



AUDITOR GENERAL'S REPORT ACTION REQUIRED

Local Road Resurfacing – Improvements to Inspection Process Required to Minimize Incorrect Payments to Contractors

| | |
|------------------------------|--------------------|
| Date: | September 25, 2013 |
| To: | Audit Committee |
| From: | Auditor General |
| Wards: | All |
| Reference Number: | |

SUMMARY

The Auditor General's Office recently completed a review of Transportation Services local road resurfacing contracts. The report entitled "Local Road Resurfacing – Contract Management Issues" is available at: <http://www.toronto.ca/legdocs/mmis/2013/au/bgrd/backgroundfile-58415.pdf>. The report identified issues in the areas of progress payments, quality assurance and project documentation. It was determined that supplementary audit work on road measurement practices was warranted.

This report includes six recommendations and includes management's response to each one of the recommendations. The implementation of the recommendations contained in this report will minimize incorrect payments to contractors that can arise from poor road measuring techniques, inadequate equipment or incomplete records.

RECOMMENDATIONS

The Auditor General recommends that:

1. City Council request the General Manager, Transportation Services Division, to ensure that inspectors are provided guidelines and training on appropriate measuring practices.

2. City Council request the General Manager, Transportation Services Division, to ensure that cost sheets completed by inspectors include all measurements and appropriate notations to allow for an accurate determination of work done.
3. City Council request the General Manager, Transportation Services Division, to give consideration to recovering overpayments made to various contractors.
4. City Council request the General Manager, Transportation Services Division, to assess whether the measuring wheels currently in use meet the standard for quality, accuracy and dependability required by the division and take corrective action as required.
5. City Council request the General Manager, Transportation Services Division, to ensure that inspectors maintain comprehensive and accurate measurements and records in their field books for all work done.
6. City Council request the General Manager, Transportation Services Division, to ensure that inspectors check that work order numbers have been coded correctly on cost sheets and that supervisors randomly spot check work order numbers when approving cost sheets. Evidence of any review should be documented.

Financial Impact

The implementation of recommendations in this report will minimize the number of incorrect payments to contractors. Potential cost savings resulting from implementing the recommendations in this report are not determinable at this time.

COMMENTS

The Auditor General's Office recently completed a review of Transportation Services Summer Road Maintenance Program. While conducting that particular review, we identified certain discrepancies with the accuracy of inspectors' road measurements at two districts. This report provides the results of the Auditor General's review of the local road resurfacing inspection process.

The Auditor General's report entitled "Local Road Resurfacing – Improvements to Inspection Process Required to Minimize Incorrect Payments to Contractors" is attached as Appendix 1. Management's response to each of the recommendations contained in the report is attached as Appendix 2.

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ATTACHMENTS

Appendix 1: Local Road Resurfacing – Improvements to Inspection Process Required to Minimize Incorrect Payments to Contractors

Appendix 2: Management's Response to the Auditor General's Review of Local Road Resurfacing – Improvements to Inspection Process Required to Minimize Incorrect Payments to Contractors

AUDITOR GENERAL'S REPORT

**Local Road Resurfacing – Improvements to
Inspection Process Required to Minimize
Incorrect Payments to Contractors**

August 22, 2013

Jeffrey Griffiths, CPA, CA, CFE
Auditor General



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EXECUTIVE SUMMARY

The Auditor General's Office recently completed a review of Transportation Services Summer Road Maintenance Program. The resulting report, Local Road Resurfacing – Contract Management Issues, identified a number of issues in the areas of progress payments, quality assurance and project documentation.

Additional audit required due to previous observations

While conducting that particular review, we identified certain discrepancies with the accuracy of inspectors' road measurements at two districts.

On each project, the City inspector is required to take and record measurements for work completed on the road or sidewalk. We found that in some cases inspectors' measurements are not always accurate and measuring practices and controls could be improved at both districts.

This review supplements our previous observations contained in our initial report and was necessary given the potential for incorrect payments to contractors that may result from inaccurate measurements.

Audit objective

The objective of this audit was to determine whether inspectors' road measurements are accurate and if there is proper documentation to support all measurements used to calculate amounts payable to contractors.

