Winnipeg

Traffic Signals Branch Performance Audit
November 2010

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Audit Department

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EXECUTIVE SUMMARY

The Traffic Signals Branch forms part of the Transportation Planning and Traffic Management Division of Public Works. The Division is responsible for planning, designing and managing the transportation system and the traffic regulatory environment to provide a safe, environmentally – aware, accessible and sustainable transportation system. More specifically, the Traffic Signals Branch is responsible for the operation and maintenance of 611 traffic signals, 155 pedestrian corridors, 50 hazard flashers and four all red flashing intersections located in the City of Winnipeg, as well as new signal development and installation.

The purpose of this audit is to report to the Audit Committee and Council on the efficiency and effectiveness of the Traffic Signals Branch. The audit was identified in the City Auditor's 2009-2010 Audit Plan and endorsed by the Audit Committee. The objectives of this audit were to:

- assess the operational performance of the Branch;
- determine whether adequate systems, practices and controls are in place to achieve the Traffic Signals Branch goals and objectives; and,
- determine the extent reported service performance results are complete, relevant, accurate, balanced and meaningful.

Traffic congestion is a major problem in most cities today and can be quite costly as a result of environmental harm caused by pollution emitted from idling engines, increased fuel consumption and safety concerns as a result of frustrated motorists. Delays can be reduced however, by a well run traffic signal system. Unfortunately, Winnipeg has an aging traffic signal system, with a significant number of signals still using electro-mechanical controllers which are 30 to 40 years old. The ability to adjust signal timing and improve traffic flow is limited because of the older technology used in many of the City's signals.

The Traffic Signals Branch has made a number of positive improvements to the traffic signal system in the last couple of years. The Branch is currently in the third year of a five year major capital project to enhance traffic signals. The project started in 2008 and is scheduled for completion in 2012. The project has an approved budget of $2.3 million per year and includes the development and implementation of an enhanced traffic signal management system. Major City routes have been assessed and traffic signals will be upgraded. In addition a traffic management centre will be developed which will house the traffic signal management system and other equipment and resources to visually monitor the performance of the roadway network. The project, however, is over 6 months behind schedule and the 2012 completion date may be difficult to achieve.

Key Observations and Recommendations

We have made a number of recommendations to improve the efficiency and effectiveness of the Traffic Signals Branch. A summary of all recommendations is attached as **Appendix 3.**

The Traffic Signals Branch needs to develop a formalized mission statement, strategic plan and objectives for the Branch. The Branch should also develop an IS strategy or

plan to maximize the benefit derived from information technology and to ensure IS projects are prioritized.

To support the newly defined Branch objectives, a study should be undertaken to review overall resource requirements in order to run an efficient and effective traffic signal operation. In the last three years the Branch has incurred total overtime costs exceeding $1.1 million. In 2009 alone, twelve Branch employees earned more than $20,000 each in overtime. A significant portion of this overtime is earned by first responder team members who are called out while on standby on weekends and after hours on weekdays to respond to traffic signal failures. We recommend that the Branch review the make up of first responder teams. First responder teams are currently made up of two electricians. Manitoba Work Place Safety and Health Regulations requires that only electrical workers perform electrical work and that a standby worker who is trained in emergency procedures be present when electrical work is done, there is no requirement however that both members of the first responder team be electricians. The inclusion of a Technician on the first responder team would allow for more efficient and effective repairs to be performed on signal controllers as well as provide more flexibility in scheduling first responder teams. Branch management should consider: changing the composition of first responder teams, adding additional evening and weekend shifts, modifying work hours and possibly outsourcing some areas of work to reduce overtime.

Branch Management should also determine the resources required (both internal and external) to complete the signal enhancement project on schedule. Branch Management has indicated that some parts of the project are currently more than six months behind schedule largely due to insufficient staff resources being dedicated to the project. Delays have occurred due to crews being pulled off the project to work on other priority areas including maintenance repairs and new capital development initiatives. In addition, the Branch should perform more detailed financial tracking of the project, including a comparison of percentage of work completed/remaining to budget to identify potential cost overruns so that actions can be taken to mitigate budget overruns.

The Traffic Signals Branch needs to review and rate all intersections to determine the level of criticality for each signal. The Branch does not have a formal priority schedule in place for handling and attending traffic signal failure incidents. Although the Branch has developed a deferral policy for some types of signal damages and there is an understanding by employees that reports of damages and light malfunctions get a higher priority, there is no formalized priority schedule or listing of critical intersections in place. As a result, the Branch is incurring overtime in order for crews to handle minor or lower priority calls and may be incurring longer response times due to the number of calls being responded to at any given time.

We recommend that the Branch develop some key components of an effective traffic signal operation. These include a regular preventative maintenance program, a formalized signal timing review process, and a formalized signal monitoring process. The Branch currently either does not have a process in place (i.e. preventative maintenance) or performs the function in a limited or sporadic basis. Such measures should reduce the level of reactive maintenance work currently being performed, reduce response time rates and improve the flow of traffic on City streets.

MANDATE OF THE CITY AUDITOR

The City Auditor is a statutory officer appointed by City Council under the *City of Winnipeg Charter Act*. The City Auditor reports to Council through the Audit Committee (Executive Policy Committee) and is independent of the City's Public Service. The City Auditor conducts examinations of the operations of the City and its affiliated bodies to assist Council in its governance role of ensuring the Public Service's accountability for the quality of stewardship over public funds and for the achievement of value for money in City operations. Once an audit report has been communicated to Council, it becomes a public document.

AUDIT BACKGROUND

The audit was identified in the City Auditor's Audit Plan for 2009 to 2010 and endorsed by the Audit Committee. The long term goal for the Traffic Signal Branch is to meet the requirements of its capital program and the Branch's short term goal is to ensure all existing equipment is maintained and running with as little disruption as possible. The Traffic Signals Branch forms part of the Transportation Planning and Traffic Management Division of Public Works and is responsible for the operation and maintenance of 611 traffic signals, all pedestrian corridors, overhead sign structures and flashing reds located in the City of Winnipeg, as well as new signal development and installation.

The purpose of this audit is to report to the Audit Committee and Council on the efficiency and effectiveness of the Traffic Signals Branch.

AUDIT OBJECTIVES

The objectives of this audit were to:

- assess the operational performance of the Branch;
- determine whether adequate systems, practices and controls are in place to achieve the Traffic Signals Branch goals and objectives; and,
- determine the extent reported service performance results are complete, relevant, accurate, balanced and meaningful.

AUDIT APPROACH

We have conducted the audit in accordance with generally accepted auditing standards. **Appendix 1** provides a flowchart of the audit process.

- We conducted interviews with the management and staff of the Traffic Signals Branch to obtain an understanding of current processes and procedures.
- We obtained and reviewed financial and statistical data related to traffic signal operations.

- We reviewed traffic signal standards, procedures and other relevant background information as well as city, provincial and national data to gain an understanding of traffic signal operations and standards within the industry.
- We interviewed staff within the Risk Management Division to gain an understanding of the claims process related to third party damage of traffic signals.
- We surveyed other Canadian cities in regards to their traffic signal operations and practices.

AUDIT SCOPE

The audit covered the period January 1, 2007 to December 31, 2009. The scope of our audit included the transactions, processes, policies and practices in place at the Traffic Signals Branch during this period. We believe that this scope affords us the ability to analyze emerging trends without a pervasive risk of losing context in the examination due to continually changing social, environmental and economic circumstances.

We have undertaken appropriate procedures in an attempt to verify the accuracy of the information we were provided. At various times during the review, due to information system limitations, we were unable to obtain information to conduct further analyses.

AUDIT CONCLUSIONS

The audit work performed led us to the following conclusions:

- From an operational perspective the Branch has made strides in the last couple of years to update the traffic signal system in the City. Eight major intersections have been upgraded and although not fully functional as yet, the Traffic Signals Management System has been upgraded and will eventually allow the Branch to monitor intersections "real" time. The Branch has managed to operate the City's traffic signal system with limited resources and has installed signals for new developments. Finally, the Branch has taken steps to reduce expenditures as total expenses have decreased by approximately $256,400 (8.4%) from 2007 to 2009. At this time, the Branch needs to reevaluate its expenditure plans. Significant overtime has been incurred in the last three years and the Branch is falling behind schedule in the signal enhancement project, as a result of staff being pulled off of the project to work on other priorities. Insufficient resources may also be contributing to the Branch not having a regular preventative maintenance program in place, the lack of a formalized regularly scheduled signal timing reviews and the ongoing monitoring of signals.

- We provided nineteen recommendations to improve the efficiency and effectiveness of the Traffic Signal Branch. Key recommendations address the following areas:
    - The Branch needs to improve management oversight of traffic signal operations. Key recommendations in this area include:
        - The development of a formalized mission statement, strategic plan and objectives for the Branch.

        - Branch management should conduct a workforce analysis to determine the appropriate staffing levels and organizational structure for the Branch.
        - The Branch also needs to develop a formalized work priority schedule to address the competing work objectives to maintain signals, upgrade signals and install new signals in new developments in order to ensure that staff are being used effectively.
        - The development of a detailed project plan for the enhancement project to ensure the project is completed by the original overall completion date. The plan should include a human resources plan and a staff schedule which identifies the staff requirements to complete the project.
        - Review and ranking of all intersections/routes to determine their level of criticality. Based on the level of criticality the Branch should develop response priorities. Formalized priorities should also be established by incident type.
        - Branch management should change the composition of first responder teams to include a technician and an electrician.
        - Branch management should consider adding additional evening and weekend shifts, modifying work hours and possibly outsourcing some areas of work. in order to reduce the level of overtime currently being incurred.
        - The Branch should develop an IS strategy or plan to maximize the benefit derived from information technology and to ensure IS projects are prioritized.
    - We recommend that the Branch develop some key components of an effective traffic signal operation that are currently not in place. These include a regular preventative maintenance program, a formalized signal timing review process, and a formalized signal monitoring process. The Branch currently either does not have a process in place (i.e. preventative maintenance) or performs the function on an adhoc basis. Such measures should reduce the level of reactive maintenance work currently being performed, reduce response time rates and improve the flow of traffic on City streets. Resources required to implement these processes should be addressed as part of the overall resource requirement review discussed above.

- Few performance measures have been established by the Branch. The Branch needs to develop and report on key performance indicators for all significant areas of operations such as system reliability, response time to signal failures and travel times. The performance information should provide insight into whether the Branch is achieving its goals and objectives.

ACKNOWLEDGEMENT

The Audit Department wants to extend its appreciation to the management and staff of the Traffic Signals Branch of the Public Works Department and the Corporate Finance Department.

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Date

TRAFFIC SIGNALS BRANCH BACKGROUND

The Traffic Signals Branch forms part of the Transportation Planning and Traffic Management Division of the Public Works Department. The Division is responsible for planning, designing and managing the transportation system and the traffic regulatory environment to provide a safe, environmentally – aware, accessible and sustainable transportation system.

The key goals of the Division are:

- Provide integrated transportation and land use planning.
- Provide an accessible transportation system.
- Invest in equipment and technology that supports a sustainable transportation system.
- Expand the Active Transportation System Network.
- Support Downtown revitalization initiatives.
- Maintain or improve service levels on the arterial street system.

The first traffic signal was installed in Winnipeg in 1928 on the corner of Donald Street and Ellice Avenue. Currently, the Traffic Signals Branch is responsible for the operation and maintenance of 611 traffic signals, 155 pedestrian corridors, 50 hazard flashers and four all red flashing intersections located in the City of Winnipeg, as well as new signal development and installation. Specifically this includes:

- Responding 24/7 to trouble reports regarding signal failures;
- Repair of damaged signals;
- Signal system upgrade analysis;
- Implementation of signal timing and phasing changes as required;
- Installation and ongoing maintenance of traffic signals, pedestrian corridors, overhead sign structures, flashing reds, etc.;
- Transit priority signal maintenance;
- Railroad crossing pre-emption system maintenance;
- Preparation of designs and estimates for new construction;
- Preparation and programming of controllers;
- Provide services to other City departments in regards to traffic signal clearance, installation, adjustment etc.; and
- Signals record management.

The Traffic Signals Branch is currently in the third year of a five year major traffic signal enhancement project. The project started in 2008 and is scheduled for completion in 2012. The project has an approved budget of $2.3 million per year and includes the development and implementation of an enhanced traffic signal management system. This system will allow for real time monitoring of intersections and will alert the Branch of signal failures. The system will also allow the Branch to modify signal timing remotely. Major City routes have been assessed and traffic signals will be upgraded where required. As well, a traffic management centre will be developed which will house the traffic signal management system and other equipment and resources to visually assess the performance of the roadway network.

