Winnipeg

Public Works Asset Management Performance Audit

Part 1 – Roadway Construction and Maintenance

September 2005

Audit Department

Leaders in building public trust in civic government

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Executive Summary

Introduction
As a result of a series of Risk Management Workshops conducted by the Audit Department, physical asset management was identified as a priority area for a performance audit. Due to the scope of activities included in this function, we decided to focus on two services: Roadway Construction and Maintenance and Facilities Maintenance Services of the Public Works Department.

This report deals with Roadway Construction and Maintenance. The objectives of the audit were to assess the following:

- the extent to which the services delivered adequately reflect the department's mandate, objectives and priorities;
- the adequacy of the design and implementation of the control framework for the delivery of services;
- the compliance with key legislation, regulations and policies governing the delivery of services; and
- the extent to which service performance results are relevant, accurate, balanced and meaningful.

Background
A dependable transportation infrastructure system helps to expand and strengthen the economy. The City's roadway infrastructure represents a very large investment of public funds. It is currently estimated at a replacement cost of $4.862 billion in 2003 dollars. Hundreds of thousands of people use these assets on a daily basis. In addition, much of the existing infrastructure (roads and bridges) was built many decades ago. This makes the management of the maintenance of the assets more crucial. Poorly maintained assets increase the chance of accidents and can add costs to users.

The primary mandate of the Public Works Department is asset management. Asset management is a systematic process of maintaining, upgrading, and operating physical assets cost-effectively. It combines engineering principles with sound business practices and economic theory, and it provides tools to facilitate a more organized, logical approach to decision-making. Given the current financial environment, the Public Works Department must be able to demonstrate that scarce resources are being used effectively and efficiently as well as have the capacity to report on the consequences of funding decisions made by the Administration and Council.

Report on Performance
Overall, the results indicate that the condition of the roadway infrastructure is deteriorating. The Department's measurement of surface condition, the growth in service requests, the high levels of spending on corrective maintenance and the results of citizen surveys all point to a serious deterioration of the roadway infrastructure. This is not surprising given the constraints placed on the financial resources available to support Roadway Construction and Maintenance. The Department has reported a significant infrastructure deficit for several years. In 2003, the shortfall for the preservation maintenance of roads and bridges was $53 million. As well, the City's approach to roadway investment and maintenance decisions within and among roadway asset classes has tended to reflect tradition, intuition, personal experience, resource availability and political considerations. Systematic application of objective analytical techniques has only been applied to a lesser degree because of the lack of available, complete and reliable information on the assets. Historically, the application of asset management systems has been limited to monitoring conditions and then planning and programming projects primarily on a "worst first" basis.

We also noted that the allocation of resources to regional roads or local roads is not supported by an analysis of how the money should best be spent over the long-term. It also does not reflect the importance of the regional street system to the City's economic growth and development. In addition, for local streets, consideration is given to carrying out projects based on a distribution of budget dollars to City wards in accordance with the ward's share of street segments that meet the criteria for the treatment, rather than ensuring that the right treatment is applied to the right road at the right time to preserve the infrastructure at the lowest cost over the long run. The result of developing a work plan without an effective asset management system is inefficiencies and higher costs over the long-term. This approach to asset management, in general, and resource allocation and investment analysis, in particular, is tactical rather than strategic. The Public Works Department has taken steps recently to improve its performance through the acquisition of an asset management system. It is clear that challenges still lie ahead to develop and utilize the system to its full capacity. While the asset management system is a critical element in improving the Department's performance, the lack of financial resources remains the Department's biggest challenge.

We were not able to evaluate the performance of the service grouping in each area that we identified because of the lack of performance information. The Department has not established performance targets for the service grouping against which to measure its performance, and many of the measures have just been established preventing any comparison with past performance. There is also limited information to use as a basis for comparison with other jurisdictions, although we were able to make some tentative observations. Public Works will not be able to assess the effectiveness or efficiency of the Roadway Construction and Maintenance service grouping without a more comprehensive performance measurement system. Without the ability to objectively report on results, it is more difficult for Public Works to discharge its accountability to Council and to the public.

Key Observations and Recommendations

In attempting to explain the results of the Report on Performance, we examined five areas that we believe must be well managed for the business objectives to be achieved. We also focused on key controls that should be in place to manage significant risks associated with these business objectives. Below are some of the recommendations that we believe will improve the current control environment and position Public Works to realize opportunities in the future:

Performance of Assets

- Public Works needs to develop a comprehensive performance management process that includes the identification of desired outcomes, established levels of service, service standards and benchmarks for the evaluation of results and to regularly report on the achievement of intended results to senior administration and Council. The information from measuring results allows management to make informed decisions and can help to justify budget requests by demonstrating needs with actual data on resources used to deliver services.

- Public Works has to continue the work on the development of the VEMAX asset management system. The complete implementation of the system is crucial for the Department to develop optimal plans for the preservation of the roadway infrastructure. The Department must include data in the asset management system that will

improve the accuracy and completeness of the information provided by the system including traffic and roadway capacity data and asset value data which recognizes the cost of use (depreciation).

- The Department needs to ensure that all the systems involved in asset management are interconnected to the extent possible and do a better job of securing the system and documenting procedures for backing up the system.

- Staffing issues in relation to the asset management system also need to be addressed. The maintenance of the system is primarily the responsibility of one person; cross training should be implemented to ensure that others are aware of the intricacies of the system. The position of GIS technician needs to be fully staffed and a back-up person cross-trained to ensure the continuity of the information in this system.

Determining the Work to be Done

- Public Works needs to begin to use the asset management system optimization capabilities to develop long-term asset management plans that outline needs and priorities as well as the implications of not adequately funding these needs and priorities. The Department should also be using the VEMAX system to develop a short-term optimal list of projects to be worked on that will provide the most cost-effective use of resources.

- Council should be receiving sensitivity analysis on the various alternative options available to assist in the decision making process. Best practices suggest that many of these reports should be provided to Council and senior administration prior to establishing priorities and the setting of budget target levels so the ramifications of decisions will be known.

- Public Works should continue to strive to implement life cycle cost analysis as a project evaluation tool. The Department should also establish “trigger values” that are specific to the City of Winnipeg that are related to the need to apply a specific preservation treatment at the right time to be effective or before the pavement reaches a condition where a different, more expensive treatment would be required.

Controlling Costs

- Project status reporting needs to be improved. Most reporting on the status of projects is done on an informal basis. Actual costs are not routinely compared against Council approved budgets and project budgets are frequently changed in anticipation of increasing costs to complete projects. In addition, the Department does not routinely perform financial variance analysis on project results. Public Works should develop a set of standardized reports on the financial performance of completed projects and programs as well as reports for projects in progress. In addition, the Department should report to the Standing Policy Committee on Fiscal Issues and Council on the financial status of all major projects (in excess of $10 million).

- The Department tends to hold projects open for extended periods of time to allow for the reallocation of unspent budgets from these projects to projects that are expected to require increases to the budget. These practices make it difficult to demonstrate or evaluate the financial management of projects and programs. The Department should establish a process to ensure that projects are closed on a timely basis.

- Risk Management is an integral part of project management and should be thought of as a component of any project management methodology. While Public Works always considers project risks during project design, the process is carried out in varying degrees and is not formally documented.

- The Engineering and Streets Maintenance Divisions both utilize a mix of in-house resources and external consultant resources to conduct the work. We found that the Department was not adequately documenting the process of assigning work to consulting engineers. This process needs to be enhanced to ensure that the Department is not exposed to questions about fairness of the process or the appropriateness of the fees paid.

- The Public Works Department needs to consistently enforce the liquidated damages clause in the construction contracts for projects that were not completed on time.

Quality of Work

- The Department needs to complete the documentation of the quality assurance and inspection processes and procedures relating to capital projects, new developments and contracted maintenance work and include them in the project management manual. In addition, the Department needs to develop a formal quality assurance process that will ensure that in-house maintenance projects are meeting the required specifications.

- The Public Works Department needs to establish an overall departmental succession plan. In the Public Works Department, 58% of the staff will be eligible to retire by 2010 and, as a result, the Engineering Division and Streets Maintenance Division may have difficulty maintaining continuity of knowledge and skills in the future. A sound training development, mentoring and monitoring process should result in improved service provision and quality work. Effective training-related processes are essential to ensuring that employees have the knowledge, skills, abilities and competencies required for their jobs.

Impacts on the Public and Staff

- The Department should assign the responsibility for managing the right of way to a specific division. Establishing a coordinator position to improve the coordination of maintenance work on the regional streets to minimize traffic disruption should be considered.

- Public Works should also determine the feasibility of using work practices that will maximize the coordination of work and minimize the disruption caused by projects that involve the closing of lanes/streets. Such practices include the following: charging degradation fees to utilities, work hour and lane closure restrictions, working multiple shifts and/or working evenings; and using contract penalties such as liquidated damages and lane closure fees.

- Communication to the public about upcoming street/lane closures is important to ensure minimal disruption.

- The Department should be performing more frequent formal safety audits both internally and of contractors to demonstrate compliance. Public Works should report on which areas are in compliance with the Act and which are not and how any gaps will be remedied.

Conclusion

The environment in which the Public Works Department operates today is different than it was five years ago, and it will continue to change in the future. The infrastructure deficit has been well articulated and is fast approaching a crisis level. There will come a point in time whereby a lack of new infrastructure and preservation investments will have economic impacts. Citizens have made their concerns known. Resolution of a problem of this magnitude is well beyond the ability of the department to manage on its own. Indeed, municipal leaders have taken their concerns to the senior levels of government, and there is some basis for anticipating relief in the future. Within these financial constraints, the Department has done a reasonable job of making trade-offs among relative priorities.