Inspectors' measurements are not accurate

To ensure correct payments are made to contractors, it is important that inspectors' measurements are accurate and complete.

Incorrect payments made to contractors

Our review identified inaccurate inspector measurements in a number of areas. The inaccuracies led to overpayments on several items such as grinding of asphalt, sidewalk and curb replacement. As well, there were underpayments for asphalt work as a result of missed measurements.

Inspectors are using low cost measuring wheels prone to failure

Inspectors are using two types of measuring tools, a retractable tape measure and measuring wheel. Based on our observations and discussions with staff, it appears that inspectors are using a low cost measuring wheel that is prone to failure. Faulty equipment will produce inaccurate measurements leading to incorrect payments to contractors.

Inspectors' field books are used to record all field measurements and notes with regards to construction activity. Comprehensive written records provide support for all work completed.

Inspectors' field books were incomplete and difficult to comprehend

Inspectors' field books were incomplete and difficult to comprehend, even for the inspector when asked to go back and interpret their notes.

Conclusion

This report identifies a number of opportunities to improve the accuracy of inspectors' road measurements and associated field records. The implementation of the report's recommendations will minimize incorrect payments to contractors that can arise from poor measuring techniques, inadequate equipment or incomplete records.

BACKGROUND

Local Road Resurfacing – Contract Management Issues report recently completed

Transportation Services Division's Road Operations Unit is responsible for managing local road resurfacing contracts. The Auditor General's Office recently completed an audit of local road resurfacing contracts. Our report, Local Road Resurfacing - Contract Management Issues, was adopted by Audit Committee on May 29, 2013. The Auditor General's report identified issues in the areas of progress payments, quality assurance and project documentation.

Additional audit necessary because of potential incorrect payments to contractors

In performing that review, we identified some discrepancies with the accuracy of inspectors' road measurements at two districts. We determined that additional audit work was necessary given the potential for incorrect payments to contractors.

In 2012, over \$30 million was spent on local road resurfacing contracts. This report provides the results of this additional audit work.

AUDIT OBJECTIVES, SCOPE AND METHODOLOGY

Audit objective

The objective of this audit was to determine whether inspectors' road measurements are accurate and if there is proper documentation to support all measurements used to calculate amounts payable to contractors.

Audit scope

The audit scope was limited to a review of inspectors' road measurements and documentation for one contract each at Toronto and East York and North York Districts. The contract value at the Toronto and East York District was \$6.3 million and the value of the contract in North York was \$2.9 million.

Audit methodology

Our audit methodology included the following:

- independent verification of road measurements taken by inspectors
- review of contract cost sheets
- review of inspectors' field books and other relevant documentation
- review of contract financial reports
- analysis of variances between quantities measured by Auditor General's Office staff and Transportation Services inspectors
- evaluation of measurement controls and practices

Compliance with generally accepted government auditing standards

We conducted this performance audit in accordance with generally accepted government auditing standards. Those standards require that we plan and perform the audit to obtain sufficient, appropriate evidence to provide a reasonable basis for our findings and conclusions based on our audit objectives. We believe that the evidence obtained provides a reasonable basis for our findings and conclusions based on our audit objectives.

AUDIT RESULTS

A. ROAD MEASUREMENT TECHNIQUES AND CONTROLS

A.1. Inaccurate Road Measurements

Four basic methods to determine payments to contractors

For road resurfacing and sidewalk repairs, there are four basic methods for determining payments to contractors. These are:

- 1) by weight – used primarily for stone and asphalt
- 2) by area – for specific items such as sidewalk replacement, road base and grinding asphalt
- 3) by length – generally for curb replacement
- 4) by quantity – for individual replacement items such as maintenance hole covers and catch basins

Material weight records were addressed in our initial review of local road resurfacing contracts. This review deals more fully with area, length and quantity measurements.