Organizational Structure

The Branch has a full time equivalent (FTE) complement of thirty-two staff and an additional seven seasonal workers to effectively manage and maintain the City's traffic signal operations. Four FTEs are assigned to the management of the Branch (supervisory position), two FTEs perform clerical admin functions and the remaining twenty-six FTEs and seven seasonal workers work in operations. Two groups comprise operations including the Traffic Signals Systems Group who are responsible for the design of new and existing signals as well as timing and phasing reviews and the Traffic Signals Operations group who are responsible for the preparation and programming of all controllers, the installation and maintenance of all signals and the repair of damaged signals. An organizational chart of the Traffic Signals Branch is included in **Appendix 2**.

KEY RISKS

The following potential key risks associated with traffic signal operations were considered in the conduct of the Audit:

- Inability to monitor and maintain compliance with various legislative authorities such as the Department of Highways, environmental regulations and health and safety standards;
- Information systems that do not capture the appropriate data to be able to provide useful information to manage traffic signal operations;
- Inadequate performance information to effectively manage the Traffic Signals Branch;
- Inability to hire or retain qualified staff;
- Inadequate financial resources to maintain and reinvest in assets and infrastructure; and,
- Inadequate information collected or available for third party damages in order to process and collect claims related to damaged infrastructure.

PERFORMANCE ANALYSIS

Few performance measures have been established by the Traffic Signals Branch to monitor how effectively and efficiently they are managing the City's traffic signal operations. Branch management informed us that the long term goal/requirement for the Branch is to meet requirements of its capital program and the Branch's short term goal is to ensure all existing equipment is maintained and running with as little disruption as possible.

The 2008 Canadian Traffic Signal Report Card prepared by the Canadian Institute of Transportation Engineers, provides additional guidance with respect to performance and states that performance excellence in traffic signal operations involves five core components:

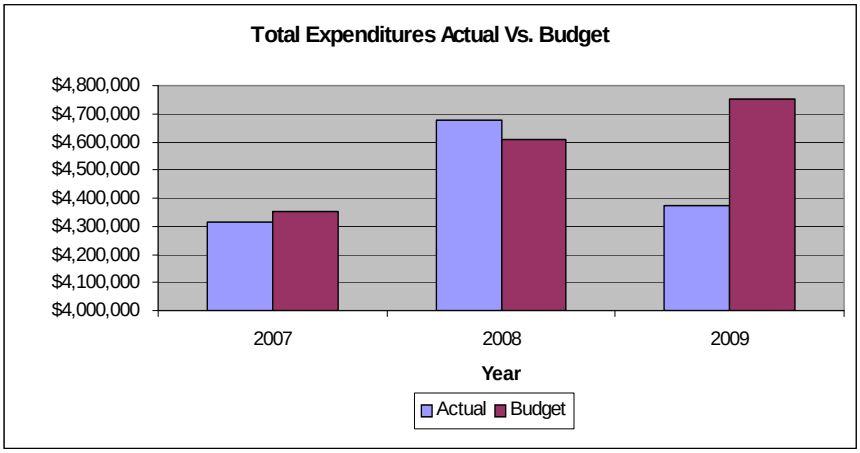
- Program management
- Appropriate traffic signal hardware
- Sound maintenance practices
- Traffic monitoring and data collection
- Routine signal timing updates[1]

The long and short-term goals of the Traffic Signal Branch, provided to us by Branch management relate to the second and third components listed above. We reviewed the performance of the Branch in relation to both of these as well as the other 3 components listed. In addition we also reviewed the financial performance of the Branch

Financial

The financial results for the Traffic Signals Branch for the years 2007-2009 are shown in exhibits 1 and 2 below:

Exhibit 1



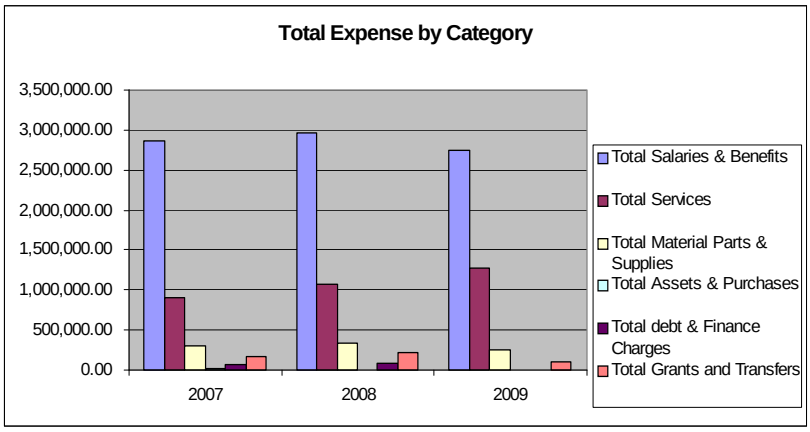
Total expenses for 2009 decreased 8.4% compared to 2008. In 2009 all expense categories have decreased except for total services which increased by 42.3% since 2007 and 18.7% since 2008.

Source: PeopleSoft database

[1] Canadian Traffic Signal Report Card, Canadian Institute of Transportation Engineers, September 2008, p16

Total services expense was higher largely due to an increase in fleet capital and operating lease expense of $244,000 since 2007. One of the main reasons for the decrease in overall expenses is a drop in salary and benefits expense. Salaries and benefits expense decreased by 7.5% in 2009 compared to 2008.

Exhibit 2



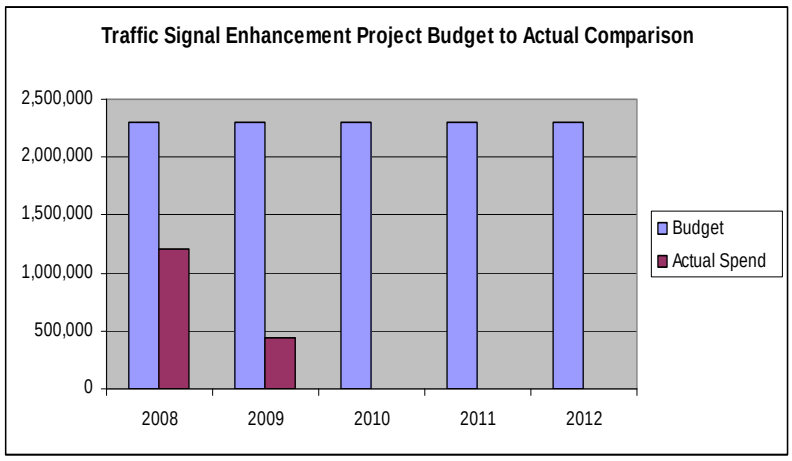
Source: PeopleSoft database

Over the last three years the Branch has been operating with four to five fewer FTEs than the authorized level. This was done to achieve budget expenditure targets. Management has also indicated that turnover of staff has been high in the last few years and that it has been difficult to hire replacement staff due to current market conditions. As a result, a position may be vacant for several months. Some replacement staff are also being hired at lower salary levels, than the more senior staff they are replacing.

As part of our review of the financial performance of the Branch, we also reviewed the financial status of the Branch's largest capital project, the signal enhancement project.

We compared the actual expenditures made on the enhancement project to date and compared the amounts to budget. This comparison is shown in Exhibit 3.

Exhibit 3



Source: PeopleSoft Project Current and YTD Costs Report

The actual amount spent on the enhancement project to date is below budget. This is largely due to the project being behind schedule. Branch management indicated costs are expected to increase in the remaining years of the project as more intersections are upgraded. The downtown area originally scheduled to be completed in 2011, has been pushed back to the end of the project (2012) due to the amount of work involved. The Branch anticipates the cost for upgrading this area will be higher than the others due to the large amount of older equipment in the area that needs to be replaced. The work completed in the final years is anticipated to cost more than $2.3 million per year. The Branch does not budget or

track costs by phase or by corridor, as a result we were unable to assess whether the intersections completed to date were completed within budget for that intersection. Total spend is only compared to total budget for the project, there is no detailed progress reporting performed, nor is a comparison done of percentage of work completed and remaining to budget.

The financial management of the Branch's operations is adequate, however, the financial management of the capital project needs significant improvement due to the Branch not tracking actual costs by phase or corridor to budget and not calculating estimates of completion and work and cost remaining. As a result the project may be at risk for budget overruns.

Program Management

Both the United States Department of Transportation (US DOT), in their *Traffic Signal Operations and Maintenance Staffing Guidelines* and the *Canadian Traffic Signal Report Card* report prepared by the Canadian Institute of Transportation Engineers stress the importance of clearly defined goals with measurable, reasonable objectives for performance excellence in traffic signal management and operations. The US DOT in their *Traffic Signal Operations and Maintenance Staffing Guidelines* expands further on this, indicating traffic signal agencies should:

- Develop a mission statement which includes objectives;
- Develop and review annually a strategic management plan;
- Create a set of measures and collect and evaluate performance data relative to these measures;
- Establish communications paths that are clear for the public to use; and
- Resolve issues and servicing requirements involving other stakeholders (includes signal preemption, transit priority, corridor coordination, coordination of signal timing with other agencies).[2]

The Traffic Signals Branch forms part of the Transportation Planning and Traffic Management Division which does establish key goals annually. The Branch however, does not have a formalized mission statement, strategic plan or measurable objectives of its own and collects limited performance information as discussed earlier in this report.

Reports of signal failures are made by the public through the City's 311 line. Calls are received through 311 and the Winnipeg Police Service indicating that there is a problem with a traffic signal. The calls are forwarded to the Traffic Signals Service line run by Integrated Messaging Inc. (IMI) for follow up by the Branch. The Branch also communicates with other stakeholders such as Winnipeg Transit to determine their needs and requirements.

This objective has been partially met by the Branch. Although the Branch has established a method for the public to report signal failures and has communicated with

[2] Traffic Signal Operations and Maintenance Staffing Guidelines, US Department of Transportation Federal Highway Administration, March 2009, page 18

other stakeholders, the Branch has failed to identify clear objectives, develop a strategic management plan and develop measures to evaluate performance.

Capital Program/Appropriate Traffic Signal Hardware

The *2008 Canadian Traffic Signal Report Card* recommends "to keep from using outdated equipment that limits the operations or increases the maintenance of the traffic signal system, signal controllers should be upgraded at least every 10 years and possibly more frequently in high growth areas that require more complex control"[3]

The US DOT, in their report *Improving Traffic Signal Operations*, indicated that more than half of the signals in North America are in need of repair, replacement or upgrading. If signals are not properly designed, installed, operated and maintained, motorists will likely:

- Spend more time delayed in traffic,
- Increasingly disobey signal indications (for example run red lights),
- Reroute themselves onto adjacent neighborhood streets, and
- Experience higher accident rates, especially involving rear end collisions.[4]

The City of Winnipeg has a total of 611 traffic signal installations. Of these, 417 are 170-type computerized controllers and the remaining 194 are electro-mechanical (EM) controllers. The controller, as the name implies controls intersection traffic by determining light cycle length, timing, signal coordination, etc. The first EM controller was installed in the City in 1928 and some version of these EM controllers are still in use at some intersections present day. EM controllers are similar to electrical timers. Cycle lengths are determined by inserting pins on a timing dial, thus the ability to change cycle length and timing for variations in traffic demand is limited. EM controllers currently used by the City are 30 to 40 years old and are subject to failure more frequently, particularly in very cold or wet weather. In addition, replacement parts are difficult to obtain. The 170 type computerized controllers provide much more flexibility in regards to signal cycle length and timing.

In 2007 in an effort to improve the City's aging traffic signal system, the City in its capital budget approved $2.3 million for 5 years (2008-2012) or $11.5 million to upgrade and enhance traffic signals on key major routes within the City and update the Traffic Signals Management System (TSMS). The Traffic Signals Branch is in the third year of this enhancement project. Exhibit 4 shows the current status of the enhancement project.

[3] Canadian Traffic Signal Report Card, Canadian Institute of Transportation Engineers, September 2008, p18

[4] Improving Traffic Signal Operations, US Department of Transportation, Federal Highway Administration, 1995, p5

Exhibit 4

Street Intersections	Originally Scheduled Completion Date	Actual or Revised Completion Date
Kenaston	2007	2008
Bishop Grandin Blvd.	2008	2010
Lagimodiere Blvd.	2008	2008
Main St.	2008	2009
Pembina Hwy.	2008	2010
McPhillips St.	2009	2010
Portage Ave.	2009	2010
St. Anne's Road	2009	2009
St. Mary's Road	2010	2009
Fermor Ave.	2010	2011
Downtown	2011	2012
Grant Ave	2012	2011
Henderson Hwy.	2012	2011

Source: Traffic Signals Branch Management

A number of intersections have been upgraded; however the project is currently more than six months behind schedule. Branch management has indicated that this is largely due to two factors; first resource shortages, as staff are being pulled off of the enhancement project to work on other new development and maintenance projects and secondly the learning curve experienced for the new wireless technology involved.