Having said that, we are unable to state definitively that the citizens have received value for money for the tax dollars spent on this service. The lack of complete performance information leaves the Department unable to demonstrate the efficiency and effectiveness of its activities. And until the asset management system is fully developed and utilized, we cannot be certain that planning efforts and maintenance decisions are optimal, either with existing resources or in anticipation of additional funding in the future. We believe that implementation of our recommendations will improve the Roadway and Construction Service and help the Public Works Department establish a higher degree of transparency and accountability. With support from decision makers and funding partners, Public Works should be able to work towards building and maintaining a more desirable roadway infrastructure to benefit all of our citizens.

Background

In 2003, we conducted a series of risk management workshops and considered the results in developing our annual audit plan. Physical Asset Management was identified as a priority area for a performance audit. Due to the scope of activities included in Physical Asset Management, we decided to focus on two services: Roadway Construction and Maintenance and Facilities Maintenance Services of the Public Works Department.

Audit Objectives

The objectives of the audit were to assess the following:

- The extent to which the services delivered adequately reflect the department's mandate, objectives and priorities;
- The adequacy of the design and implementation of the control framework for the delivery of services;
- The compliance with key legislation, regulations and policies governing the delivery of services; and
- The extent to which service performance results are relevant, accurate, balanced and meaningful.

Audit Scope and Approach

Our audit will be performed in two parts. The first part, which is the subject of this report, dealt with Roadway Construction and Maintenance and focused on the performance of the service for the period January 1, 2003 to April 30, 2004. (Snow Removal was excluded from the scope.) The second part will review Facilities Maintenance upon completion of Part 1.

We approached our audit in three phases:

- Preliminary survey phase
- Fieldwork phase
- Reporting phase

In conducting our audit, we employed a variety of methods:

- We conducted interviews and discussions with the Acting Director of Public Works, Manager of Streets Maintenance Division, Manager of Engineering, Manager of Building Services, Manager of Finance and Administration, Asset Management Engineer, Pavement Management Analyst, GIS Project Officer and the Investment Strategies Engineer.

- We worked with management to determine the most significant risks that could inhibit or prevent the achievement of their business objectives and used the risk assessment to focus our audit resources on specific areas. We also identified and evaluated controls in place to mitigate significant risks.

- We reviewed and analyzed relevant background information including the *InfraGuide, National Guide to Sustainable Municipal Infrastructure* authored by the National Research Council (NRC), Federation of Canadian Municipalities, Infrastructure Canada and the Canadian Public Works Association.

- We interviewed management and staff responsible for Roadway and Bridges in the cities of Edmonton, Calgary and Hamilton to determine whether there were opportunities to improve management practices and results at the City of Winnipeg.

- We reviewed and analyzed relevant Public Works Department reports, operating information, documentation and independent consulting reports.

- We reviewed the key policies and administrative directives governing the management of physical assets, human resources and contracting.

- We reviewed the Physical Asset Management system (VEMAX), the flowchart of the Asset Management Model used in Public Works and key operational systems, processes and procedures required to manage the Roadway and Bridge assets.

- We developed a *Report on Performance* based upon information available.

We communicated the results of our audit on an on-going basis and presented a formal report to Public Works Senior Management, the Chief Administrative Officer, Audit Committee and Council at the end of the audit.

Audit Conclusions

Based on the audit work completed, we concluded that:

- The delivery of the Roadway Construction and Maintenance Service Grouping is consistent with the mandate, objectives and priorities of the Public Works Department.

- The Public Works Department needs to implement improvements to the control framework to ensure that risks are managed such that there is reasonable assurance that business objectives will be met.

- The Public Works Department complies with the key legislation, regulations and policies governing the delivery of services except for the process used in the assignment of work to consulting engineers.

- The Department has not established performance targets against which to measure its performance. This limits the ability to understand whether the Department's performance results met expectations. Because the Department has only recently begun to track some key performance measures, any meaningful comparison with past performance is limited.

The audit was conducted in accordance with generally accepted auditing standards. In preparing our report, we have relied upon extensive interviews with Public Works management, staff and others, and information, data, and other documentary evidence provided to us. The conclusions reached in this report are based upon information available at the time. In the event that significant information is brought to our attention after completion of the audit, we reserve the right to amend the conclusions reached.

Acknowledgements

The Audit Department wants to extend its appreciation to the many individuals who participated in the audit. Their comments and insights assisted us in completing our analysis and provided the foundation for many of the report recommendations.

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August, 2005
Date

Introduction

It is the mandate of the Public Works Department to deliver municipal services relating to the planning, development, operation and maintenance of roadway systems, parks, open spaces, natural area systems and the maintenance and security of civic buildings.

A common responsibility for the divisions of the department is physical asset management. The Department provides integral components of asset management for the following types of assets: Roadway Systems, Structures, Traffic Signals and Traffic Signal Plant, Parks and Open Space Systems, and Building Maintenance and Operation. See Appendix 1 for an Organization Chart.

Roadway Construction and Maintenance

The Streets Maintenance Division and the Engineering Division of Public Works are responsible for the roadway construction and roadway maintenance services provided to Winnipeg citizens. The Transportation Division also provides direct support to a limited extent (mainly involving intersections). Their overall goal is to provide users with access to well-maintained roadways and bridges in order to ensure the safe movement of people, goods and services.

Key goals and strategies

The key goals and strategies for roadway construction and roadway maintenance services are:

1. Support interdepartmental cooperation
2. Invest in equipment and technology
3. Support Downtown revitalization
4. Develop a diverse and competent workforce
5. Develop and implement a risk management program
6. Optimize service delivery
7. Consider the principles of environmental stewardship
8. Address declining infrastructure condition

Engineering Division

The Engineering Division's responsibilities in relation to Roadway Construction and Maintenance can be broken down into four specific areas:

Asset Management – responsible for roadway asset management, including financial planning and capital budgeting, investment strategy analysis, pavement management system, bridge management system, the Local Improvements program development, the technical research and standards development, and responsibility for the development of an asset management strategy for other asset types within the Public Works Department.

Project Management – responsible for capital project planning, public participation, regulatory approvals, design and construction, implementation of local improvements design and construction, development agreements, and planning, design and construction.

Bridge Maintenance and Inspection – responsible for bridge maintenance, inspection and monitoring, bridge cost estimates, bridge technical standards development, and bridge yard operation.

Technology Services – responsible for survey services, inspection services (construction/permits/utility), roadway design services, street cut restoration, non-conforming approach review, GIS-T and LBIS, and for engineering records management.

The 2004 operating budget for the Engineering Division is $4,447,957 and the capital budget is $32,331,000. The budgeted staffing numbers include 79 full time equivalent positions. See Appendix 3 for the Organization Chart.

Streets Maintenance Division

The services provided by the Streets Maintenance Division include Road Construction and Maintenance and Roadway Snow and Ice Control. The Streets Maintenance Division provides right-of-way management, asset

management, snow and ice removal, street and boulevard cleaning and dust control. The key components of these services include:

- Maintenance of paved and unpaved surfaces, associated ditches and culverts, alley and railway crossings and includes patching, restoration, pavement raising, crack filling and curb maintenance of paved roadways and alleys, as well as grading, dust control, gravelling, and ditch and culvert maintenance of gravel roadways and alleys
- Sidewalk rehabilitation and maintenance
- Street cleaning of paved streets, alleys and sidewalks
- Snow clearing and ice control

The 2004 operating budget for the Streets Maintenance Division is $37,882,251. The division has 331 full time equivalent staff positions. See Appendix 4 for the Organization Chart.

Infrastructure Assets

Public Works is responsible for maintaining and managing the City of Winnipeg's roadway, bridge and sidewalk assets as detailed below.

Inventory of Assets at September 2003

Asset	Inventory[1]	Replacement Cost (estimate in 2003 dollars)
Regional Streets	1,700 lane km	$860 Million
Local and Collector Streets	5,000 lane km	$2.15 Billion
Lanes/ Alleys	800 km	$490 Million
Sidewalks	2,700 km	$160 Million
Traffic Signals & Pedestrian Corridors	1,000	$70 Million
Traffic Signs	400,000	$20 Million
Bridges and Structures[2]	199	$1.12 Billion
Total		$4.870 Billion

1 – Report to Standing Policy Committee on Public Works, September 2003
2 – This number is only for the major and minor bridge structures. The additional structural elements under the division's stewardship – overhead signs and roadside safety devices total an additional 645 items with an additional replacement cost of $14 million.

The regional street system carries about 80% of the traffic in Winnipeg and local and collector streets carry the remaining 20% of the traffic. Although the inventory (by area) of local and collector streets exceeds regional streets by about three to one, street preservation funding should be focused on the regional streets because of the comparatively higher volume of traffic they carry. The inventory under management is increasing every year due to roadway infrastructure required by new residential developments.

Value of Assets

Several techniques have been used to establish the value of municipal infrastructure assets. For the purpose of renewal planning, replacement cost is generally the preferred method of quantifying the value of an asset.

Public Works has performed an asset valuation based on replacement costs for 2000 and 2003. The valuation for 2003 is listed above. The total replacement value of Public Works' Bridges and Roadway infrastructure assets was $5,275,060,550 (in 2003 dollars) in 2000 and $4,870,000,000 in 2003, a decrease of $413,060,050 over this period of time. This is contrary to what would normally be expected given the new infrastructure associated with the growth of existing and new residential developments and the inflationary effects on construction costs. This anomaly is mainly due to the fact that the inventory data of the infrastructure assets is getting more accurate; the values in 2000 involved more estimates than the 2003 inventory figures. The latter consists mostly of actual measurements.