City inspectors are required to take and record precise measurements

On each project, a City inspector is required to take and record precise measurements for work done on the road or sidewalk. All measurements are recorded in field books and then transcribed to cost sheets which are signed-off by both the inspector and the contractor's representative. District supervisors review and approve the cost sheets. Cost sheet information is input into the Toronto Maintenance Management System which uses relevant contract unit prices to calculate amounts payable to each contractor.

Further work required to determine underlying cause of variances initially identified

In our initial review, we recorded measurements taken in our presence by independent divisional staff. Our measurements were significantly lower than those originally recorded by the inspectors in two districts. We discussed our observations with divisional management and determined that additional work should be conducted to determine the underlying cause of the variances. This further work was conducted in this review.

Measuring wheel not appropriate for measuring small area or length

In North York, inspectors have been instructed to take all length and area measurements using a measuring wheel. A measuring wheel is a hand held device where the wheel is on a handle. The inspector pushes the wheel along the surface being measured and the meter attached to the wheel records the distance. While this is an efficient technique for longer distances, it is not appropriate when measuring a small area or length since the measurement will not necessarily be precise over a short distance.

We noted several discrepancies where a wheel was used for measuring a short distance. For example, in one case, the sidewalk width recorded using the wheel was 1.70 metres. When checked with a measuring tape the actual width was 1.55 metres. While this does not appear to be a significant difference the inspector's recorded width is 9.7 per cent greater than the actual width.

Detailed measurements not taken and recorded

We also noted that in North York, inspectors do not measure the actual width of each section of sidewalk replaced. Inspectors take several measurements along the entire section of road to approximate the average width. This approach is not accurate since the actual width of sidewalk along a road can vary making it difficult to precisely calculate the average width. In one example that we checked, using the average width resulted in the inspector's measured area being 11% larger than the actual total area. This difference resulted in the overpayment of \$12,752 as indicated in Exhibit 2.

Measurement errors and incomplete documentation

Inspectors at other districts measure and record the actual length and width of each segment of sidewalk by line item on the cost sheet. This approach is more accurate and creates a detailed record when correctly done. However, at Toronto and East York, we did find measurement errors and instances where inspectors did not accurately document work done on the cost sheet.

Incorrect payments because of poor measurement techniques or inspector error

Our detailed review of inspectors' road measurements is attached as Exhibits 1 and 2 to this report. Most differences could be attributed to either poor measurement practices or inspector error. During our review we identified the following:

- there were significant overpayments on several items such as grinding of asphalt, sidewalk and curb replacement
- underpayments for grinding of asphalt and missed measurements

No guidelines on appropriate measuring techniques

Currently, there are no guidelines provided to inspectors on appropriate measuring practices to be used for different types of work to be measured.

Table 1 summarizes the overall results of our testing.

**Table 1:
Analysis of Inspectors' Road Measurements**

| Description | Toronto and East York (\$) | North York (\$) |
|--|-----------------------------------|------------------------|
| Total value of items as originally measured by inspectors | \$699,009 | \$277,188 |
| Total value of items as measured by Auditor General's Office | \$640,669 | \$262,235 |
| Total variance of measured items | \$58,340 | \$14,953 |
| Variance | 9.11% | 5.70% |

Inspectors should exercise due care when taking measurements and use proper measuring practices to minimize errors. When required, staff should be provided an appropriate level of training.

Recommendations:

- 1. City Council request the General Manager, Transportation Services Division, to ensure that inspectors are provided guidelines and training on appropriate measuring practices.**

2. **City Council request the General Manager, Transportation Services Division, to ensure that cost sheets completed by inspectors include all measurements and appropriate notations to allow for an accurate determination of work done.**
3. **City Council request the General Manager, Transportation Services Division, to give consideration to recovering overpayments made to various contractors.**

A.2. Measuring Equipment Should Be Reliable and Accurate

Measuring wheels are not reliable

Inspectors are provided with two types of measuring tools, a retractable tape measure and measuring wheel, which are both widely used in the construction industry. The tape measure is used for taking smaller measurements and the measuring wheel is designed for distance measuring. During one of our site visits we observed a few instances where new measuring wheels malfunctioned.

