issues identified in this report to their mutual benefit.

We thank the tip reporter, Traffic Operations Branch, and members of the development industry for their invaluable cooperation during the course of this project.