Asset Management

Asset management is a systematic process of maintaining, upgrading, and operating physical assets cost-effectively. It combines engineering principles with sound business practices and economic theory, and it provides tools to facilitate a more organized, logical approach to decision-making. Thus asset management provides a framework for handling both short- and long-range planning.

At its core, asset management is a strategic, as opposed to tactical, approach to managing assets. The process works as follows: First, performance expectations (levels of service) consistent with goals, available budgets and policies are established to guide the analytical process, as well as the decision-making framework. Second, inventory, condition and performance information is collected and analyzed. Asset management links user expectations for system condition,

performance, and availability with system management and investment strategies. This information provides input on future system requirements (needs). Third, the use of analytical tools and procedures produces viable cost-effective strategies for allocating budgets to satisfy the needs of City and the public, using performance expectations as critical inputs. Asset management provides ready access to quantitative and qualitative data and allows decision makers to more readily identify and focus on key issues. Alternative choices are then evaluated, consistent with long-range plans, policies, and goals. The ability to weigh and articulate the impact of choosing one alternative over another through "what if" analyses is enhanced. And, importantly, the support and documentation explaining the selection is improved. A fact based reproducible, systematic approach can enhance the dialogue among decision makers regarding capital investment levels. The entire process is re-evaluated annually through performance monitoring.

A typical Asset Management System involves these key components:

Physical inventory – A complete and accurate inventory of the infrastructure assets is maintained.

Condition assessment – A condition assessment of each inventory item needs to be performed and maintained. Scheduling of inspections varies with the kind of infrastructure being managed; elements that tend to change quickly are inspected more often.

Modeling – The infrastructure elements' condition assessments from previous years are input into a deterioration model and used to predict the elements' condition in the future. The models can also be used to perform "what if" analyses on the system, predicting the performance based on different treatment schemes.

Expert System – Expert systems can consolidate the knowledge of a number of experts by developing a set of rules and logic provided by them. Scenarios fed through the system will result in decisions that are consistent and supported.

Database – The information stored in the database is made up of the results of the inventory, condition assessment, deterioration modeling and expert system. The database must be arranged so that it is easy to use and efficient. The information in the database must be kept current.

Goals – These are targets for optimization that are used in the analysis. Typical goals are determined by the politicians or are forced by budget constraints.

Optimization – This is the process by which the program attempts to meet the goals imposed on it.

Analysis – A plan is produced for how to use the available resources to provide the most value.

Project assignment – The results generated from the analysis stage are plans for improvements for individual infrastructure elements. These are translated into project assignments that can include: doing nothing, maintenance, repair or rehabilitation.

Follow-up – It is important to revisit the condition assessments and inventory on an ongoing basis to ensure the effectiveness of the system and the accuracy of the information in the database.

Report on Performance

Performance Measurement
Municipal managers want to be efficient and deliver value for their services. Taxpayers need to know how their tax dollars are spent and how their services compare both year-to-year and in relation to others. There are four main reasons why performance measurement is important:

- Enhances accountability - In today's environment, it is important that taxpayers are informed about what Public Works plans to achieve, what it is actually achieving and what the public service costs. Measuring and reporting on performance strengthens the understanding between staff and Council of the expected results and actual results for the service. It helps focus Council's decision making and helps Public Works staff understand the level and type of service delivery required. Performance measures demonstrate to taxpayers how they are being served and the value they are receiving for their tax dollars.

- Helps to improve performance - The analysis of performance results identifies opportunities for municipalities to improve the quality, efficiency and effectiveness of the services.

- Stimulates productivity and creativity - Performance measures can be used to create new incentives and rewards to stimulate staff creativity and productivity.

- Improves budget processes - Performance measures can help municipalities develop budgets that are based on realistic costs and benefits, not just historical patterns. Performance measurement can also improve the monitoring of budgets by measuring whether the budget and expected service levels are being met.

Current Performance Results
An integral part of our audit is the assessment of the performance of the asset management program in Public Works with respect to roadways. To do this, we compared recommended performance criteria outlined in the *InfraGuide, National Guide to Sustainable Municipal Infrastructure* published by the National Research Council (NRC), Federation of Canadian Municipalities, Infrastructure Canada and the Canadian Public Works Association. Performance reporting with respect to asset management is in its initial stages in most cities and, as a result, there is very limited performance information available to make comparisons with the City of Winnipeg. The municipalities of Edmonton and Hamilton were chosen since they had the most mature asset management models and were similar in size to Winnipeg. To the extent possible, we relied on performance information and data currently maintained by Public Works and compared this information to Edmonton and Hamilton.

It is important to note that there are differences that make comparison between jurisdictions difficult. Whether administrative costs are factored into the costs for maintaining roadways, the definition of maintenance work, or the type and number of criteria that are used to assess the condition of the roadways are some key factors that make comparisons challenging. *The InfraGuide: Municipal Infrastructure Asset Management* states that "Caution must be used when using metric benchmarking since performance measures do not necessarily account for the unique circumstances within each municipality (e.g., demographics, climate). Furthermore, financial performance measures do not provide a true indication of the efficiency of a municipality. Nevertheless, an analysis of trends in performance indicators over several years will allow a municipality to determine whether its performance is improving."

In assessing the performance of an entity or program it is important that the different types of performance measures are not viewed in isolation. It is also important to measure quality as well as unit costs. Results should be viewed in terms of how much is achieved and how well. Although the term "quality" can have many different meanings, it essentially boils down to meeting client or taxpayer expectations. Therefore, both efficiency and effectiveness measures should be considered when evaluating the overall performance, since there is often a trade-off between the two. For example, Public Works may be able to reduce its unit costs for maintenance work significantly, but only by providing a quality or level of service that taxpayers find unacceptable. Performance data is also most meaningful when comparisons can be made (i.e. actual to budget, year to year, jurisdiction to jurisdiction).

Performance Indicators

We identified the following performance indicators as important to understanding how well the Public Works Department is performing maintenance of the Roadway and Bridge Assets:

- Strategic infrastructure investments vs. preservation expenditures
- Preservation maintenance vs. corrective maintenance
- Infrastructure funding needs vs. planned expenditures
- Surface or structural condition
- Availability of regional streets network
- Timeliness of service response
- Service requests
- Citizen satisfaction
- Maintenance cost per lane kilometre
- Number of lane kilometres renewed per year

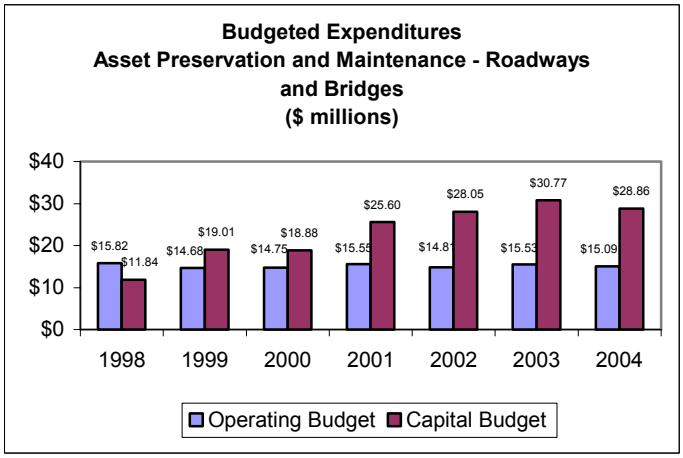
Effectiveness Measures

These measures refer to the extent to which a service is achieving its intended results.

It focuses on the outcomes of a service or program. The emphasis is on the quality of service, the benefits a service delivers to taxpayers or the impact the service has on the quality of life in a community. Results are usually expressed as percentages or ratios.

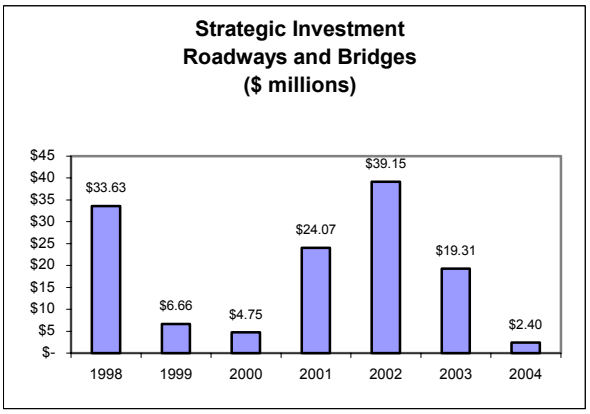
Strategic Infrastructure Investments versus Preservation Expenditures

Public Works divides its asset management expenditures into two main categories. The first category, Infrastructure Preservation, consists of the expenditures necessary to maintain the current infrastructure at the current level of service. This includes expenditures like joint sealing, Thin Bituminous Overlay (TBO) program, and rehabilitation to restore roads to original condition. The other category, Strategic Investment, is defined as projects that are "intergenerational", that is, built today but with benefits expected to span beyond the current generation. These projects typically involve functional enhancements to allow for future growth, as opposed to simply extending their life. Projects include bridge replacements and reconstruction of large segments of regional roads (i.e. Kenaston underpass). The chart that follows highlights the funding levels over the past seven years, both operating and capital, for Infrastructure Preservation.



The operating and capital figures for Roadway and Bridges included only those expenditures directly related to the preservation of the assets. Expenditures associated with roadside safety devices, overhead sign structures, traffic signals, pedestrian corridors and traffic signs were

excluded, as they did not specifically relate to asset preservation. In addition, some administrative and supervisory expenditures were difficult to segregate and were not included. The chart indicates that the Public Works operating budget for sidewalk, street and bridge maintenance work has remained relatively flat over the period 1998 to 2004. Given that there has been development of new roadways over the past six years and, combined with the effects of inflation, Public Works has incurred a real decrease in the operating budget. The capital budget is increasing over this period, but as seen in a later graph, it is not increasing enough to maintain the condition of the roadways at the current state.