The traffic signal system within the City uses a significant number of old signals that do not comply with the recommendations of the Canadian Transportation Engineers concerning upgrades to controllers. Significant improvements are now being made as part of the signal enhancement project.

Ongoing Maintenance/Sound Maintenance Practices

The US DOT – Federal Highway Administration recommends a number of maintenance practices in their *Traffic Signal Operations and Maintenance Staffing Guidelines*. One key practice referred to in the Guidelines is the monitoring of response time to a traffic signal failure. The US DOT recommends:

a. For systems in excess of 400 intersections, 70% of failures should be detected by the operating agency.
b. Time to respond after receiving an indication of a controller or signal failure should be within 1 hour during business hours and within 2 hours during non business hours.[5]

Detection of a signal failure is discussed under Traffic Monitoring and Data Collection below. Ongoing maintenance is key to an effective traffic signal operation. A poorly maintained signal can compromise traffic efficiency and safety. The Traffic Signals Branch does not track time spent on signal maintenance, however, Branch management estimates that Signal staff spend approximately 50% of their time performing ongoing maintenance of traffic signals. The maintenance work preformed is purely reactive in nature, and Branch management indicated they do not have sufficient staff to implement a preventative maintenance program. The goal of preventative maintenance is to avoid

[5] Traffic Signal Operations and Maintenance Staffing Guidelines, US Department of Transportation Federal Highway Administration, March 2009, page 14

signal failures in the future, thereby reducing the level of reactive maintenance which needs to be performed and providing for a more efficient traffic signal operation. Branch management also indicated a lack of resources has also resulted in the Branch not monitoring its maintenance activities in regards to response time, rates of critical failures, etc.

We reviewed staffing levels in more detail as part of our audit. The US DOT in their Traffic Signal Operations and Maintenance Staffing Guidelines dated March 2009 recommends a staffing level of 30 to 40 signals per technician for agencies that operate a minimum of 150 signals to ensure adequate maintenance staffing[6]. The City of Winnipeg currently operates 611 signals and based on these guidelines would require a maintenance staff of fifteen to twenty technicians to adequately maintain these signals. The Branch currently employs twelve crew and eight technical employees, for a total of twenty employees to perform maintenance as well as new development and the enhancement project. Branch Management indicated that the enhancement project alone requires 1.6 FTE's annually or 8 FTE's over the entire project to complete the work required. The Branch estimates that approximately 50% of the staff's time is spent on maintenance activities. This would be the equivalent of ten employees devoted to maintaining the 611 signals which are currently in place, significantly less than the number recommended by the US DOT.

The Traffic Signals Branch has created first responder teams who respond to traffic signal incidents reported by the citizens of Winnipeg or other City departments (i.e. Winnipeg Transit, Winnipeg Police Service). The Branch currently does not monitor the time it takes for the first responder team to respond to an incident, nor do they have a formal priority schedule in place for attending incident calls. The Branch is working at developing a program in Microsoft Access to capture response time information

In an attempt to determine how responsive the Branch is to traffic signal failure calls, we examined 797 trouble reports prepared by the first responder teams for July and December 2009 and calculated the response time. Response times calculated are shown in exhibit 5 below:

Exhibit 5

Response Time (in hours)		
	July 2009	**December 2009**
Average Response Time	2:26	1:57
Response Time During Business Hours (8:00 – 24:00)	2:00	1:44
Response Time During Non Business Hours	3:44	2:19

Source: 2009 Trouble Reports

The Traffic Signals Branch has the highest response time compared to any of the Canadian cities who responded to our survey. Four of the cities indicated that their response time to signal failures was less than 30 minutes, four cities indicated they had a response time of less than 1 hour and one city had a response time of less than 1 ½ hours. A summary of all survey results is shown in **Appendix 4.**

[6] Traffic Signal Operations and Maintenance Staffing Guidelines, US Department of Transportation Federal Highway Administration, March 2009, page 22

All cities surveyed with the exception of Winnipeg and Montreal perform regularly scheduled preventative maintenance on their traffic signal operations.

The Traffic Signal Branch is maintaining the City's traffic signal system on an ongoing basis, however because the maintenance being performed is reactive versus preventative in nature, they may not be providing the service in the most efficient and effective manner. The lack of a preventative maintenance program as well as the number of older signals and lack of a formalized priority schedule is likely contributing to longer response times to signal failures than recommended by the US DOT and compared to other Canadian cities.

Traffic Monitoring and Data Collection

We previously referred to the US DOT recommendation with respect to detection of signal failures in the Ongoing Maintenance section above, The US DOT – Federal Highway Administration recommends for systems in excess of 400 intersections, that 70% of failures should be detected by the operating agency. Currently the Traffic Signals Branch does not perform significant traffic monitoring and data collection because until recently the Branch did not have the system capability to perform this function. The Branch implemented the Traffic Signals Management System (TSMS) in 2008 as part of the signal enhancement project. Branch management has indicated that this new system will allow them to monitor intersections "real" time, alert them of any signal failures and modify timing remotely. The system is up and running and some of these functions are being provided for the intersections connected (Kenaston, Lagimodiere and parts of Regent), however monitoring of traffic signal failures is not yet up and running. Management indicated that human resource constraints are preventing the Branch from having more functionality (i.e. monitoring of signal failures) and intersections on line on the system. These constraints are also preventing the Branch from implementing a formal monitoring process as they do not have an individual dedicated to monitoring the system, even when the system becomes fully functional. Additional resources to monitor the TSMS were not included in the original signal enhancement budget or in ongoing operating budgets.

Winnipeg is behind other Canadian Cities in this regard. Five of the nine cities who responded to our survey have a monitoring system in place and one city is working at implementing monitoring capabilities within the next year.

The Branch has made progress in this area, however the full benefit of the TSMS cannot be achieved without ensuring the system is adequately resourced and monitored going forward.

Routine Signal Timing Updates

The US DOT and the Canadian Institute of Traffic Engineers recommend that reviews of signal timing performance be conducted every thirty to thirty-six months in order to keep pace with changing travel patterns. The US Federal Highway Administration estimates that the benefit–to-cost ratio of traffic signal timing optimization projects approaches 40

to 1. That is, for every $1 invested in optimizing the timing of traffic signals, $40 is returned to the public in time and fuel savings.[7]

The Traffic Signals Branch does not have a formalized signal timing review process in place. Signal timing reviews are performed sporadically, as time is available and when a new signal is installed. Branch management indicated that due to insufficient resources signal timing reviews can not be conducted at regular intervals. As a result, changes in traffic conditions, volumes or adjacent land use may not be accounted for leading to unnecessary traffic congestion and travel delays.

In our survey of nine Canadian cities we found that only four cities had regular timing reviews. These reviews were conducted every three to seven years. Two of the cities surveyed were in the process of implementing a more formalized signal review process.

[7] Improving Traffic Signal Operations, US Department of Transportation , Federal Highway Administration, 1995, page 7

OBSERVATIONS AND RECOMMENDATIONS

The remainder of this report details our observations and recommendations. We believe the issues identified are important and implementing the recommendations will assist management in better managing traffic signal operations. A complete summary of our recommendations is attached as **Appendix 3**.

Branch Management

We reviewed a number of areas related to management of the Traffic Signals Branch including:

- Longer-Term Plans, Goals and Objectives
- First Responder Teams
- Overtime
- Outsourcing
- Information Technology
- Performance Measurement

Longer-Term Plans, Goals and Objectives

The Traffic Signals Branch forms part of the Transportation Planning and Traffic Management Division. The Division as a whole does establish key goals annually. The Branch however, does not have a formalized mission statement, strategic plan or measurable objectives of its own.

Branch management informed us that their informal long term goal/requirement is to meet the requirements of the capital program and the Branch's short term goal is to ensure all existing equipment is maintained and running with as little disruption as possible. The absence of a strategic plan, Branch priorities and measurable objectives, however, make it difficult for the Branch to monitor whether even these informal goals are being met in an efficient and effective manner. The lack of a strategic plan and formalized objectives, also make it more difficult for Branch management to determine Branch priorities in regards to day to day activities as well as IS and other capital initiatives. For example, the signal enhancement project is running more than six months behind schedule and Branch management has indicated that part of the reason for this is that Branch staff are being reassigned from the enhancement project to work on maintenance and other new capital/development initiatives.

Staffing levels should be driven by the objectives and performance targets selected by the Branch. The Branch currently does not have a strategic staffing plan. Insufficient resources may be contributing to the Branch not having a regular preventative maintenance program and a formalized signal timing program as discussed later in this report. A formalized mission statement, strategic plan and measurable objectives would assist the Branch in determining the appropriate organizational structure and resources

(staffing and funding) required to operate the Branch in an efficient and effective manner.

Both the US DOT and the Canadian Traffic Signal Report Card prepared by the Canadian Institute of Transportation Engineers stress the importance of clearly defined goals with measurable, reasonable objectives for performance excellence in traffic signal management and operations.

Recommendation 1:
Traffic Signal Branch management should develop a formalized mission statement, strategic plan and objectives for the Branch which align with the Division's goals and optimize the Branch's limited resources.

Management Response
The Traffic Signal's Branch agrees with this recommendation. This work will be done within the framework of the commitment statement of the Public Works Department. It is anticipated that this can be achieved within 6 months

Recommendation 2:
Traffic Signal Branch management should conduct a workforce analysis to determine the appropriate staffing levels. In conjunction with this review, the Branch should also examine its current organizational structure to determine if it is the best structure to meet the objectives of the Branch. The results of the analysis should be used to develop a strategic staffing plan which would encompass any planned outsourcing of functions and any business or organizational changes which may impact staffing in the future.

Management Response
The Traffic Signals Branch agrees with this recommendation. Subsequent to addressing recommendations related to Traffic Signals Branch's direction, a request will be made for funding an initiative to conduct a workforce analysis as per this recommendation. The Traffic Signals Branch will plan to implement this recommendation by December 2011.

First Responder Teams

First responder teams respond to calls from the public or other City departments regarding a traffic situation (i.e. lights out, damaged signal, etc). Calls are received through 311 indicating that there is a problem with a traffic signal. The calls are forwarded to the Traffic Signals Service line run by Integrated Messaging Inc. (IMI). A trouble report (TR) is prepared and sent in real time, by email, to the first responder team on call and the Traffic Lab. The TR describes the problem with the signal and includes the time the email was sent by IMI. The crew responding to the TR will record their arrival time at the signal site, the condition of the signal on their arrival, the repairs/corrections made to the signal, the time that the repair is completed and the work order number on the report. The TR is subsequently signed off by the crew chief and the crew and technical foremen. Completed TRs are sent to the records technician within the Traffic Signals Branch. Copies of the TR are kept in hard copy and are also scanned for electronic filing.

There is no formal priority schedule in place for attending TR calls; as well IMI does not have a priority system in place for assigning calls to the team. All calls are forwarded to the crew chief on call. This can result in overtime being paid for crews to handle minor calls over the phone as employees are paid a minimum of 15 minutes of overtime for every call they handle and clear at home while on standby. The Branch has established a deferral policy for some types of signal damages and there is an understanding that reports of damages and light malfunctions (i.e. calls where police assistance may be required) get a higher priority versus lesser calls such as bulb outages, timing issues, etc. It is not uncommon to receive multiple reports of damages to different signals at about the same time, particularly in bad weather. The priority may be to attend the closest intersection, however if more information regarding the damage is available the crew may attend a further location because all the lights are out at that location, or the intersection may be near a school, high speed route, etc. Some cities, such as Fort Richmond, British Columbia, have identified on their website the types of calls which will be handled during regular business hours and have indicated that only the more serious problems will be attended to after hours in order to reduce overtime.[8]

The lack of a formal priority system for repairing signal failures may also contribute to the Branch having slower response times for attending traffic signal failures than recommended by the US DOT and in comparison to other Canadian cities. This is discussed in further detail later in this report.