The supervisor mentioned that this was not an isolated incident and cited some common types of problems experienced with measuring wheels such as:

- sticking rotating wheel
- jammed or sticking counter measure
- counter measure skipping digits
- accuracy of the calibration

Low cost measuring wheels may cause inaccurate measurements

Based on our observations and discussions with a number of staff, it appears that inspectors are using low cost measuring wheels that are prone to breaking down. As such, there likely were inaccurate measurements taken that resulted in incorrect payments to contractors.

Toronto and East York district has upgraded all measuring wheels

We were also advised by Toronto and East York staff, the district with the highest volume of work, that the measuring wheels currently used by staff need to be replaced every year. As a result of our audit work, management advised us that they have replaced all of their original plastic measuring wheels which cost approximately \$75 per unit with a more reliable and higher quality steel wheel at a cost of about \$200 each.

Consideration given to replace all existing measuring wheels

Given the magnitude of payments determined using this equipment, consideration should be given to supplying all inspection staff with more durable and reliable measuring wheels designed for professional use.

Recommendation:

- 4. City Council request the General Manager, Transportation Services Division, to assess whether the measuring wheels currently in use meet the standard for quality, accuracy and dependability required by the division and take corrective action as required.**

B. ADMINISTRATIVE RECORD KEEPING

B.1. Inspectors' Field Records Are Incomplete

The division's Road Operations Contract Inspection Manual requires that inspectors keep an up-to-date field book. As well, photographs are taken prior to the start of construction work and throughout to supplement inspectors' field book records.

Good written records are important in case of dispute

Inspectors' field books are used to record all field measurements and notes with regards to construction activity. It is important for inspectors to have accurate written records to support all work completed in case of contractor dispute or third-party claims for damages. Comprehensive documentation can also assist the supervisor during a review of the inspector's work.

Inspectors' field book records were incomplete and difficult to comprehend

In certain cases inspectors' field book records were incomplete and difficult to understand. For example:

- different inspection staff were using the same field book resulting in duplicate measurements being recorded
- some measurements were incomplete or not recorded at all
- entries were made with no explanation
- measurements were not referenced to any specific site location making it impossible to identify the location related to the measurement

To obtain further clarification, we followed up with inspectors. However, staff could not recall or provide an explanation for certain entries contained in their field book records. This highlights the importance of keeping comprehensive and accurate notes.

Recommendation:

- 5. City Council request the General Manager, Transportation Services Division, to ensure that inspectors maintain comprehensive and accurate measurements and records in their field books for all work done.**

B.2. Inaccurate Tracking of Road Resurfacing Costs

*Work order
number tracks
cumulative
construction
costs*

Each road to be resurfaced is assigned a unique work order number. The cumulative construction costs for each road are tracked in the Toronto Maintenance Management System by work order number. This information is available to management when analyzing current and final contract costs.

*Reported
construction
costs misstated*

Inspectors are required to record the work order number for each road project on a separate cost sheet. At Toronto and East York there were several instances where inspectors recorded the wrong work order number on cost sheets. This resulted in the construction costs being charged to the wrong road. Although this did not have an impact on the final contract costs the reported costs on some roads were misstated.

Inaccurate reporting of construction costs impairs management's ability to assess the reasonableness of payments made to contractors and analysis of final construction costs.

Recommendation:

- 6. City Council request the General Manager, Transportation Services Division, to ensure that inspectors check that work order numbers have been coded correctly on cost sheets and that supervisors randomly spot check work order numbers when approving cost sheets. Evidence of any review should be documented.**

CONCLUSION

This report represents the results of our review of inspectors' road measurements and related documentation. The report contains six recommendations. Implementation of the report's recommendations will minimize incorrect payments to contractors that can arise from poor measuring techniques, inadequate equipment or incomplete records.