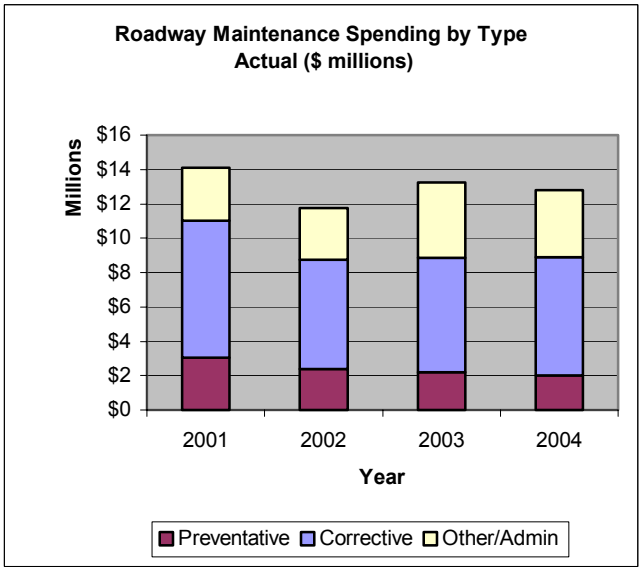
The chart above illustrates the level of strategic investment funding for Roadways and Bridges over the past six years. This is the part of the capital budget that relates to projects that meet the definition of a strategic investment. From the graph you can see that the budgeted expenditures for strategic investments fluctuates significantly from year to year and there is no overall trend that can be established. This is due primarily to the nature of these projects, which typically require a significant amount of capital resulting in a need to phase these projects out over several years due to funding limitations.

Preventative Maintenance versus Corrective Maintenance

A strong preservation program is essential to assist management in focusing on preserving the pavement asset while maximizing the economic efficiency of the investment. In such a program, both preventative and corrective maintenance are needed to provide and maintain serviceable roadways as effective maintenance practices are necessary to address deficiencies early before the pavement defects become major problems as well as extend the life of the asset at a relatively low cost.

However, the focus should be on preventative maintenance activities since the costs associated with corrective maintenance are significantly higher. Experience has shown that spending $1.00 on timely preventative maintenance while the pavement is still in good condition will improve the performance and provide a savings of $3.00 to $4.00 in future corrective maintenance costs.

Therefore one of the goals of any good asset management system should be to increase the amount of preventative maintenance that is undertaken and, as a result, reduce the need for corrective maintenance. The chart below shows the percentage of the Streets Maintenance actual expenditures for maintenance of roadway assets that is used for preventative and corrective maintenance.



A review of the expenditure information displays a clear trend during the years from 2001 to 2004 towards a reduction in the preventative maintenance activities that the City is undertaking, even though research

has shown that this is the least cost-effective approach.

Public Works is currently using the majority of roadway maintenance resources to address corrective maintenance. This is a result of the fact that the Department does not receive adequate funding to maintain the current condition of its assets. As a result of this lack of funding, the roadways are deteriorating at a faster rate resulting in more corrective maintenance issues that have to be addressed immediately. This is inconsistent with proper asset management and more money should be spent on preventative maintenance.

We also noted from the chart that the Other Maintenance Costs have been increasing over the same period. The reasons for the increased spending in this category primarily represent the administrative changes that were made to more accurately identify the program activity costs by including lost time due to weather and breakdowns costs in this category. Other factors were the introduction of asset management costs, increased safety and training requirements and an increase in the maintenance services provided for special events in the City.

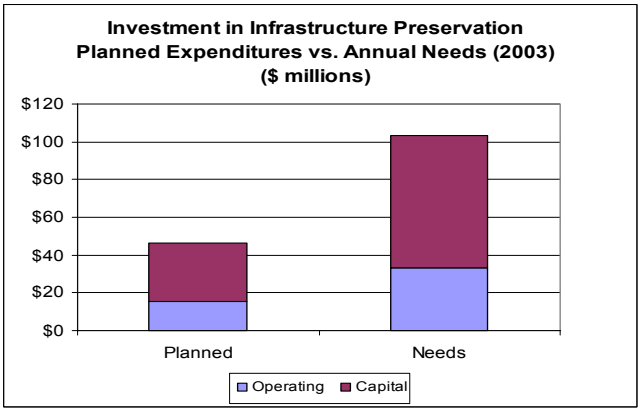
Infrastructure Funding Needs versus Planned Expenditures

The infrastructure deficit is essentially the difference between the required level of funding to sustain a desired level of service (for the City of Winnipeg the present condition) and the planned or budgeted expenditures. It represents the amount of additional funding required to prevent deterioration of the asset below the present condition.

The most recent *State of the Public Works Infrastructure in the City of Winnipeg* document that was presented to the Standing Policy Committee on Public Works by the Public Works Department in September of 2003 indicated that there is a $70 million annual shortfall in infrastructure spending (for the maintenance of existing assets) of which just over $50 million relates to bridges and roadways for the period 2004-2008. Like a budget deficit, every year there is a funding deficit for preservation of an asset, the backlog of required preservation work grows. Public Works has measured this deficit for both Infrastructure Preservation and Strategic Investments.

The graph below highlights the fact that Public Works is facing a significant infrastructure deficit ($53 million shortfall) for Infrastructure Preservation. This essentially means that the current level of funding is not sufficient to maintain the current level of service. The result, over time, will be deterioration in performance of the roadways and an increasing requirement for corrective maintenance. Given limited funding, this will likely result in funding being diverted away from required strategic investments and preservation to corrective maintenance work.

As well, the Public Works Department reported that in order to maintain the serviceability of the transportation system and Winnipeg's competitiveness and

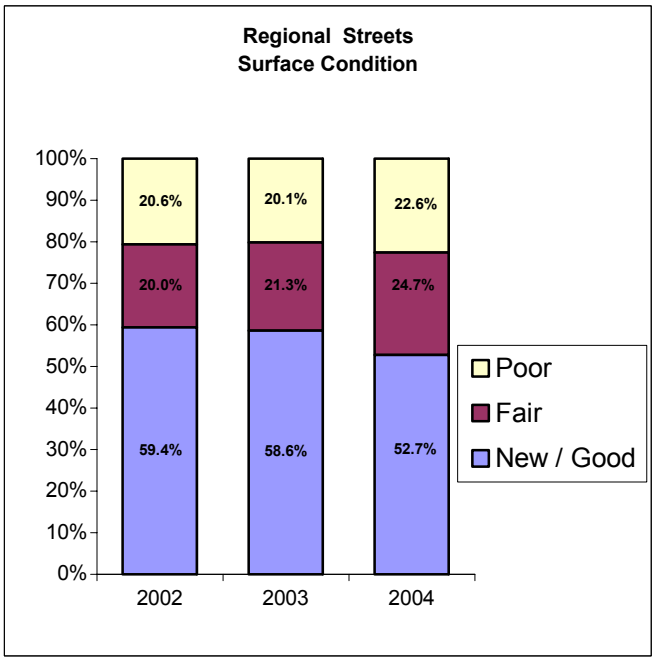


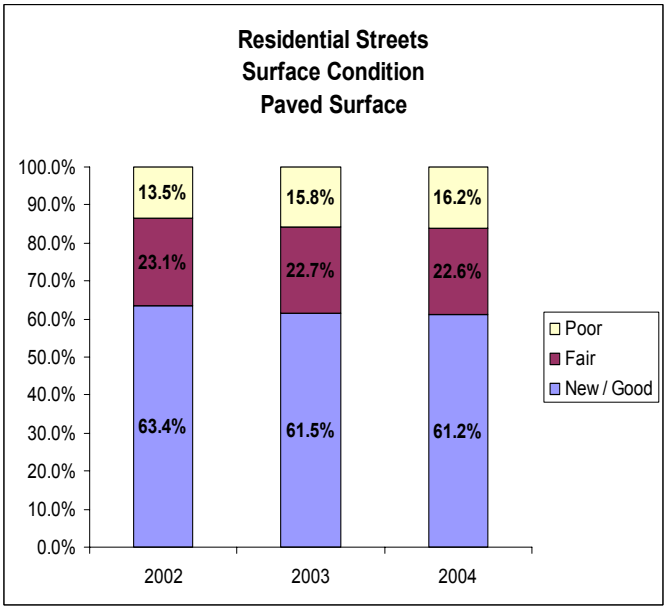
attractiveness, strategic investments in new infrastructure, over and above mere preservation, are necessary. Beginning in 2004 and over the next six years, an investment of approximately $159 million is required in major roadway enhancements and bridge construction projects which include projects like the Kenaston underpass, Chief Peguis extensions, Kenaston Boulevard widening and reconstruction, widening of St. Mary's Road and St. Anne's Road, extension of

Charleswood Parkway to Wilkes, and extension of Kenaston Boulevard to the perimeter. For the period of 2004 – 2008, $39.1 million is planned, leaving $120 million in required strategic investment to be funded for the following two years. The result over time of this level of underfunding of Strategic Investments is a roadway and bridge system that will not provide the desired level of service in terms of traffic flow for anticipated growth and surface condition. Ultimately, this will impact the City's ability to support economic development.