The US DOT in their report *Traffic Signal Operations and Maintenance Staffing Guidelines*, published March 2009 recommends Traffic Signal agencies develop procedures to identify the level of criticality for each intersection with respect to safety and congestion. Response priorities should be developed in accordance with this procedure.[9]

In addition, *Manitoba Work Place Safety and Health Regulation 217/2006 Section 38.4* requires that only electrical workers perform electrical work, section 38.14 (2) also requires that a standby worker who is trained in emergency response be present when electrical work is done. The regulations do not require that the standby worker be an electrical worker. The Traffic Signals Branch currently has two electricians making up the first responder team. The current team structure has also lead to an increase in overtime, due to the limited number of electricians available to form the responder teams. Technician staff have a limited “m” license which allows them to do some electrical work. Currently, first responder team members are not trained to program controllers. If a signal failure is "controller" related the first responder team would need to call in a Technician to repair it. Branch management indicated to us that often crew members will attempt to resolve the controller problem themselves prior to calling in a Technician. Branch management also indicated the lack of a technician on the team does result in controllers not being repaired correctly which could result in the first responder team making several trips to the same intersection as a result of a faulty controller. The Branch is currently reviewing whether the first responder team should include one technician and one electrician.

[8] City of Richmond British Columbia website

[9] Traffic Signal Operations and Maintenance Staffing Guidelines, US Department of Transportation Federal Highway Administration, March 2009, page 14

Recommendation 3:
Traffic Signals Branch management should review and rate all intersections to determine the level of criticality. Based on the level of criticality, response priorities should be determined. Formalized priorities should also be established by incident type (i.e. bulb outages, pole down, etc). These priorities should be provided to all first response team members as well as IMI.

Management Response
The Traffic Signals Branch agrees with this recommendation. The branch will develop target response times for the various types of incidents as it is important to distinguish that not all incidents require the same level of priority and cannot be measured by a single "response time". This will help put the metric of response time in the proper context. In addition to this, the branch will enhance the current deferral policy to provide more direction to first responder's staff on how to prioritize their activities to meet the target response times. The Traffic Signals Branch will plan to implement this recommendation by December 2011.

Recommendation 4:
Traffic Signals Branch management should include one technician and one electrician on first responder teams.

Management Response
Traffic Signals Branch agrees with this recommendation. The branch has already started pursuing this recommendation, however this requires Provincial approval. The branch has been providing significant information to Provincial officers to accomplish this recommendation. The Province regulates the work performed by electrical workers and is currently reviewing information pertaining to tasks that we proposed to delegate to technicians that hold an M license (limited electrical license). An update on this matter can be provided by June 2011.

Overtime

The Traffic Signals Branch has created first responder teams, made up of two employees who respond to traffic signal incidents reported by the citizens of Winnipeg or other City departments (i.e. Winnipeg Transit, Winnipeg Police Service) 24/7. The teams operate during two shifts 8:00-16:00 and 16:00-24:00 Monday to Friday. The evening shift team is also on standby from 24:00-8:00 Monday to Friday and on weekends. While the team is on standby they are paid overtime for all traffic signal incidents they attend, as per the CUPE agreement.

The current schedule can often result in long work days for first responder teams, when they are working on weekend and late night standby shifts. The current shift schedule has resulted in significant overtime over the years and can eventually lead to worker fatigue and potentially less efficient and effective work being performed. Total overtime costs incurred for the three year period of 2007 – 2009 amounted to $1,120,200. Exhibit 6 shows overtime and related salary expense for the period 2007-2009.

Exhibit 6

Comparison of Overtime Expense for 2007 -2009			
	2007	2008	2009
Overtime Actual	$359,900	$376,600	$383,700
Overtime Budget	$246,200	$312,800	$311,600
Variance	$113,700	$63,800	$72,100
% Actual over Budget	46.2%	20.4%	23.1%
Total Salary Expense	$2,539,600	$2,624,500	$2,435,416
Overtime as a % of Total Salary Expense	14%	14%	16%

Source: PeopleSoft Database

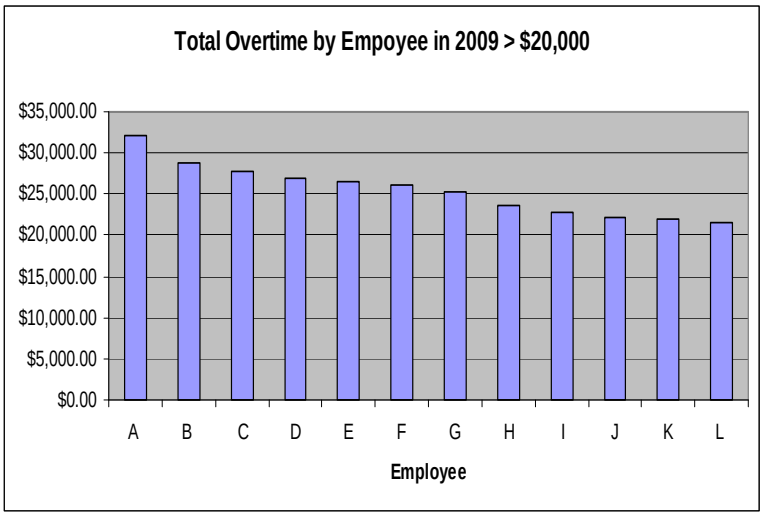
Overtime has increased and exceeded budget year over year. Actual overtime as a percentage of total salary expense has increased by 2% since 2007.

We reviewed 797 traffic signal incidents during the period of July and December 2009. Of these incidents, 541 (68%) occurred during normal business hours (8:00 – 24:00) and 256 (32%) occurred while the team was on standby. Of the 256 incidents which occurred while the team was on standby, 162 (63%) occurred on weekends and statutory holidays and 94 (37%) occurred on weekdays. We further broke down the weekday incidents and determined that 61 (65%) of the weekday calls occurred between the hours of 6:00 – 8:00 am.

The Branch paid an average of $12,180 per month for July and December 2009 for overtime worked while on standby during the weekend and statutory holidays, which extrapolates to approximately $146,200 annually. In addition the Branch paid an average of $3,080 per month for July and December 2009 for overtime worked between 6 am and 8 am on weekdays, which extrapolates to approximately $36,960 annually. A significant portion (48%) of overtime paid by the Branch in 2009 falls within these two timeframes. A number of options exist for the Branch to adjust shift schedules in order to reduce overtime, including increasing the hours worked on a first responder shift from eight hours to 10 hours (4/2 shift) or 12 hours (4/4 shift) so that peak travel times are covered. Branch management should evaluate these and other options to reduce overtime including the implementation of a priority schedule and increasing the number of first responder teams by including technicians on the team..

The current 24/7 schedule for first responder teams, the requirement to have two employees respond to all calls, staff turnover and the lack of a formalized priority schedule for attending signal failures has resulted in significant overtime payments to employees. The majority of overtime is being incurred by twelve employees who were paid in excess of $20,000 each for overtime incurred during 2009. The highest earner made in excess of $30,000 for overtime. Exhibit 7 illustrates the overtime earned by the twelve employees earning more than $20,000 in overtime.

Exhibit 7:



Source: Traffic Signals Branch Work Order MMS System

Employees submit their overtime hours on overtime timesheets. The timesheets are approved by the Foreman, Supervisor and Traffic Signals Engineer. There is no verification of overtime worked while on standby to supporting trouble reports. In our review we noted minor discrepancies between hours worked reported on trouble reports and overtime hours paid for the two months, July and December 2009.

Employees are also allowed to claim travel time when they are called out to a traffic signal failure while they are on standby. The amount claimed varies by employee and the same employee may claim different amounts for each trip. Typically the crew chief will pick up the second employee to attend the call. In all time sheets which we reviewed both employees claimed the same travel time, even though one would expect the crew chief to have claimed a higher amount. Travel time claimed ranged from 20 minutes to 1 hour and 20 minutes per call. The Branch does not have a formalized policy in regards to allowable travel time claims.

Recommendation 5:
Traffic Signals Branch management should review the type and level of resources required to adequately staff the first responder team with the aim to reduce overtime incurred. The addition of a regular night and weekend shift should be considered as well as modified work hours.

Management Response
The Traffic Signals Branch agrees with this recommendation where it relates to the First Responders activities. The Branch is already looking at addressing this issue. In particular, the Branch has modified the hours of work for First Responders and is seeking Provincial approval to implement multidisciplinary teams to increase the knowledge base in the field to reduce repair times (see management response 4). An update on this matter can be provided by June 2011.

Recommendation 6:
Traffic Signals Branch management should develop procedures in regards to the submission, review and approval of overtime claims for travel time and should implement a process to ensure all overtime hours claimed are valid and supportable.

Management Response
The Traffic Signals Branch agrees with this recommendation. The Branch will investigate timekeeping practices that can be implemented to improve the accuracy of

the overtime claims. The Branch will also look for alternatives to eliminating the need for overtime activities, such as establishing work hours that cover all hours of the day. The Traffic Signals Branch will plan to implement this recommendation by December 2012.

Outsourcing

Traffic Signals Branch management told us that the Branch currently does not have sufficient resources to operate all areas of traffic signal operations in an effective manner. Currently there are 39 FTE's in the Traffic Signals Branch including seven seasonal positions. It has been difficult to hire additional people, particularly electricians, due to market conditions.

Capital projects, street projects, new development and ongoing signal maintenance take staff away from the signal enhancement project. The enhancement project is currently behind schedule by more than six months. We were told the Traffic Signals System group handles about sixty to seventy projects per year, but only have three individuals who modify and create all drawings. Budget constraints have prevented the addition of more resources to this group. As noted in this report, the Branch does not have a preventative maintenance program in place, does not perform regular timing reviews, cannot actively monitor the Traffic Signals Management System for signal failures and is incurring significant overtime costs, $1.1 million for the period 2007- 2009, in a large part due to staff shortages. Outsourcing of some signal functions should reduce the level of overtime being incurred and would allow the Branch to devote resources to functions currently not being performed. The resulting cost savings would at least partially reduce the cost of outsourcing. Regular maintenance may be the most feasible area to look at outsourcing. The work appears to be more routine in nature and other Canadian cities have already outsourced their regular maintenance and could provide valuable information on their own experience in this area. Branch management would also need to take into account the resources and organizational structure required to manage any outsourced function.

The Branch contracts with an outside supplier to perform all of its underground construction work. The Branch is also using an outside consultant to assist with the signal enhancement project. Our survey of other Canadian cities showed that most cities outsource some aspects of their traffic signal operation, although the degree of outsourcing varied between cities. Of the nine cities that responded three outsource underground construction work, two make use of outside consultants related to design and signal warrants and two outsource maintenance and repair work.

The lack of resources does not appear to be unique to the Winnipeg Traffic Signal Branch. The US DOT indicated in guidelines issued by them in March 2009 that ineffective operation and maintenance of traffic signals may have safety implications and contributes annually to millions of hours of unnecessary traffic delays, congestion, fuel consumption and air pollution. The report goes on to say that major contributors to inconsistency found in traffic signal operations and maintenance budgets include:

- A lack of clear guidelines describing traffic signal operations and maintenance and the resources required to support these activities;
- The lack of documented objectives and performance standards;

- Funding mechanisms that are geared more towards project development than operations and maintenance.[10]

The Canadian Institute of Transportation Engineers in their 2008 report card on Canadian Traffic Signals rated overall traffic signal operations in Canada a D+, indicating that there is a need for continued attention and additional resources for traffic signal management and operation.[11]

Recommendation 7:
We recommend that Traffic Signal Branch management evaluate the feasibility and cost of contracting out one or more signal functions in order to make more efficient use of current Branch resources.

Management Response
This will be done as part of the resource analysis as stated in Management Response 2, (evaluation of resource requirements to meet performance objectives). The Traffic Signals Branch will plan to implement this recommendation by June 2012.

Information Technology

Work Order Tracking System

The Traffic Signals Branch currently uses an internally developed system in DOS Quattro Pro called MMS, for tracking material and labor expenses for all work orders issued. Expenses tracked through the work order system are used to bill both internal and external customers for services provided by the Branch. The process to update MMS for all costs incurred is manual and requires, in some cases duplicate keying of information.

Manual work orders are prepared for all work performed by the Branch. Work orders are preprinted three-part sequentially numbered forms. Work details, including start and finish dates and requisition numbers for any material or parts used are recorded on the form. The work in progress copy of the work order is sent to the Traffic Signals Clerk to set up the work order in the MMS system. The completed copy is sent to the clerk when all work has been completed. It is an indication to the clerk that the work order can be closed. The third copy is kept by the Foreman on the job. The payroll clerk receives, on a daily basis, employee time sheets for regular and overtime hours worked by each employee and stores requisition forms listing all parts and supplies used. Time sheets are not automated. The time sheets break out the hours each employee worked on each work order. The clerk must manually calculate the total hours worked for each work order and calculate overtime hours, standby pay hours, shift premium hours, etc. The stores requisition form is also a manual form. The clerk prices all items on the requisition, using a Stores price list and calculates the total cost of parts and supplies used. The clerk then enters the total hours worked by each employee into PeopleSoft and also enters the total hours worked by work order into the MMS system. The time sheets also indicate the number of hours a Branch truck was used for each work order.