EXHIBIT 1

**Road Operations – Toronto and East York
Analysis of Inspectors’ Road Measurements**

| Road No. | Item No. | Description | Value Per AGO Road Measurements (\$) | Variance from Inspectors’ Measurements (\$) | Variance from Inspectors’ Measurements (%) |
|---------------------|-----------------|-----------------------------------|---|--|---|
| 1 | 17a | Grinding of asphalt with asbestos | 28,421 | -11,018 | -38.77 |
| | 18 | Concrete curb | 11,682 | 1,098 | 9.40 |
| | 21 | Concrete sidewalk, driveway | 10,689 | 1,939 | 18.14 |
| | 22 | Monolithic curb and sidewalk | 13,403 | 1,739 | 12.97 |
| 2 | 9 | HL8 hand laid asphalt | 27,262 | 1,172 | 4.30 |
| | 17a | Grinding of asphalt with asbestos | 63,525 | 16,165 | 25.45 |
| | 18 | Concrete curb | 15,361 | -89 | 0.58 |
| | 21 | Concrete sidewalk, driveway | 25,743 | 2,988 | 11.61 |
| | 22 | Monolithic curb and sidewalk | 80,438 | 16,094 | 20.01 |
| 3 | 16 | Grinding of asphalt | 6,204 | 482 | 7.77 |
| | 18 | Concrete curb | 768 | 20 | 2.60 |
| | 21 | Concrete sidewalk, driveway | 323 | 1,303 | 403.41 |
| | 22 | Monolithic curb and sidewalk | 63,789 | 19,528 | 30.61 |
| 4 | 4 | HL3 asphalt blvd. and driveway | 10,217 | 830 | 8.12 |
| | 17a | Grinding of asphalt with asbestos | 93,214 | -1 | 0 |
| | 18 | Concrete curb | 477 | 9 | 1.89 |
| | 21 | Concrete sidewalk, driveway | 10,930 | 379 | 3.47 |
| | 22 | Monolithic curb and sidewalk | 158,477 | 4,318 | 2.72 |
| | 26 | Adjust manhole, catch basin | 4,850 | 320 | 6.60 |
| | 27 | New manhole, catch basin | 14,896 | 1,064 | 7.14 |
| TOTAL (\$) | | | <u>\$640,669</u> | <u>\$58,340</u> | |
| VARIANCE (%) | | | | | 9.11% |

EXHIBIT 2

**Road Operations – North York
Analysis of Inspectors’ Road Measurements**

| Road No. | Item No. | Description | Value Per AGO Road Measurements (\$) | Variance from Inspectors’ Measurements (\$) | Variance from Inspectors’ Measurements (%) |
|---------------------|-----------------|-----------------------------------|---|--|---|
| 1 | 4 | HL3 asphalt blvd. and driveway | 7,378 | 497 | 6.73 |
| | 16a | Grinding of asphalt with asbestos | 33,670 | 798 | 2.37 |
| | 18 | Concrete curb | 25,560 | 18 | 0.07 |
| | 21 | Concrete sidewalk, driveway | 13,512 | 805 | 5.96 |
| | 26 | Adjust manhole, catch basin | 3,640 | 0 | 0 |
| | 27 | New manhole, catch basin | 17,490 | 0 | 0 |
| 2 | 4 | HL3 asphalt blvd. and driveway | 11,035 | -1,346 | -12.20 |
| | 15 | Grinding of asphalt 0-40 mm | 4,695 | 163 | 3.47 |
| | 16 | Grinding of asphalt 40 mm | 5,141 | 179 | 3.48 |
| | 21 | Concrete sidewalk, driveway | 1,688 | 1,087 | 64.40 |
| | 22 | Monolithic curb, sidewalk | 116,706 | 12,752 | 10.93 |
| | 26 | Adjust manhole, catch basin | 4,760 | 0 | 0 |
| | 27 | New manhole, catch basin | 16,960 | 0 | 0 |
| TOTAL (\$) | | | <u>\$262,235</u> | <u>\$14,953</u> | |
| VARIANCE (%) | | | | | 5.70% |