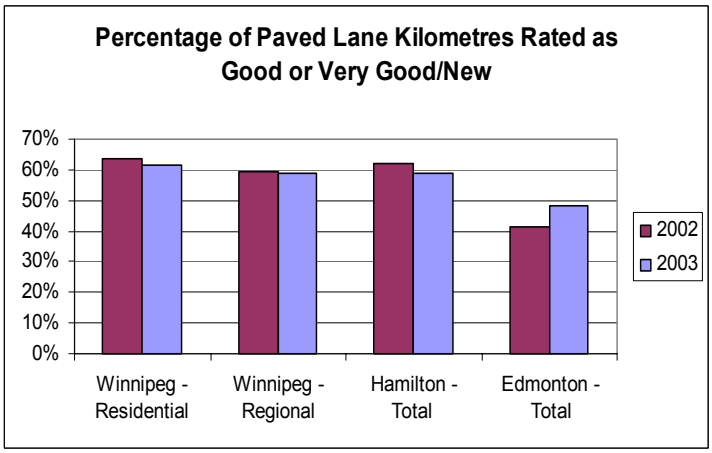
Surface or Structural Condition

Surface condition is a performance indicator for streets and structural condition is a performance indicator for bridges. We have collected information on the condition of streets. The two graphs depict the condition of the City of Winnipeg's streets in 2002, 2003 and 2004 for regional streets and local streets. For both regional and local streets, the percentage of streets that are in new or good condition is decreasing. In 2004, the percentage of regional streets considered to be in New/Good condition decreased by 4.9% in the period of one year. Although the percentage decrease may appear small, it is important to note that this decrease occurred over just one year and these assets are designed to last 35 years before a major rehabilitation is to occur. A subsequent increase in the streets in poor condition has also resulted. This is evidence that the current level of spending on the maintenance of roadway inventory is not sufficient to maintain the condition of the roadways. Without sufficient funding the City of Winnipeg's roadways will continue to deteriorate to a point where they will have to be reconstructed because the condition of the roads will have deteriorated to a point where maintenance or rehabilitation is no longer an option. As a result, the next generation will be faced with the much higher cost of reconstruction at an earlier point in time.





The chart to the right compares the surface condition of the City of Winnipeg's streets to that of the City of Hamilton and the City of Edmonton. The City of Winnipeg's percentage of roads in good or new condition compares favourably to that of the City of Edmonton and is very similar to the City of Hamilton. This data may suggest that the condition of the City of Winnipeg's roadways is comparable to other jurisdictions and, in fact, is considerably better than the City of Edmonton. However, given the fact that different municipalities utilize different criteria and weightings of the criteria, we cannot determine that the definition of "good" or "very good" is the same for each city. Therefore, it is not possible to make definitive comparisons without more information. Another way to use this information is to observe the trends. In both the City of Winnipeg and the City of Hamilton, the percentage of roadways that is rated as "good" or "very good/new" is decreasing. The City of Edmonton on the other hand, is increasing its percentage, indicating that this City has been more effective at improving the condition of its roadways.



Available Lane Kilometres as Percentage of Regional Streets Network

This is an indicator of the percentage of the regional street system or number of lane kilometres that are open to traffic. Currently, Public Works is not measuring this. The availability of the regional street network is a good measure of the impact roadway and bridge maintenance and capital work is having on the public and traffic. Public Works could establish a minimum percentage of the regional street network that is required to be open and plan capital and maintenance projects accordingly.

Timeliness of Service Response

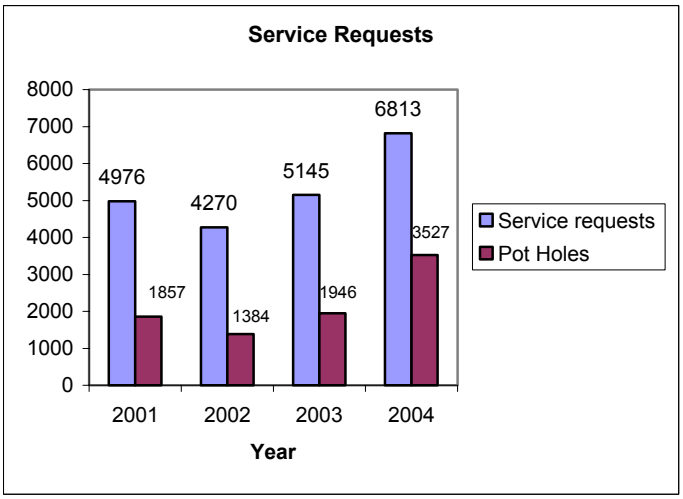
An important measure of effectiveness for any service is how quickly staff respond to service requests. The Public Works Department currently does not measure how long it takes to perform a service request, nor has it established a standard time to respond. The Ontario Government, by contrast, has established minimum maintenance standards for municipal highways that clearly outline the minimum acceptable response times for a variety of streets maintenance activities including the repair of potholes and the repair of cracks. The standards are specific to the class of highway and the severity of the maintenance item (i.e. a large pothole requires a faster service response time than a smaller one). Public Works should consult with the public and other jurisdictions to determine what an acceptable service response time is within a given budget. This way the public can be involved in the decision of what level of service they want and can afford. Once a set of service standards is determined, Public Works should measure and report on its performance against these standards. Some of the measures could be:

- Average time for full restoration of cuts to streets and boulevards
- Average time to repair pothole
- Average time to repair cracks
- Percentage of service responses addressed within minimum acceptable standards

Service Requests

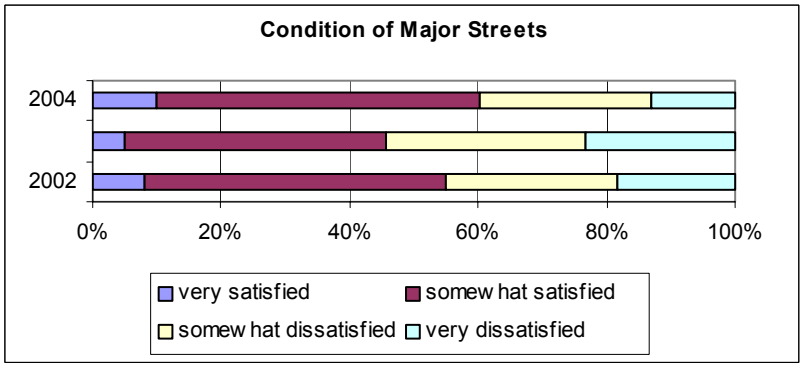
The Public Works Customer Service Centre tracks service requests by type. The number of service requests related to roadway asset condition is a good indicator of the state of the infrastructure assets compared to what is expected by the public. A service request is defined as a call or group of calls that resulted in a service request being issued (i.e. if 20 calls came in for the same problem, it would be recorded as 1 service request).

The graph below indicates that service requests relating to the condition of roadway assets has been increasing every year except for the period 2001 to 2002. Over the period 2002 to 2004, there has been an increase of approximately 59% in the number of service requests. This is an indicator that the condition of the roads is declining and is also an indicator of the dissatisfaction the public has with the condition of the roads.



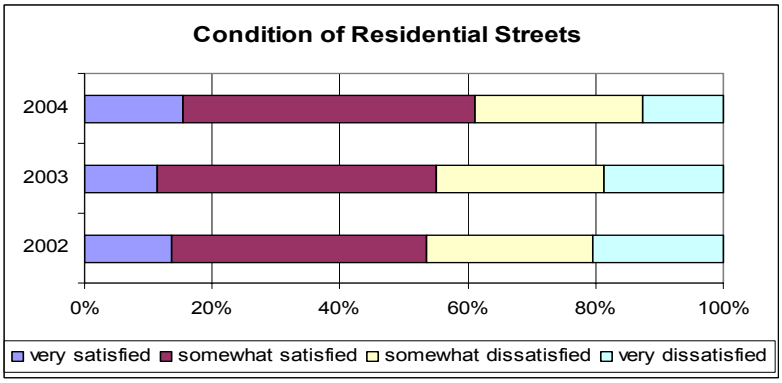
Citizen Satisfaction

A critical component to evaluating effectiveness is the extent to which customers are satisfied. The City of Winnipeg, through the CAO Secretariat, conducts an annual citizen survey and, as a part of the survey, the public's satisfaction with road conditions is assessed.



This chart above shows citizen satisfaction with the condition of major (i.e. regional) streets in the City of Winnipeg. While there does not appear to be an established trend, the overall level of satisfaction rated as "very" or "somewhat satisfied" has been at or below 60%, which is well below the City approval ratings for other City services. This could be an indication that the public sees this as a problem area or an area where the City is not meeting customer expectations with respect to the level of service.

The graph to the right measures citizen satisfaction with the condition of residential (i.e. local) streets in the City of Winnipeg. Here the overall satisfaction rating (i.e. the percentage rated as "very" or "somewhat satisfied") improved from 53.6% in 2002 to 61.0% in 2004. Although the trend is positive, the overall satisfaction rating has been below or close to 60%, which is well below other City services. Again, this could be an indication that the public sees this as a problem area or an area where the City is not meeting customer expectations with respect to the level of service. The fact that the approval rating is increasing for residential (local) streets rather than for major (regional) streets is consistent with where Public Works has focused its maintenance efforts.

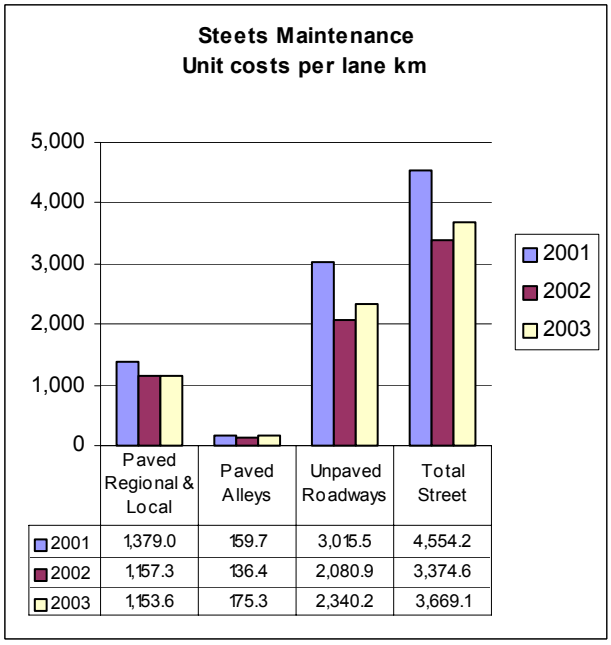


Efficiency Measures

Efficiency measures are the amount of resources used to produce a given amount of service. They are usually expressed in unit costs. They are designed to indicate how efficiently resources allocated to a department or division are being utilized.