[10] Traffic Signal Operations and Maintenance Staffing Guidelines, US Department of Transportation, Federal Highway Administration, March 2009, p3
[11] Canadian Traffic Signal Report Card, Canadian institute of Traffic Engineers, September 2008, p4

The truck hours are also entered by the clerk into MMS for each work order along with details from the priced stores requisition forms.

The MMS system is backed up regularly onto 3½ inch disks. It takes several disks to backup the system. The system only allows a specific number of lines for each work order, resulting in multiple work orders with the same work order number being set up for routine work performed. The manual nature of the current system lends itself to errors occurring and does not allow for ease of monitoring or managing the work performed.

Trouble Reports

Manually prepared trouble reports (TRs) are completed for all calls received from external and internal sources relating to traffic signal failures. The first responder crew attending the call, record the condition of the signal on arrival, the repairs made, crew arrival time and repair completion time on the form. The TR is then forwarded to Signal Records, where it is scanned into a file which can be reviewed if questions on the work done arise. The actual information on the form is not recorded electronically and as a result cannot be used to monitor performance (i.e. response time) or the number and type of calls received. The forms are not used to verify overtime claims made by employees on standby and there is also no verification that all forms have been received by Signal Records. When duplicate calls are received for the same signal failure, multiple TRs are produced and scanned into the system, although the form does not contain additional information.

Asset Management

The Traffic Signals Branch does not have an asset management system and as a result, there is no tracking of signal assets held by the Branch. The Branch was initially looking at implementing SignalView as their asset management software. The software was recommended by the consultant the Branch is using to assist with the signal enhancement project after their review of various software programs. There was no cost to purchase the software, except for an annual license fee of $1,500. Once the Branch started working with SignalView and comparing its capabilities to what was needed by the Branch, it was concluded it would be too costly to customize the software. The Branch then decided to create a system internally using Microsoft Access which would meet their current needs.

The Branch is currently working on recording all trouble reports in Access in order to monitor response time, types of signal failures, etc. While it is encouraging to see the development of such a tracking system, the Branch has not developed a strategy or plan to deal with the IS requirements for the Branch as a whole. For example, no priorities have been established regarding which systems should be updated first. As well no analysis has been completed to determine how the various IS systems should operate and interface with each other and finally no business case has been prepared which evaluates different IS options available (internally or externally) to the Branch. A comprehensive IS strategy or plan which considered all significant activities performed by the Branch would provide better information to manage operations and assets more effectively and would allow for more efficient and effective processes.

Recommendation 8:
The Traffic Signals Branch should develop an IS strategy or plan to maximize the benefit derived from information technology, to ensure alignment with the Branch's goals and objectives and to optimize the resources spent on information technology.

Management Response
The Traffic Signals Branch agrees with this recommendation. The branch will request capital funds to initiate a review of existing systems and needs with the intent to develop a roadmap to create the suitable IS solutions to address these needs. The project will be initiated when funds become available. Subject to funding approval, the Traffic Signals Branch will plan to implement this recommendation by December 2011.

Performance Measurement

Few performance measures have been established by the Traffic Signals Branch to monitor how effectively and efficiently they are managing the City's signal operations. Typical performance measures for traffic signal operations could include:

- Response time for signal failures;
- Types and rates of signal failures;
- System down and up times;
- Staff productivity;
- Signal failures detected real time;
- Number of trouble calls, handled/received;
- Signal before and after timing runs; and
- Travel time.

On an annual basis, as part of their annual plan the Transportation Planning and Traffic Management Division does provide some statistical information for the Traffic Signals Branch. These measures are shown in Exhibit 8.

Exhibit 8

Transportation Infrastructure	2005	2006	2007	2008
Number of Signalized Intersections	604	605	607	611
Number of Audible Traffic Signals	86	155	165	240
Number of Pedestrian Corridors	147	149	150	151

Efficiency Measures	2006	2007	2008
Maintenance Costs per Signalized Intersection	$5,353	$5,186	$5,506
Average Signal Damage Repair Cost	$2,553	$2,679	$3,181

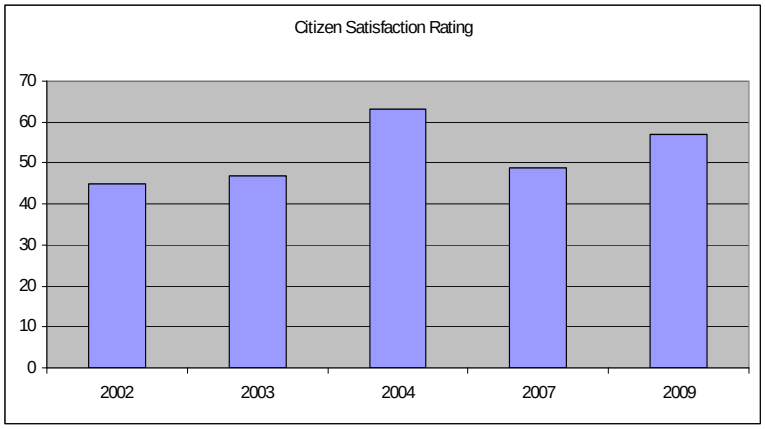
Source: City of Winnipeg Business Plan by Service

A number of these measures are not true measures of performance. The transportation infrastructure measurements provide an indication of the size of the Traffic Signals Branch's operation, but do not provide any indication on how effectively and efficiently these assets are being managed. The cost of maintenance and damage repair provides some indication of how well the Traffic Signal Branch is managing their expenses.

The City of Winnipeg also routinely measures customer satisfaction for a number of services provided by the City including traffic management during rush hour. Public works measures morning peak travel time on major city routes. Details of these measures are shown in Exhibits 9 and 10:

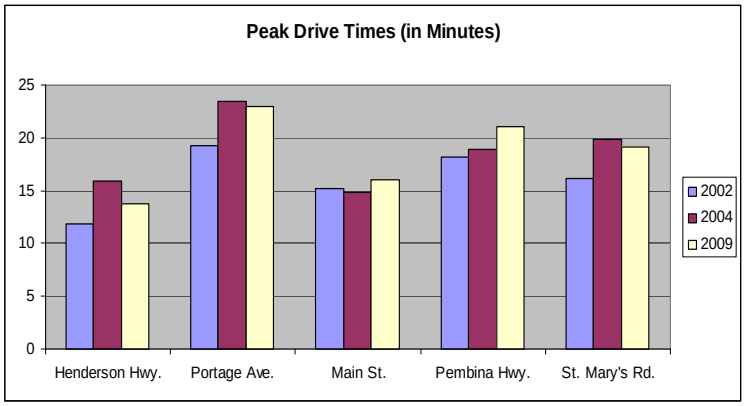
Citizens of Winnipeg were asked how satisfied they were with City services provided in regards to traffic flow management during rush hour. Satisfaction with traffic management during rush hour has increased from 49% in 2007 to 57% in 2009 and has mainly increased year over year since 2002. In 2004 citizen satisfaction peaked at 63.3%. Citizen satisfaction has increased despite increased morning peak travel times. Morning peak travel times have increased from 5 to 20 percent on the major routes measured since 2002, although three of the five routes did experience a reduction of travel time between 2004 and 2009.

Exhibit 9



Source: Citizen Satisfaction Survey

Exhibit 10



Source: Transportation Planning and Traffic Management Business Plan

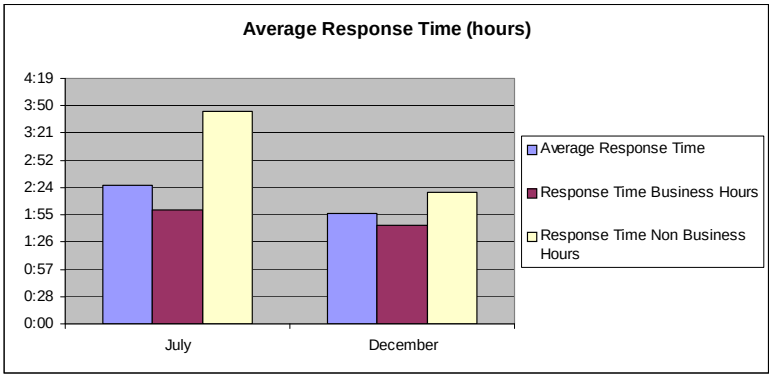
These measures provide some indication of how well the traffic management system is operating, although other factors besides traffic signal operation (new development, construction, etc) may influence the result.

Current systems and processes within the Traffic Signals Branch do not allow for the ease of collecting and monitoring performance information. As previously discussed, the Branch currently uses a manual work order and trouble report process which results in errors and inaccuracies in data collected.

In our survey of other Canadian cities, we found that the majority of agencies do not measure performance. Ottawa appears to have the most comprehensive measurement system and the other cities either have limited measures in place or are planning to develop performance metrics in the future

One key performance indicator for traffic signal operations is response time for attending traffic signal failures. Response time depends on two factors. The first factor is the time it takes to obtain an indication of a failure and the second is the time it takes to respond after receiving an indication of failure. The time it takes to obtain an indication of a failure is discussed later in this report under Real Time Signal Monitoring. The Traffic Signals Branch does not measure their response time. As discussed in the Performance Analysis section of this report, we calculated the response time for the first responder teams for July and December 2009. Exhibit 11 shows the results of our review.

Exhibit 11



Source: Traffic Signals Branch Trouble Reports

Average response time during both business and non business hours was two hours, 26 minutes for July and one hour 57 minutes for December. The average response time during regular business hours was two hours for July and one hour, 44 minutes for December. Response time during non business hours was three hours, 44 minutes and two hours, 19 minutes for July and December respectively.

The US DOT recommends response time for signal failures of within one hour during business hours and within two hours during non business hours. The Traffic Signals Branch has the highest response time compared to any of the Canadian cities who responded to our survey. Four of the cities indicated that their response time to signal failures was less than 30 minutes, four cities indicated they had a response time of less than one hour and one city indicated a response time of less than one hour and 30 minutes.

Recommendation 9:

We recommend the Traffic Signals Branch develop and report on, a comprehensive set of performance measures for each key area of the business. The performance measures should be linked to the Branch's goals and objectives and targets should be established for each measure.

Management Response

The Traffic Signals Branch agrees with this recommendation. The Traffic Signals Branch will work on establishing metrics that are primarily consistent with and support the Service Based Operating Budget. This approach will help link the Corporate and Branch requirements related to goals and objectives. Additional metrics will be considered together with their budget implications. The Traffic Signals Branch will plan to implement this recommendation by December 2011.

Traffic Signal Operations

We reviewed a number of areas related to Traffic Signal Operations including:

- Preventative Maintenance
- The Signal Enhancement Project
- Signal Monitoring
- Signal Timing Reviews
- Claims
- Manitoba Retail Sales Tax Self Assessment on Enhancement Project Invoices
- Facilities

Preventative Maintenance

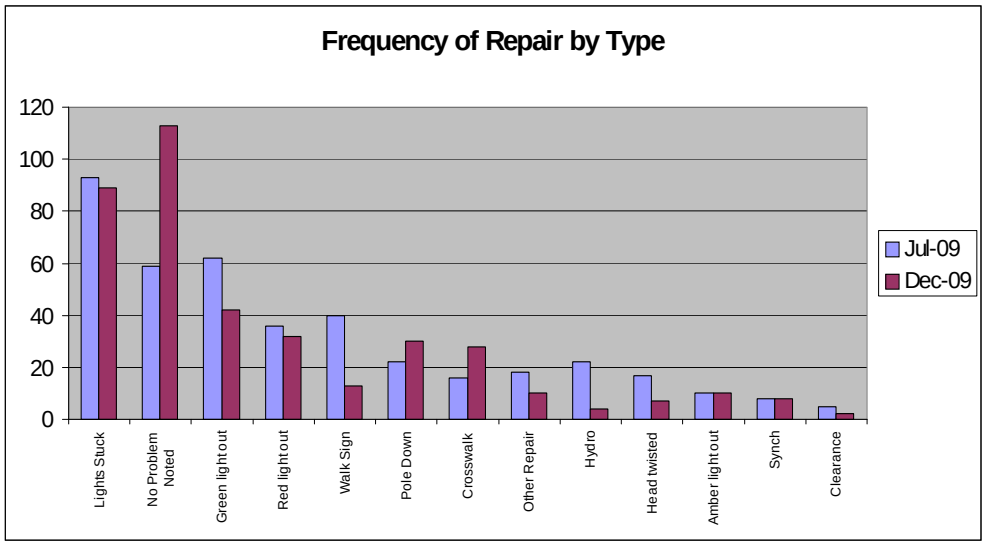
Good maintenance is a key component to effective traffic signal operations. A poorly maintained traffic signal system can compromise traffic efficiency and safety and result in increased signal failures and repair costs.