**Management’s Response to the Auditor General’s Review of
Local Road Resurfacing – Improvements to Inspection Process Required to Minimize Incorrect Payments to Contractors**

| Rec No. | Recommendations | Agree (X) | Disagree (X) | Management Comments: <i>(Comments are required only for recommendations where there is disagreement.)</i> | Action Plan/Time Frame |
|---------|---|-----------|--------------|--|---|
| 1. | City Council request the General Manager, Transportation Services Division, to ensure that inspectors are provided guidelines and training on appropriate measuring practices. | X | | | <p>In July 2013, Transportation Services updated its Road Operations Contract Inspection Manual to reflect the recommendations made by the Auditor General in his April 2013 review of Local Road Resurfacing. Training on the updated manual was conducted on July 23 and 25, 2013 for approximately 125 contract management and inspection staff. Measuring practices and protocols, recording of measurements, usage of forms and respective entry of information were covered as individual topics.</p> <p>Based on the current report, recommendations Transportation Services will further prepare tailgate training modules and provide tailgate training sessions to all contract management and inspection staff prior to November 2013.</p> |

| Rec No. | Recommendations | Agree (X) | Disagree (X) | Management Comments: <i>(Comments are required only for recommendations where there is disagreement.)</i> | Action Plan/Time Frame |
|---------|---|-----------|--------------|--|---|
| 2. | City Council request the General Manager, Transportation Services Division, to ensure that cost sheets completed by inspectors include all measurements and appropriate notations to allow for an accurate determination of work done. | X | | | Same as above for Recommendation 1. |
| 3. | City Council request the General Manager, Transportation Services Division, to give consideration to recovering overpayments made to various contractors. | X | | | Transportation Services has consulted with the Legal Services Division and was advised that the City may have no legal recourse to recover payments made to the contractor, since the limitation period to commence actions against the contractor has passed, and further it was the City itself which inspected each location, made measurements, verified what was done, certified the work and the quantity of work, and then made payment accordingly. |

| Rec No. | Recommendations | Agree (X) | Disagree (X) | Management Comments: <i>(Comments are required only for recommendations where there is disagreement.)</i> | Action Plan/Time Frame |
|---------|--|-----------|--------------|--|---|
| 4. | <p>City Council request the General Manager, Transportation Services Division, to assess whether the measuring wheels currently in use meet the standard for quality, accuracy and dependability required by the division and take corrective action as required.</p> | X | | | <p>Based on the recommendation of the Auditor General and Transportation Services’ interest in minimizing mechanical error, the Toronto and East York District has already replaced the Lufkin model MW38M measuring wheels with higher quality Rolatape model 32-415M steel measuring wheels. All other districts have been provided with one of the higher quality wheels to assess based on accuracy, dependability and efficiency.</p> <p>Based on the assessment, Transportation Services will determine the best model of measuring wheel for contract inspection measurement accuracy, and will replace all wheels accordingly as needed.</p> <p>In the meantime, all inspection staff have been instructed to calibrate the measuring wheels weekly in a marked location within their workplaces. They have also been instructed to measure back from the start point as a check for long distance measurements. These will also be covered in the tailgate training sessions described above for Rec. 1.</p> |

| Rec No. | Recommendations | Agree (X) | Disagree (X) | Management Comments: <i>(Comments are required only for recommendations where there is disagreement.)</i> | Action Plan/Time Frame |
|---------|--|-----------|--------------|--|---|
| 5. | City Council request the General Manager, Transportation Services Division, to ensure that inspectors maintain comprehensive and accurate measurements and records in their field books for all work done. | X | | | <p>The updated Road Operations Contract Inspection Manual and the training sessions held in July 2013 have addressed this recommendation in detail.</p> <p>It will further be emphasized and covered in the tailgate training sessions as described in Rec. 1 that will be scheduled before November 2013.</p> |
| 6. | City Council request the General Manager, Transportation Services Division, to ensure that inspectors check that work order numbers have been coded correctly on cost sheets and that supervisors randomly spot check work order numbers when approving cost sheets. Evidence of any review should be documented. | X | | | <p>The updated Road Operations Contract Inspection Manual and the training sessions held in July 2013 have reinforced this audit requirement for Supervisors, with specific protocols for same. All audited and signed-off sheets will be maintained in the contract files.</p> <p>This topic also will further be emphasized and covered in the tailgate training sessions as described in Rec. 1 that will be scheduled before November 2013.</p> |