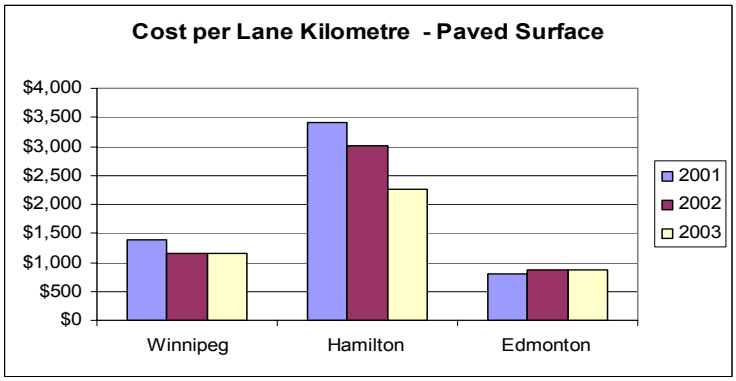
Maintenance Costs per Lane Kilometre

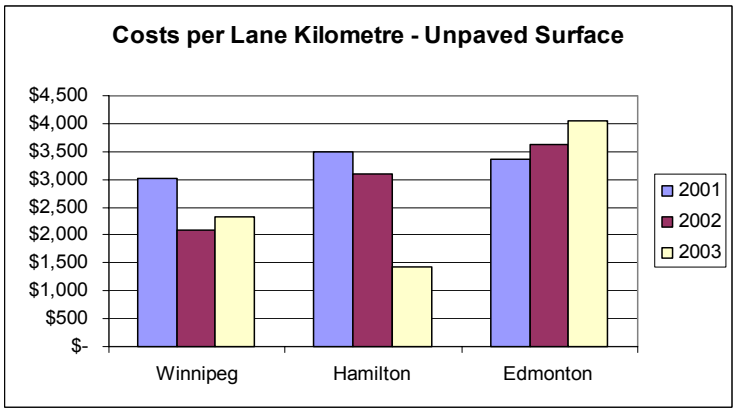
A comparison of the costs of maintenance work (corrective and preventative) for Public Works over the period 2001 to 2003 shows that, for paved and unpaved roadways, the unit costs per kilometre have been on a decreasing trend. The unit costs can be reduced for a number of reasons, one being the type of treatments applied in any given year, so this information, while indicating a positive trend of unit cost reductions, only reflects a portion of the true performance picture.



	Paved Regional & Local	Paved Alleys	Unpaved Roadways	Total Street
2001	1,379.0	159.7	3,015.5	4,554.2
2002	1,157.3	136.4	2,080.9	3,374.6
2003	1,153.6	175.3	2,340.2	3,669.1

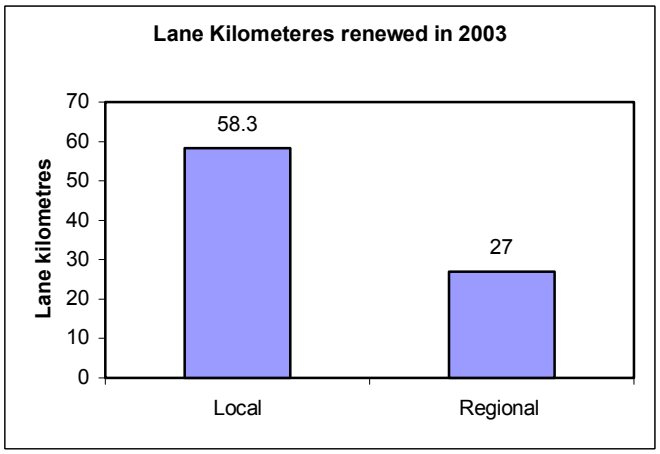
The next two charts compare the City of Winnipeg's unit costs for maintenance of paved and unpaved roads to that of the cities of Hamilton and Edmonton. The City of Winnipeg's unit costs are lower than Hamilton's for paved surfaces. It is important to note that although the City of Hamilton's unit costs are higher than the City of Winnipeg's, this is, in part, due to the fact that Hamilton's figures include an allocation of overhead that the City of Winnipeg's figures do not. It may also be due to what each city defines as maintenance work versus capital work. Even with the limitations of cross-jurisdictional comparisons, it is still valuable to track comparative information in order to assess relative performance against other municipalities. For example, the trends related to the City can be compared to other municipalities.





Number of Lane Kilometres Renewed per Year

The table to the right (reported in the 2003 Business Plan), outlines the average amount of system preserved (rehabilitated) through the capital budget by lane-kilometre per year for street and bridges. The Department began collecting this data in 2003 but has not compiled the data for 2004 to date. This is a good measure of both how well the money is being used and how efficiently it is being used to preserve the infrastructure. Because there is no comparative data, the 2003 statistics alone provide little information except demonstrating that the focus of the capital budget in terms of preservation efforts is on local streets. The number of lane kilometres renewed for local streets is more than double that of regional streets although local streets only handle 20% of the total traffic. This is not consistent with asset management literature that suggests that the focus of preservation efforts to maintain a desired level of service should be on the regional street system. In the following years, comparative data will be available to determine if the trend is positive (i.e. an increase in the lane-kilometres preserved) and whether the focus is shifting from local streets to regional streets.



Summary of Performance Results

Overall, the results indicate that the condition of the roadway infrastructure is deteriorating. The Department's measurement of surface condition, the growth in service requests, the high levels of spending on safety maintenance and the results of citizen surveys all point to a serious deterioration of the roadway infrastructure. This is not surprising given the constraints placed on the financial resources available to support Roadway Construction and Maintenance. The Department has reported a significant infrastructure deficit for several years. In 2003, the shortfall for the preservation maintenance of Roads and Bridges was $53 million. As well, the City's approach to roadway investment and maintenance decisions within and among roadway asset classes has tended to reflect tradition, intuition, personal experience, resource availability and political considerations. Systematic application of objective analytical techniques has only been applied to a lesser degree because of the lack of availability of complete and reliable information on the assets. Historically, the application of asset management systems has been limited to monitoring conditions and then planning and programming projects primarily on a "worst first" basis.

We also noted that the allocation of resources to regional roads or local roads is not supported by an analysis of how the money should best be spent over the long-term. It also does not reflect the importance of the regional street system to the City's economic growth and development. In addition, for local streets consideration is given to carrying out projects based on a distribution of budget dollars to City wards in accordance with the ward's share of street segments that meet the criteria for the treatment, rather than ensuring that the right treatment is applied to the right road at the right time to preserve the infrastructure at the lowest cost over the long run. The result of developing a work plan without an effective asset management system is inefficiencies and higher costs over the long-term. This approach to asset management, in general, and resource allocation and investment analysis, in particular, is tactical rather than strategic. While the Public Works Department has taken steps recently to improve its performance through the acquisition of an asset management system it is clear that challenges still lie ahead to develop and utilize the system to its full capacity.

We were not able to evaluate the performance of the Roadway Construction and Maintenance service grouping in each performance area that we identified because of the lack of performance information maintained by the Department. The Department has not established performance targets for the service grouping against which to measure its performance, and many of the measures have just been established preventing any comparison with past performance. There is also limited information to use as a basis for comparison with other jurisdictions, although we were able to make some tentative observations. Public Works will not be able to assess the effectiveness or efficiency of the Roadway Construction and Maintenance service grouping without a more comprehensive performance measurement system. Without the ability to objectively report on results, it is more difficult for Public Works to discharge its accountability to Council and to the public.

Positioning for the Future

In our *Report on Performance*, we looked at the current Roadway Construction and Maintenance service being provided by the department. In the remainder of the report, we will review and analyze potential reasons for the performance. We will assess the extent to which the department has identified significant risks that could impede the achievement of its business objectives related to this service and implemented a control framework to manage these risks. We also consider whether controls are operating as intended and provide recommendations where improvements are required. We believe that a strong control environment will enhance current performance and position the department to realize opportunities in the future.

We have focused our report on five areas that must be well managed to achieve the business objectives of the Roadway Construction and Maintenance Service. These are described below:

Areas of Focus

Performance of Assets
The department must have clear performance objectives, targets, standards and information on results.

Determining the Work to be Done
The department must treat the right road at the right time with the right treatment.

Controlling Costs
The department must have an effective framework in place to control costs.

Quality of Work
The department must ensure that maintenance work is of appropriate quality.

Impacts on the Public and Staff
The department needs to minimize negative impacts of maintenance work on the public and staff.

Risk Profile
A risk profile is a map that indicates the most significant risks facing the operations of an organization at a point in time. The Risk Profile for the Roadway Construction and Maintenance service was adopted from the department's *Corporate Plan and Budget Submission* and categorizes risk according to the City's *Corporate Risk Framework.* We organized the risk profile according to the areas of focus for the audit. Management reviewed and validated the Risk Profile.

In the final section of the report, we will consider the effectiveness of the controls implemented to manage the risks identified for each Area of Focus. We used a control model to identify key controls that should be in place. The control model we used is the Criteria of Control Model (CoCo) developed by the Canadian Institute of Chartered Accountants. The model defines control as a broad concept that incorporates all elements that support the achievement of an organization's business objectives. (The model is described more fully in Appendix 5.) The recommendations contained in the report are intended to provide management with actions that will assist in the mitigation of the significant risks or control gaps identified during the audit.