Traffic signal maintenance can be classified into three categories:

1. Preventative Maintenance – inspecting, cleaning and adjusting signals at regular intervals. The goal of preventative maintenance is to avoid signal failures through timely maintenance procedures.
2. Responsive/Reactive Maintenance - procedures and actions taken when a signal failure occurs.
3. Design Modification Maintenance – modifications made to signals (displays, timing plans, etc) to reflect changed traffic conditions.

Traffic Signals Branch management believes the majority of their time spent on maintenance is spent on responsive/reactive maintenance with a minimal amount of time spent on design modification maintenance. The Branch does not have a formalized preventative maintenance program in place. Branch management indicated this is largely due to the Branch having insufficient resources to carry on this type of work. A significant portion of first responder calls relate to maintenance activity which may not have been necessary if a preventative maintenance program had been in place (i.e. light bulb replacements). We analyzed first responder calls received by the Branch for July and December 2009 to determine the type of signal failures occurring most frequently. Exhibit 12 shows a breakdown of the type and frequency of signal failures attended to by the first responder team.

Exhibit 12



Source: Traffic Signals Branch Trouble Reports

Our analysis indicated 39% of the calls received in July and December related to burnt out light bulbs, pedestrian push button failures, etc. A regular preventative maintenance program would likely have reduced the frequency of these types of incidents. As part of our research in this area, we noted that one county in the US, after implementing a preventative maintenance program, had a reduction in signal malfunction calls of 35.6% in the first year of their preventative maintenance program.[12] A similar reduction in the number of signal failure calls received by the Winnipeg Signal Branch would have reduced the calls received in July and December 2009 by approximately 284 calls or over 1700 calls annually.

Our survey of other Canadian cities found the majority of agencies do have a preventative maintenance program in place. Of the nine cities who responded to the survey, eight had some type of preventative maintenance program in place, typically performed on an annual basis.

The US DOT in their Traffic Signal Operations and Maintenance Staffing Guidelines dated March 2009 recommends a staffing level of 30 to 40 signals per technician for agencies that operate a minimum of 150 signals to ensure adequate maintenance staffing.[13] As discussed in the Performance Analysis section of this report, the City of Winnipeg currently operates 611 signals and based on these guidelines would require a maintenance staff of fifteen to twenty technicians to adequately maintain these signals. The Branch currently employs twelve crew and eight technical employees, for a total of twenty employees to perform maintenance as well as new development installation and other capital project work including the enhancement project. With approximately 50% of the staff's time spent only on responsive/reactive maintenance activities, the Branch has the equivalent of 10 employees devoted to maintaining the 611 signals currently in place, significantly less than the number recommended by the US DOT.

[12] Traffic Signal Preventive Maintenance: An Ounce of Prevention is Worth a Pound of Cure, Peggy Vonsherie Allen, Institute of Transportation Engineers, ITE Journal. April 2009

[13] Traffic Signal Operations and Maintenance Staffing Guidelines, US Department of Transportation Federal Highway Administration, March 2009, page 22

Recommendation 10:
The Traffic Signals Branch should implement a comprehensive preventative maintenance program. Resources should be reviewed and analyzed to ensure adequate staffing either internally or externally exists to implement the program.

Management Response
The Traffic Signals Branch agrees with this recommendation. The Traffic Signals Branch will develop a preventative maintenance program based on generally established acceptable practices related to this type of maintenance for equipment maintained by the Traffic Signals Branch. Subject to adequate funding, the Traffic Signals Branch will plan to implement this recommendation by December 2012.

Signal Enhancement Project

The 2008 *Canadian Traffic Signal Report Card* prepared by the Canadian Institute of Transportation Engineers indicates that having appropriate traffic signal hardware is a core component for performance excellence in traffic signal operation. The report recommends "to keep from using outdated equipment that limits the operations or increases the maintenance of the traffic signal system, signal controllers should be upgraded at least every 10 years and possibly more frequently in high growth areas that require more complex control"[14].

The City of Winnipeg has over 600 traffic signals which are controlled by both electro-mechanical and computerized controllers. Approximately 200 of these signals have electro-mechanical controllers which are 30-40 years old. These old controllers have limited functionality, break down more frequently and when repairs are required replacement parts are difficult to obtain. In early 2007, the City in its capital budget approved $2.3 million for 5 years (2008-2012) or $11.5 million to upgrade and enhance traffic signals on key major routes within the city. The Traffic Signals Branch engaged a consultant to assist with certain aspects of the enhancement project including project management, signal timing analysis, communication network analysis and software/hardware configuration and troubleshooting. The work was budgeted to be completed with existing resources and no additional employees were hired by the Branch to work on the project. Branch management estimates that 1,858 of internal person days are required to complete the project. This has been included in the Capital budget. Resources were not included in the operating budget for the ongoing monitoring and staffing required to operate and maintain the new traffic signals management system.

Exhibit 13 shows the current status of intersections to be upgraded through the enhancement project.

[14] Canadian Traffic Signal Report Card, Canadian Institute of Traffic Engineers, September 2008, p18

Exhibit 13

Street Intersections	Originally Scheduled Completion Date	Actual or Revised Completion Date
Kenaston	2007	2008
Bishop Grandin Blvd.	2008	2010
Lagimodiere Blvd.	2008	2008
Main St.	2008	2009
Pembina Hwy.	2008	2010
McPhillips St.	2009	2010
Portage Ave.	2009	2010
St. Anne's Road	2009	2009
St. Mary's Road	2010	2009
Fermor Ave.	2010	2011
Downtown	2011	2012
Grant Ave	2012	2011
Henderson Hwy.	2012	2011

Source: Traffic Signal Branch Management

The enhancement project is currently running more than six months behind the original timeline for the project. As of the end of 2010, management has indicated that they will have installed new timing plans on eight of the nine routes that were to be completed by the end of year three of the project (2010). The remaining route is planned to be completed in the first quarter of 2011. The communication network is complete on one of these nine routes and is 60% complete on four routes. No work has been started on the remaining four routes. The Branch indicated to us that delays have occurred due to crews being pulled off of the project to work in other priority areas such as ongoing maintenance and new capital development initiatives. There is no crew dedicated to working solely on the enhancement project and as a result, as higher priority jobs come up, crews are reassigned to this work. Delays have also occurred due to the Branch experiencing a learning curve, as they are dealing with new wireless technologies and systems. The Downtown area, the most difficult portion of the project due to the number of older signals involved, was originally scheduled to be completed in 2011, has now been pushed back to the end of the project (2012) due to the amount of work involved. Routes originally scheduled to be completed in 2012 are now scheduled for completion in 2011.

The budget for the enhancement project is at a high level and is not broken down to show detailed costs. The Branch does not budget or track costs by phase or by corridor, nor does it break out internal and external cost. As a result we were unable to assess whether the intersections completed to date where completed within budget for that intersection. In addition a detailed plan and schedule, outlining staff resource requirements and estimated dates of completion for specific aspects of the project was not developed by Branch management. The Branch has set up a work order for the project and all costs are accumulated in this work order. Invoices submitted by the project consultant are not broken down by corridor. Total spend is only compared to total budget for the project, there is no detailed progress reporting performed, nor is a comparison done of percent of work completed and remaining to budget. We also confirmed with the controller of Public Works that other than tracking total actual cost to budget no detailed cost analysis or tracking by phase or corridor is performed by the controllership group. Management oversight at the start of the project does not appear to have been sufficient. This lack of oversight as well as turnover in key management roles has led to some of the above issues that the Branch is experiencing today.

Although the Branch is indicating that it is still too early to determine whether the project will be completed by the original 2012 timeline, continued reallocation of Branch resources to other maintenance and development work, could cause the project to extend past the original overall completion date of 2012. In addition, the lack of detailed monitoring of project costs to budget, could result in cost overruns as compared to budget.

Recommendation 11:
Traffic Signals Branch management should develop a detailed project plan for the enhancement project to ensure the project is completed by the original overall completion date. The plan should include a human resources plan and a staff schedule which identifies the staff requirements to complete the project.

Management Response
The Traffic Signals Branch agrees with this recommendation. While a project schedule and implementation plan was created, the management of this project could be enhanced by formalizing the elements identified by this recommendation. As such, the Traffic Signals Branch will enlist the support of the Department's Engineering Division which specializes in Capital project management. The Traffic Signals Branch will plan to implement this recommendation by April 2011.

Recommendation 12:
Traffic Signals Branch management should perform more detailed financial tracking of the signal enhancement project, including a comparison of percentage of work completed and remaining to budget and should work with the project consultant to obtain detailed invoices which break down the project costs by individual corridor.

Management Response
Refer to management response for Recommendation 11.

Signal Monitoring

One of the factors impacting the response time to attend a traffic signal failure is the amount of time it takes to be notified of a traffic signal failure in the first place. The US DOT in their Traffic Signal Operations and Maintenance Staffing Guidelines recommends for systems in excess of 400 intersections 70% of all traffic signal failures should be detected by the traffic signal agency[15].

Currently the Traffic Signals Branch does not have a formalized signal monitoring process in place and relies on the citizens of Winnipeg and other City departments (i.e. Winnipeg Transit, Winnipeg Police Services) to notify them of a traffic signal failure. The Branch implemented their Traffic Signals Management System (TSMS) in 2008 as part of the signal enhancement project. The Branch has indicated that this new system will allow them to monitor intersections "real" time, alert them of any signal failures and modify timing remotely. The system has been updated and some of these functions are being provided for the intersections connected, however monitoring of traffic signal failures is not yet up and running. Further testing is being performed on the remaining

[15] Traffic Signal Operations and Maintenance Staffing Guidelines, US Department of Transportation Federal Highway Administration, March 2009, page 14

functions. Staff resource constraints and a learning curve related to the new technology are preventing the Branch from having more functionality and intersections on line. These constraints are also preventing the Branch from implementing a formal monitoring process as they do not have an individual dedicated to monitoring the system. The original signal enhancement budget and subsequent operating budgets did not include a component for ongoing funding of staff resources to monitor the TSMS.

Winnipeg is behind other Canadian cities in this regard. Five of the nine cities who responded to our survey have formalized monitoring capabilities. An additional city is working at implementing monitoring capabilities within the next year.

Recommendation 13:
Traffic Signals Branch management should continue to develop formalized monitoring capabilities within the Traffic Signals Management System. The Branch should establish benchmarks as to the level of "real" time monitoring they wish to achieve and the staff resources required to achieve these benchmarks. This benchmark and actual results achieved should form part of the Branch's performance information.

Management Response
The Traffic Signals Branch agrees with this recommendation. The Branch will continue working on developing the TSMS and benchmarking for monitoring of equipment operation will be part of the elements of the TSMS once completed. The Traffic Signals Branch will plan to implement this recommendation by June 2013.

Signal Timing Reviews

Traffic signal coordination is an important aspect of an efficient traffic signal operation. Signal coordination and timing improvements help to ensure that motorist can pass through multiple signal intersections with a minimum of stops. The US Federal Highway Administration estimates that the benefit–to-cost ratio of traffic signal timing optimization projects approaches 40 to 1. That is, for every $1 invested in optimizing the timing of traffic signals, $40 is returned to the public in time and fuel savings.[16]

The Traffic Signals Branch does not have a signal timing review process in place. The Branch does review signal timing sporadically and when a new signal is installed. However, Branch management indicated that due to insufficient staff resources signal timing reviews are not conducted at regular intervals. As a result, changes in traffic conditions, volumes or adjacent land use may not be accounted for leading to unnecessary traffic congestion and travel delays.

The US DOT and the Canadian Institute of Traffic Engineers recommend that reviews of signal timing performance be conducted every thirty to thirty-six months.

In our survey of nine Canadian cities we found that only four cities had regularly scheduled timing reviews. The reviews are conducted every three to seven years. Two of the cities surveyed were in the process of implementing a more formalized signal review process.

[16] Improving Traffic Signal Operations, US Department of Transportation , Federal Highway Administration

Recommendation 14:
Traffic Signals Branch management should develop a formalized signal timing review process. Resources should be reviewed to ensure adequate staffing either internally or externally exists to implement the program.

Management Response
The Traffic Signals Branch agrees with this recommendation. A review of resources requirement will be conducted to estimate the requirements to establish this capability within the Branch. The Branch is currently working on establishing traffic data requirements as the first step towards addressing this recommendation. The Traffic Signals Branch will plan to develop this process by June 2011 and will request funds for implementation by December 2011.

Claims

Traffic signal equipment is often damaged as a result of motor vehicle collisions. The cost of repairing damage to signals may be recoverable from Manitoba Public Insurance Corporation (MPI) or in some cases other third parties (i.e: construction companies). The Traffic Signals Branch will track all costs related to the repair on a work order. Once the repair has been completed and finalized a statement of cost is sent to the claims group within the City of Winnipeg Risk Management Division. Claims will then attempt to collect the amount owing to the City. The outstanding claim is set up as a receivable in the general ledger by Public Works and will also be set up in a system maintained by the Risk Management Division. When a collection is made by the claims group, Public Works is informed and the outstanding receivable balance is reduced.

A significant portion of the costs incurred to repair signal damages has not been collected from MPI, largely due to missing vehicle information. MPI must be provided with a vehicle license plate number in order to assess the damage against a registered motor vehicle owner. Although the Traffic Signals Branch does attempt to obtain a police incident number when a signal is damaged, they were not aware that more emphasis should be placed on obtaining a license plate number. Further complicating this matter is that in many cases a license plate number is not available, as the vehicle that caused the damage is no longer on the scene when the signal crew arrives.

The claims group will remove or not enter a claim in their system if there is inadequate support. If no license information is available, the claims group will close the claim and no further work is done to recover the amount owing. The claims group does not inform the Traffic Signals Branch or Public Works that no further action will be taken on the claim and as a result the outstanding receivable balance will not be reduced.

Annually, Public Works will compare their outstanding receivable balance to the outstanding claims balance maintained by the Risk Management Division. In order to reconcile the two balances and account for the claims not collected, an adjusting journal entry is prepared to reduce the outstanding receivable balance. This adjustment can be significant, approximately $328,600 (33% of the outstanding receivable balance) in 2008 and approximately $424,600 (35% of the outstanding receivable balance) in 2009. The actual reasons for the difference are not investigated by Public Works which could result in errors being made. A portion of the adjustment made in 2009 actually related to work

orders which were current, but had not been entered into the Claims system, as the claims group is approximately six to eight months behind in processing damage claims.

During the course of our audit the Risk Management Division met with MPI. MPI has requested that all signal damage claims be forwarded to them, whether or not a license plate number is available. MPIC will attempt to match the damage claim submitted by the claims group with motorist claims made for the same intersection and timeframe.

Recommendation 15:
Traffic Signals Branch management should ensure that both the vehicle license plate number and the police incident report are obtained, whenever possible when damage of a signal occurs as a result of a motor vehicle accident. The Public Works Department should request detailed damage claim information from the Risk Management Division to assist them in determining the appropriate provision to set up against the outstanding receivable.

Management Response
The Traffic Signals Branch agrees with this recommendation. The Traffic Signals Branch will work with the Claims Branch to modify and improve the existing process to increase the ability of the Branch to secure (but cannot ensure) vehicle license plate numbers and police incident reports associated with damages to traffic signals equipment. The Traffic Signals Branch has been in contact with the Claims Branch to provide access to the tools used for processing claims. This access would allow the Traffic Signals Branch to enter damage information into the claims database as soon as it is available. Work is already on-going on this front. The Traffic Signals Branch will plan to implement this recommendation by June 2011.

Manitoba Retail Sales Tax Self Assessment on Invoices

The Traffic Signals Branch has contracted with an engineering firm to provide services, including project management, signal timing analysis, communication network analysis and software/hardware configuration and troubleshooting, related to the implementation of the enhanced traffic signal management system. As part of these services the engineering firm provides procurement services and processes and pays third party invoices related to the project on behalf of the City. The engineering firm then invoices the Traffic Signal Branch to recover these payments and applies a 10% administration fee for the service provided. For 2009 this service fee amounted to $28,154.

As part of our audit procedures we reviewed all 25 invoices submitted in 2009 by the engineering firm. We noted a number of discrepancies related to Manitoba Retail Sales Tax (MRST). The engineering firm invoices the Branch for the amount of the third party invoice and includes provincial retail sales tax paid by them in the total amount, not as a separate line item on the invoice. They then add on the 10% administration fee and calculate GST on the full amount. The City of Winnipeg self assesses MRST where required when it does not show as a separate line item on an invoice. Eighteen (72%) of the invoices reviewed were self assessed MRST. In nine (50%) cases where sales tax was already assessed by the third party supplier the City is in fact paying sales tax twice. The total amount of MRST assessed for these nine invoices amounted to $12,244. For five of these nine invoices MRST amounting to $6,112 was paid twice, the remaining

four invoices had Ontario provincial sales tax and MRST assessed. The City is entitled to a refund for the duplicate MRST paid. The City is also paying an inflated GST amount as GST is being assessed on the provincial sales tax paid by the third party supplier. The additional amount of GST paid by the City as a result of this practice amounted to $1,581.

We also noted that in a number of cases the City did not consistently self assess MRST on similar invoices. For example, on five invoices for services provided directly by the consultant hired to assist on the system enhancement project, three (60%) invoices were not self assessed MRST (approximately $5,280), while two (40%) were self assessed approximately $13,243 of MRST. All of the invoices provided by the consultant were for the exact same service. In discussion with the Financial Analyst responsible for commodity taxes at the City, it was noted that MRST should be self assessed when the services provided by the consultant can be linked directly to the good purchased (i.e. service on a good). Otherwise general consulting (project management) type services would not be subject to MRST. These consultant invoices are a combination of both types of services, however the invoice prepared by the consultant does not clearly distinguish between the two and as a result we could not calculate the correct MRST which should have been assessed. In addition we noted two invoices related to a third party supplier which should have been self assessed MRST totaling $2,337 and were instead assessed no MRST.

Recommendation 16:
Traffic Signals Management should review whether the paying of third party invoices could be modified in order to prevent duplicate payments of retail sales tax. Management should consider whether the invoices could be paid directly by the Branch or whether retail sales tax could be shown as a separate line item on the consultant's invoice.

Management Response
The Traffic Signals Branch agrees with this recommendation. The Traffic Signals Branch has already contacted the consultant on this issue. Invoices will be segregated in a manner that allows the City to reduce unnecessary payments of retail sales taxes.

Recommendation 17:
Traffic Signals Management should discuss with the consultant on the enhancement project whether services provided which relate directly to the good purchased can be segregated from general consulting activity.

Management Response
The Traffic Signals Branch agrees with this recommendation at it relates to the matter of being able to identify areas where the City does not need to pay unnecessary taxes. The Traffic Signals Branch will plan to implement this recommendation by April 2011.

Recommendation 18:
Corporate Finance financial staff responsible for self assessment of MRST should review the process in more detail to ensure that MRST is self assessed in an accurate manner. Refunds should be requested for MRST which was paid twice.

Management Response
The Traffic Signals Branch agrees with this recommendation. The Traffic Signals Branch will contact Corporate Finance for advice on implementing this recommendation. The Traffic Signals Branch will plan to implement this recommendation by April 2011

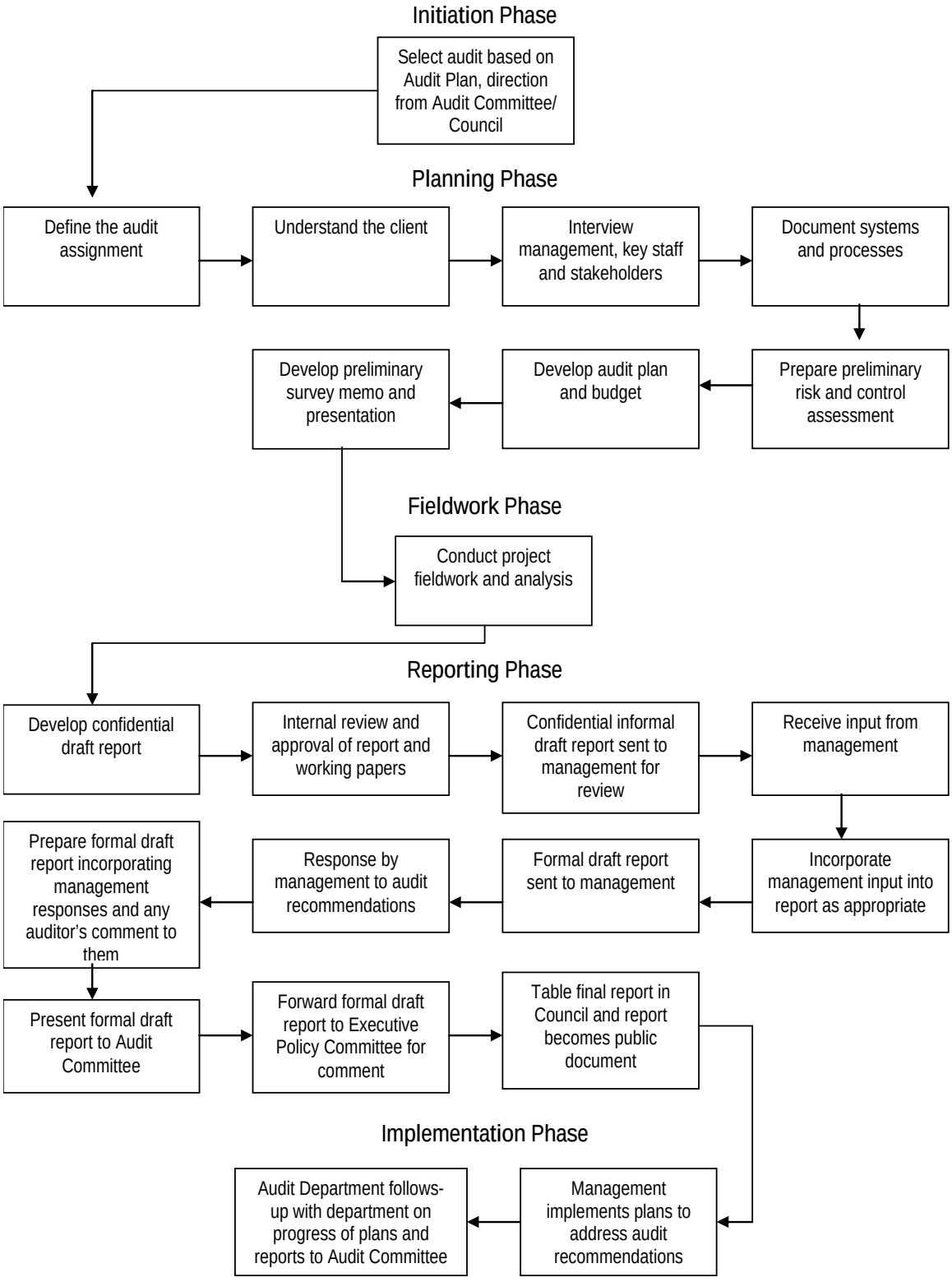
Facilities

The Traffic Signals Branch is located at 821 Elgin in a building, which was once a horse stable and dates back to approximately 1940. The building is multi-storied with two stories and a mezzanine level. The Building Services Division considers many of the building's systems to be beyond their useful life. Traffic Signals management indicated to us that the building is congested, does not provide a good work environment for employees and does not meet the Branch's current and future requirements. They provided us with several safety and security reports dating back to 2007, which outlined some of their concerns with the facility. We reviewed the information provided and while these reports identified several concerns, we did not note any significant issues that would lead us to believe that the facility is unsafe. During the course of our audit, however, we made several visits to the building and it appeared that the Branch does have a space and storage issue, as storage boxes were located throughout the office area. Staff on the mezzanine level have no natural lighting and overall conditions appeared to be cramped. Accessibility to the mezzanine and second floor may also be restricted for some individuals as there is no elevator.