Management can also use the Risk Profile on an on-going basis to identify where their resources should be focused to effectively manage the key risks associated with Roadway Construction and Maintenance. The Risk Profile will change due to changes in the operating environment or as management initiates changes in processes or policies that support the Roadway Construction and Maintenance service. Implementation of the audit recommendations will also change the Risk Profile as risk management practices are strengthened.

Risk Profile
Public Works – Roadway Construction and Maintenance

Context Risks

These risks relate to internal and external factors that impact the environment in which the organization operates or business processes are conducted.

Area of Focus	External Environment	Compliance	Organizational Culture	Business Process
Performance of assets	Outside agencies impact on roads (Hydro, Water and Waste, MTS, etc.)		Lack of adequate performance objectives and goals	Inventory and condition assessment processes are not sustained
Determining the work to be done	Extreme weather conditions promoting rapid breakdown of assets and dictating when maintenance work can be performed		Focus on corrective maintenance, resulting in poorer performance over the long term	Capital and maintenance project selection not effective
			Political involvement in prioritization	Project assignment and optimization modeling are ineffective
Controlling costs	Demand for contractor resources and materials exceeds supply resulting in significant cost increases	Contractors and staff fail to comply with contract in terms of costs and completion dates	Focus on corrective maintenance resulting in higher costs over long term	Contracting process is inadequate
			Inadequate communication and consultation with other departments and utilities on projects	Project risk management process ineffective
				Project budgeting process inadequate
Quality of Work		Contractors and staff fail to comply with terms of contract and with quality standards		Inadequate quality control – standards and inspection process
				Development agreements with sub-standard specifications
Impacts on the public and staff	Unscheduled lane closures due to work done by utilities	Contractors and staff fail to comply with employee health and safety regulations		Failure to minimize preservation /construction work that occurs during peak traffic hours

Legend

- Critical risk: CAO involvement essential, inform committee of Council.
- High risk: Senior management involvement essential, inform CAO.
- Moderate risk: management mitigation & monitoring required, inform senior management.
- Low risk: manage by routine procedures.

Risk Profile
Public Works – Roadway Construction and Maintenance

Resource Risks These risks relate to the resources used by the organization to accomplish its objectives.				
Area of Focus	**Human Resources**	**Financial Resources**	**Information Resources**	**Physical Assets**
Performance of assets			Inadequate integration of IT systems (VEMAX, GIS, TKMMS)	Aging roadway system (costs to maintain are increasing at a higher rate)
			Lack of adequate performance measures (i.e. Levels of service)	
Determining the work to be done		Inadequate financial resources to meet physical condition needs of assets to maintain recommended level of service	Accurate and complete information is unavailable (WAG, Optimization Model, Asset condition, Inventory)	
Controlling Costs	CUPE agreement inflexible regarding use of contractors and minimum guaranteed hours for part time staff		Peoplesoft Financial monitoring system for projects not useful.	Inability to obtain and maintain reliable and appropriate equipment
Quality of Work	Inadequate succession planning, training and high turnover		Appropriate management information not available or not used (Budget, Financial, TKMMS, WAG,	
Impacts on the public and staff		Inadequate resources to provide public information and notification of lane/road closures and restrictions		

Legend

Critical risk: CAO involvement essential, inform committee of Council.
High risk: Senior management involvement essential, inform CAO.
Moderate risk: management mitigation & monitoring required, inform senior management.
Low risk: manage by routine procedures.

Observations and Recommendations

Our observations and recommendations are categorized by Area of Focus. It is important to view all recommendations within the context of both current operations and future challenges.

Performance of Assets

The Department should have established clear and measurable objectives and performance targets, and strategies consistent with achieving the objectives.

The Department needs appropriate information on the assets it manages to assess what maintenance work needs to be carried out and to report on the Department's performance against targets.

Performance Management

Performance targets and measures provide essential information that is needed for the Public Works Department to evaluate the level of service it provides with respect to roadway construction and maintenance.

Levels of Service

Establishing levels of service is an important part of strategic planning. Levels of service is a composite indicator that reflects the social and economic goals of the community and may include any of the following parameters: safety, customer satisfaction, quality, quantity, capacity, reliability, responsiveness, environmental acceptability, cost and availability. The defined levels of service comprise any combination of the above parameters deemed important by the municipality. Levels of service should be based upon users' willingness and ability to pay and an understanding of the long-term (life cycle) cost implications of implementing specific levels of service. Levels of service are unique to each municipality.

In our research, we found that Edmonton has established levels of service based on a pavement quality index (PQI). This number is a composite score derived from an amalgamation of the surface distress, road roughness, and structural adequacy ratings. Hamilton had not established specific levels of service and noted that it is difficult or impossible to compare service levels since there are too many variables. The City noted that, as an example, the Overall Condition Index (OCI) rating (50% Surface Condition Index and 50% Ride Comfort Index) could be manipulated to reflect the service level the municipality wishes to provide.

To date, the City of Winnipeg has not established a target level of service for each class of roadway, and, instead, is using the current condition as the target level of service for calculating the infrastructure deficit and for purposes of asset management optimization modeling. This level of service is not mandated or approved by Council; rather it is a level of service that Public Works considers to be the minimum acceptable. In 1999, the Department conducted a pilot project to obtain public input into the level of service provided by the roads in River Heights. The Department documented the process and the results in a November 1999 report on the pilot project. The report did not recommend that the Department establish levels of service. The primary reason given at that time was insufficient funding. The Department determined that it would be unable to meet the levels of service that would be established given its current and anticipated funding levels. Public Works management decided that there was limited value in establishing a citizen driven level of service

when the current funding level was insufficient to maintain the status quo. Department management concluded that more data on service levels is required and more assurance on the reliability of the data produced by the VEMAX system is needed before they embark upon a public consultation process for the purposes of establishing a target level of service. Also, given the large infrastructure deficit the City of Winnipeg is currently facing and the resulting backlog of eligible capital and maintenance projects, management felt that Public Works limited budget would be better utilized in gathering reliable data about the condition of assets and the effectiveness of different treatments. While this is important, it does not take into account the fact that citizens, given the cost trade-offs, may be willing to accept a lower level of service than the status quo for local streets in exchange for lower taxes or a higher level of service for regional roads. The Department now has more information on the roadway assets than it had in 1999. Therefore, we believe that the Department should begin to consider when it might be appropriate to engage the public in establishing service levels for roads and bridges. Without establishing levels of service and steering the roadway program towards attaining the established levels of service, Public Works cannot manage the roadway system to meet the expectations of citizens.

Performance Measurement

The performance indicators that the Department uses should provide quantifiable, relevant and reliable information on the economy, efficiency and effectiveness of its service delivery. Information from measuring results allows management to make more informed decisions about operations.

Performance measurement can also help management justify budget requests by demonstrating needs with actual data on asset condition, workload, personnel and other resources used to deliver the service. In addition, with information gained from measuring changes in asset condition, timeliness of service response and unit costing, Public Works is better equipped to communicate actual results to Council and the public.

To enable Public Works management to monitor and report on its performance, service standards and service goals that link to the objectives for the Roadway Construction and Maintenance Service have to be established. Service standards establish the minimum level of performance to be delivered. Service goals describe what results are expected to be achieved and by when. Establishing goals and reporting on actual results enhances the accountability of the Public Works Department and helps to manage public expectations.

The Public Works Department has established some indicators of performance that include:

- Average condition rating by type of roadway (regional, local and alleys)
- Average amount of system preserved (rehabilitated) through capital budget
  - Number of lane kilometres of local street renewed in 2003
  - Number of lane kilometres of regional street renewed in 2003
- Change in infrastructure deficit (updated every two years)
- Infrastructure Deficit for roadway asset types (roads, bridges, signals)
- Replacement value (updated every three years)
- Citizen satisfaction measures

The Public Works Department has committed in its latest business plan to report on the following performance indicators:

- Unit cost per km for maintenance
- Average time for full restoration of cuts to streets and boulevards
- Unit cost per square metre for sidewalk renewal

The Public Works Department has not established service standards or measurable goals that can be used to put these results into perspective. Furthermore, the Department has just recently begun to regularly collect data on and monitor many

of these performance indicators. To date, management has been satisfied with the informal reporting that is being done through meetings and verbal reports. In the absence of a more comprehensive performance management system, Public Works management will be limited in their ability to make informed decisions to maintain and improve upon the level of service provided to the public.

Recommendation 1

Public Works needs to develop a comprehensive performance management process that includes the identification of desired outcomes, established levels of service, service standards and benchmarks for the evaluation of results and to regularly report on the achievement of intended results to senior administration and Council.

Management response

The Public Works Department agrees with this recommendation. As a starting point, we will set recommended targets for physical condition of roadways, accompanied by the costs to implement, and consequences of not implementing. From that point, the discussion on how to incorporate community needs can ensue. Details to follow in the Asset Management Audit Implementation Plan.

Asset Information

A best practice organization implementing asset management has the following information on its assets:

- Knowledge of assets owned
- Knowledge of the physical condition of assets
- Knowledge of asset performance and reliability
- Knowledge of asset utilization and capacity
- Knowledge of asset value

Successful implementation of an asset management system requires information systems to make sound asset management decisions. Decisions will only be as good as the completeness, accuracy and timeliness of the information being utilized.

Information Systems

Effective information management is critical to the success of asset management. The ability to analyze information about the performance, construction, preservation and maintenance of an asset throughout its life cycle is essential to manage it effectively. Relevant, reliable and complete information will, over time, allow Public Works to optimize the management of its assets in terms of life cycle costs, level of service and risk. It is important to note that although there are a number of software packages available for infrastructure asset management, and selecting the correct software is important, the software is only a tool. The data and information are more valuable than the software. Currently, Public Works utilizes four systems to collect and analyze asset management information - VEMAX (four modules), TKMMS (Streets Maintenance – actual cost data), GIS/ GEO Media, and Peoplesoft. The Department also utilizes Excel spreadsheets to track project information.