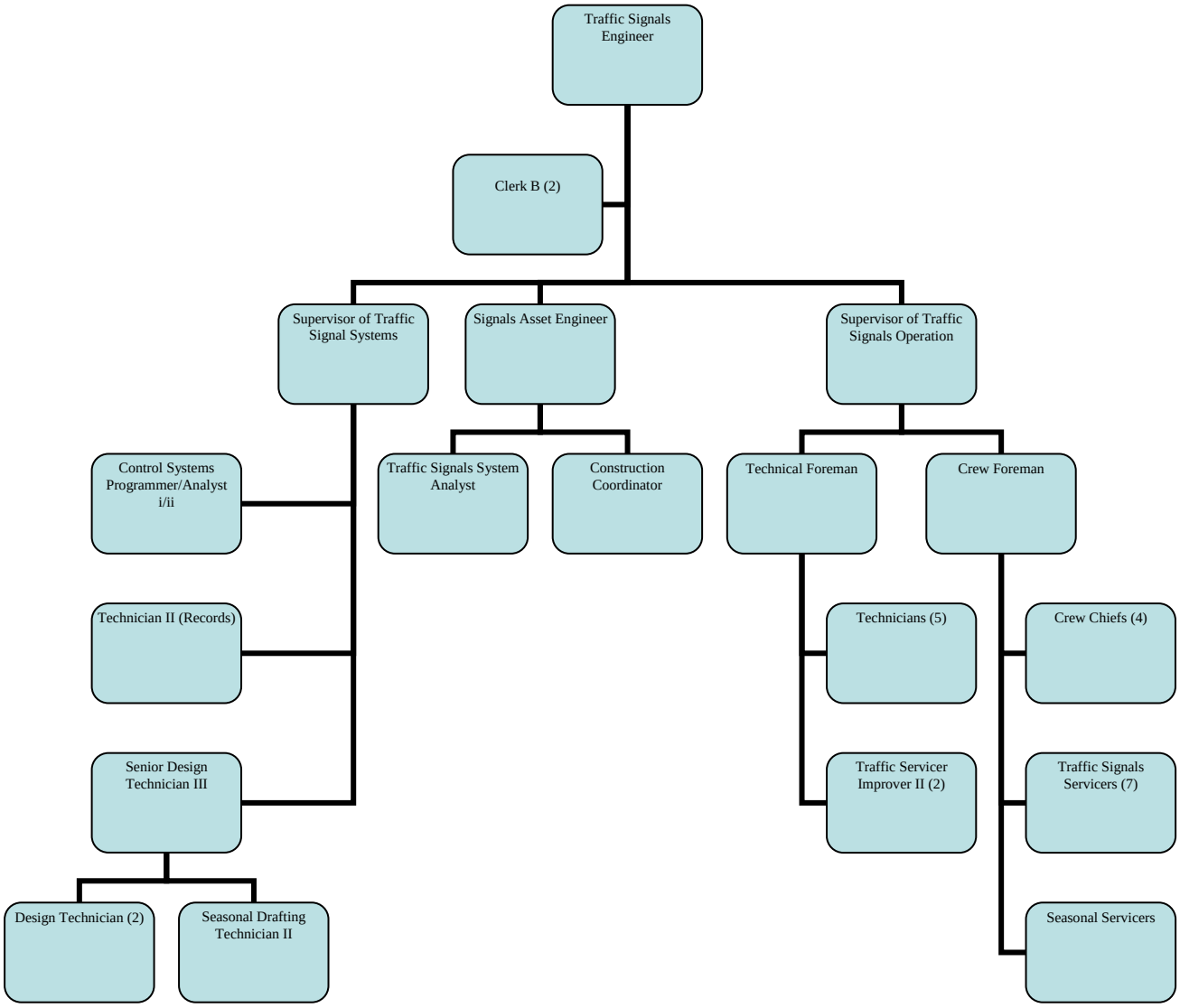
Recommendation 19:
Traffic Signal Branch management should perform a review of the suitability of their current facilities from a safety/health and requirements perspective, taking into account both their current and future needs.

Management Response
The Traffic Signals Branch agrees with this recommendation. A functional design for a new facility for the Traffic Signals Branch was completed in November 2009. This information is currently with Civic Accommodations, who are pursuing this initiative on behalf of Public Works (together with other building initiatives). As the issue is currently outside of the Traffic Signals Branch, no timeframe can be provided to achieve this recommendation. The Branch will request regular status updates from Civic Accommodations on any progress made.

APPENDIX 1 - AUDIT PROCESS



APPENDIX 2 – ORGANIZATIONAL CHART



APPENDIX 3 – SUMMARY OF RECOMMENDATIONS

Management Oversight

Program Management

Recommendation 1:

Traffic Signal Branch management should develop a formalized mission statement, strategic plan and objectives for the Branch which align with the Division's goals and optimize the Branch's limited resources.

Recommendation 2:

Traffic Signal Branch management should conduct a workforce analysis to determine the appropriate staffing levels. In conjunction with this review, the Branch should also examine its current organizational structure to determine if it is the best structure to meet the objectives of the Branch. The results of the analysis should be used to develop a strategic staffing plan which would encompass any planned outsourcing of functions and any business or organizational changes which may impact staffing in the future.

First Responder Teams

Recommendation 3:

Traffic Signals Branch management should review and rate all intersections to determine the level of criticality. Based on the level of criticality, response priorities should be determined. Formalized priorities should also be established by incident type (i.e. bulb out, pole down, etc). These priorities should be provided to all first response team members as well as IMI.

Recommendation 4:

Traffic Signals Branch management should include one technician and one electrician on first responder teams.

Overtime

Recommendation 5:

Traffic Signals Branch management should review the level of resources required to adequately staff the first responder team with the aim to reduce overtime incurred. The addition of a regular night and weekend shift should be considered as well as modified work hours.

Recommendation 6:

Traffic Signals Branch management should develop procedures in regards to the submission, review and approval of overtime claims for travel time and should implement a process to ensure all overtime hours claimed are valid and supportable.

Outsourcing

Recommendation 7:

We recommend that Traffic Signal Branch management evaluate the feasibility and cost of contracting out one or more signal functions in order to make more efficient use of current Branch resources.

Information Technology

Recommendation 8:

The Traffic Signals Branch should develop an IS strategy or plan to maximize the benefit derived from information technology, to ensure alignment with the Branch's goals and objectives and to optimize the resources spent on information technology.

Performance Measurement

Recommendation 9:

We recommend the Traffic Signals Branch develop and report on, a comprehensive set of performance measures for each key area of the business. The performance measures should be linked to the Branch's goals and objectives and targets should be established for each measure.

Traffic Signal Operations

Preventative Maintenance

Recommendation 10:

The Traffic Signals Branch should implement a comprehensive preventative maintenance program. Resources should be reviewed and analyzed to ensure adequate staffing either internally or externally exists to implement the program.

Signal Enhancement Project

Recommendation 11:

Traffic Signals Branch management should develop a detailed project plan for the enhancement project to ensure the project is completed by the original overall completion date. The plan should include a human resources plan and a staff schedule which identities the staff requirements to complete the project.

Recommendation 12:

Traffic Signals Branch management should perform more detailed financial tracking of the signal enhancement project, including a comparison of percentage of work completed and remaining to budget and should work with the project consultant to obtain detailed invoices which break down the project costs by individual corridor

Signal Monitoring

Recommendation 13:

Traffic Signals Branch management should continue to develop formalized monitoring capabilities within the Traffic Signals Management System. The Branch should establish benchmarks as to the level of "real" time monitoring they wish to achieve and the staff resources required to achieve these benchmarks. This benchmark and actual results achieved should form part of the Branch's performance information.

Signal Timing Reviews

Recommendation 14:

Traffic Signals Branch management should develop a formalized signal timing review process. Resources should be reviewed to ensure adequate staffing either internally or externally exists to implement the program.

Claims

Recommendation 15:

Traffic Signals Branch management should ensure that both the vehicle license plate number and the police incident report are obtained, whenever possible when damage of a signal occurs as a result of a motor vehicle accident. The Public Works Department should request detailed damage claim information from the Risk Management Division to assist them in determining the appropriate provision to set up against the outstanding receivable.

Manitoba Retail Sales Tax Self Assessment on Invoices

Recommendation 16:

Traffic Signals Management should review whether the paying of third party invoices could be modified in order to prevent duplicate payments of retail sales tax. Management should consider whether the invoices could be paid directly by the Branch or whether retail sales tax could be shown as a separate line item on the consultant's invoice.

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Traffic Signals Management should discuss with the consultant on the enhancement project whether services provided which relate directly to the good purchased can be segregated from general consulting activity.

Recommendation 18:

Corporate Finance financial staff responsible for self assessment of MRST should review the process in more detail to ensure that MRST is self assessed in accurate manner. Refunds should be processed for MRST which was paid twice.

Facilities

Recommendation 19:

Traffic Signal Branch management should perform a review of the suitability of their current facilities from a safety/health and requirements perspective, taking into account both their current and future needs.

APPENDIX 4 – SURVEY OF OTHER CANADIAN CITIES TRAFFIC SIGNAL OPERATIONS

The Audit Department surveyed 10 Canadian cites regarding traffic signal operations and the following nine cities responded:

- City of Edmonton
- City of Red Deer
- City of Ottawa
- City of Regina
- City of Saskatoon
- City of Toronto
- City of Hamilton
- City of Montreal
- City of Halifax

Highlights of the survey are discussed below.

Operational Information

Traffic Signal Branches in the cities surveyed were asked to provide information regarding the number of signals/intersections they were responsible for and the number of employees employed in traffic signal operations. This information is included in Exhibits 1.

Exhibit 1

City	Number of Signals	Number of Employees
Toronto	**2160**	**202**
Montreal	**2207**	**18**
Ottawa	**1064**	**72**
Edmonton	**900**	**21**
Winnipeg	**611**	**38**
Hamilton	**520**	**21**
Halifax	**260**	**54**
Saskatoon	**240**	**16**
Regina	**182**	**19**
Red Deer	**137**	**3**

Source: Audit Survey of Other Canadian Cities

Toronto manages the most signals with over 2000 and Red Deer the least at 137 signals. Winnipeg is mid size at 611 signals.

Toronto also employs the most employees in their traffic signal operations. It is difficult however to compare the different cities in this area as both Toronto and Edmonton outsource their maintenance function and areas of responsibility differ between cities. For example, Halifax employee numbers contain 15 individuals who work in the sign shop and Toronto has 91 individuals working in signs and markings, whereas the Winnipeg Traffic Signal Branch does not have responsibility for these areas.

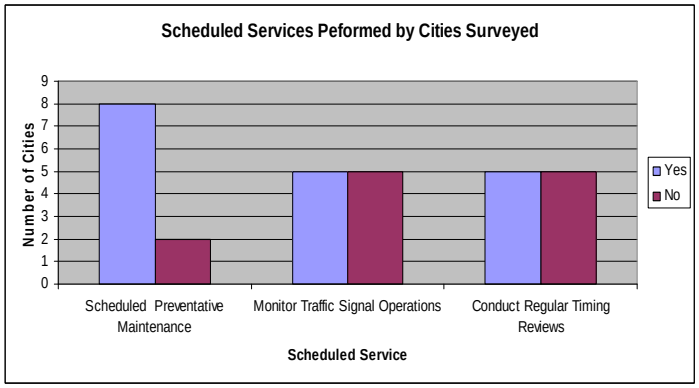
Most cities including Winnipeg outsource some traffic signal functions. Four cities including Winnipeg outsource underground installations. Two cities Toronto and

Edmonton outsource their traffic signal maintenance function and 4 cities, including Winnipeg outsource some design and consulting work.

Preventative Maintenance and Monitoring

Exhibit 2 shows the number of cities surveyed which perform regularly scheduled preventative maintenance and timing reviews as well as real time monitoring of signal operations.

Exhibit 2



Source: Audit Survey of Other Canadian Cities

All cities surveyed with the exception of Winnipeg and Montreal, perform regularly scheduled preventative maintenance on their traffic signal operations. Maintenance performed by the Winnipeg Traffic Signals Branch is mainly reactive in nature.

Half the cities surveyed monitored their traffic signal systems real time and conducted regular signal timing reviews. The Winnipeg Branch does not monitor the signal system real time and does not conduct regular signal timing reviews. The Branch however is currently in the process of implementing a new traffic signal system as part of the signal enhancement project. This system will provide the data which would allow the Branch to perform real time monitoring of signal operations

Performance

Very few of the cities surveyed have performance metrics which they monitor. Almost all cities monitor response time, however only three cities monitor other metrics such as system availability, system up time, timing runs, etc. In regards to the average time it took cities to respond to signal failures, four cities have a response time of less than 30 minutes, 4 cities have a response time of less than 1 hour and 1 city has a response time of less than 1 ½ hours.

The Winnipeg Traffic Signals Branch maintains few performance metrics. The Branch tracks the number of trouble calls received and the time it takes to repair signals damaged by third parties. The Branch does not track response time for traffic signal failures reported. Our calculation of response time for a 2 month period indicated that response time was approximately 2 hours during regular business hours.

The actual time it took the various cities to repair a signal failure varied depending on the nature of the repair. A number of cities did not track this metric. For those cities which provided information the repair time ranged from 10 minutes to 2 hours depending on the nature of the repair. The Winnipeg Traffic Signals Branch does not track this metric.

All cities surveyed, including Winnipeg responded to traffic signal failures 24/7, 365 days a year.