Our review found that information management systems met several best practices highlighted in the *InfraGuide*:

- Data is entered closest to the source and stored in one location. Public Works' foremen enter the time data daily based on time cards that are filled out at the site. The surface conditions are entered directly into the VEMAX database from the information collected on the Surface Condition Rating Worksheets. (Public Works does not have the necessary resources to supply a laptop computer to all raters to make use of electronic worksheets.)
- Data is easily retrieved and shared throughout the department. The VEMAX modules, PeopleSoft, GIS/ GEO Media and TKMMS are available to everyone in the department that requires the information. The Department does restrict functions of each user (i.e. read only, edit capabilities, reporting. etc.) based on their needs.

- Data is aggregated to provide an overall condition assessment for portions of the entire system. Public Works, through the use of VEMAX, currently provides the overall condition assessments by roadway class, ward boundaries, and functional areas of the City.
- Data is analyzed to show change in overall condition over time, including future projections. The system has the capability to perform this analysis through the VEMAX PPT module, but staff are just beginning to experiment with this type of analysis and reporting.
- Data is analyzed for life cycle trends and deterioration curves. The system has the capability to perform this analysis through the VEMAX PPT module, but staff are just beginning to experiment with this type of analysis and reporting.

For asset management purposes, these systems are not fully integrated. Information can be retrieved from each of the systems (TKMMS, PeopleSoft and GIS) and entered into VEMAX. But the information is retrieved on an ad-hoc basis. Ideally, there should be a mechanism for scheduled updates of the information relevant for asset management decisions to the VEMAX system. Methods to automate this process to the extent possible could also be explored. Currently, due to limited resources, the automation of this information transfer is not being pursued.

We also noted that there is a lack of regular backup procedures employed for the VEMAX Asset Register Pro database, which contains the inventory and the condition ratings. Backup procedures are not documented and backups occur on an irregular basis. Although this database is on the network and is covered by regular back-up procedures for the network, the live (most current) database resides on the Pavement Analyst's laptop computer. The VEMAX data on the laptop is not backed up on a regular basis. The Department does not have documented procedures for the security and back-up of the data contained in the VEMAX database. Failure to back-up the database on a regular and timely (daily or weekly) basis could result in a loss of a considerable amount of data. The recovery of lost data would require the re-entry of all data that was lost, utilizing already scarce resources.

Recommendation 2

a) Public Works should continue its efforts to ensure that the systems involved in asset management are interconnected to the extent possible to eliminate double entry of data and reduce manual procedures.

Management response

The Public Works Department agrees with this recommendation and is currently working on the integration.

b) Public Works should also document procedures with respect to the security of the VEMAX databases including back-up procedures. These procedures should include the requirement that regular back-ups be performed and that a back-up copy be kept off-site. In addition, the information in the databases on the laptop should be transferred to the network databases on a regular basis.

Management response

The Public Works Department agrees with this recommendation. Currently, the Asset Management Area Coordinators' data, being server-based, gets backed up every night. Other data is stored off-site and otherwise taken care of, but not in a formalized manner. The department will be developing a manual or paper on procedures, and amending our back-up procedures, as appropriate. Details to follow in the Asset Management Audit Implementation Plan.

Knowledge of Assets Owned - Pavement Inventory

Comprehensive knowledge of the assets owned is the foundation of any asset management program and is the basis upon which all decisions are made. The City's streets are classified into two main categories: regional streets and local streets. Regional streets are grouped into two groups, primary (Group A) and secondary (Group B), based upon criteria. Group A contains all streets that function as

major thoroughfares or arterials with the prime function of carrying through traffic. They include major external radial routes, major internal radial routes, major cross-town or circumferential routes and arterial connectors. Group B streets are traffic distributors associated with the primary regional street system. Group B streets include central business district traffic distribution streets, interchange/bridge connections, and streets that provide access to important traffic generators. All other streets that do not meet these criteria are considered to be local and collector streets.

According to the Public Works Department, the Regional Street system consists of approximately 1,700 lane kilometres of pavement, and the Local Streets system is comprised of about 5,000 lane kilometres of pavement.

The pavement inventory should include the following information:

- the location, roadway class, length, width, and area of the pavement section;
- the date of original construction and the dates of subsequent rehabilitation treatments(to the extent possible); and
- a description of the original pavement structure and subsequent pavement preservation treatments.

Pavement Segments

Segments identify the pavement inventory. Segmenting is the identification of sections of streets or a street with a uniform surface condition (appearance) meeting certain functional criteria. A segment has the same frequency of visible distresses throughout its length. The same rehabilitation or maintenance is generally applied to the segment identified. The primary purpose of segmenting is to identify streets or portions of streets where the surface condition is the same and where the treatments required and maintenance costs are consistent throughout. With a homogeneous segment established, major work is planned well ahead of time and budgets are determined with some degree of accuracy. Proper segmenting is vital to the integrity of the entire condition based budgetary process. The *Surface Condition Manual* contains guidance on how to manage the pavement segment process. The segments are assigned a Segment ID number that allows them to be entered into the VEMAX and GIS databases.

As the result of our audit work, we found that the pavement inventory in VEMAX Asset Register Pro is not complete. The pavement inventory does include

- the location, roadway class, length, width, and area of the pavement section;
- the date of original construction and the dates of subsequent rehabilitation treatments (to the extent possible);and
- a description of the original pavement structure and subsequent pavement preservation treatments.

However, the pavement inventory does not include segments for streets constructed since 2002. Currently, the omission of this data is not critical, but it does mean that some decisions will be made without complete information on pavement condition. It will also result in the understatement of the replacement value of the roadway and bridges infrastructure assets. This omission is a result of a key position, GIS Technician, being vacant for the last two years, resulting in an inability to issue new segment identification numbers. The condition ratings have been performed for these unidentified segments, and they are in a file awaiting a segment ID so they may be entered into the VEMAX application.

We also reviewed procedures around re-segmenting. This occurs when a segment is changed. The original segment is deleted from the database and the new segments are assigned new segment IDs. This is a result of major maintenance or rehabilitation work being performed on portion a of an existing segment and not the whole segment. Because one of the segmenting rules specifies that it must be in approximately the same condition, it would be inaccurate to reclassify an entire segment with an upgraded rating when only a portion of the segment was in fact

upgraded. We were informed that this affects less than 5% of the total segment inventory and that Public Works is working towards totally eliminating the practice as it makes it difficult to track performance on specific segments. The lack of formal procedures on segmenting and re-segmenting and the loss of the GIS technician who was responsible for updating the databases with new segments has led to the GIS and VEMAX databases being inconsistent. We found a discrepancy between the number of segments in the GIS database and the VEMAX Asset Register Pro database. We noted 88 out of 6942 segments (1.27%) were included in the GIS database but not in the VEMAX Register Pro database. The completeness and accuracy of pavement inventory is important to ensuring that maintenance decisions achieve full value for maintenance funds spent.

Although Public Works collects a lot of data on pavement, the Department does not report on the change in the Pavement inventory from year to year. It would be valuable to report on the change in quantity of assets (i.e. lane kilometres) year to year and compare this to the changes in maintenance and capital budget to determine if the level of funding is at least keeping up with inflation and the growth in the asset base. Information in this form would provide more complete information for Councillors to base policy and budget decisions on.

Public Works needs to implement controls to ensure the accuracy and completeness of the pavement inventory data. Procedures for updating inventory records in VEMAX and GEO Media should be developed. Procedures, such as having a standard form that authorizes changes and/ or additions to the inventory data by documenting the date, what the nature of the change is, the reason for the change and who authorized it, would provide the necessary backup to ensure only authorized changes are being made to the system. The differences between the GIS/ GEO Media systems database and the VEMAX Asset Register Pro should be followed up and corrected and steps should be taken to periodically reconcile the two databases.

Recommendation 3

a) We recommend that procedures for updating inventory records in VEMAX and GEO Media be developed. This includes the reconciliation of the two databases.

Management response

The Public Works Department agrees with this recommendation, and the procedures will be formalized. Details to follow in the Asset Management Audit Implementation Plan.

b) We also recommend the Department develop the capacity to perform the function of the GIS Technician in the event that the position becomes vacant to ensure the maintenance of the pavement inventory information.

Management response

The Public Works Department agrees with this recommendation. We are currently developing a password-protected application to enable the Pavement Management Analyst to perform segment and inventory changes. The application will be able to create new segments as well as retire old ones. The GIS technician will still process new inventory.

Currently, GIS training is being provided to other technologists in the Engineering Division, but this recommendation will be further investigated as part of Recommendation #27 – overall succession planning in the Streets Maintenance and Engineering Divisions. Details to follow in the Asset Management Audit Implementation Plan.

Knowledge of Physical Condition of Assets - Condition Assessment

A comprehensive knowledge of the condition of the assets owned is an essential component of any asset management program and is necessary to

make informed asset management decisions. The condition of pavement is assessed for each segment in the system. Assessment of General Condition includes

- identification of localized defects such as joint spalling, faulting, slab failures and heaved/ depressed utilities;
- curb condition;
- drainage; and
- profile.

The Department divides the City into three regions: North, South and East. For 2002 and 2003, the Department rated the condition of 100% of the roadway inventory. For 2004, staff began to evaluate the City on a rotational basis, one region per year, starting with the South. This will ensure that every three years the Department will have performed a surface condition assessment of 100% of the City's roadway inventory.

The Department has established practices, processes and guidance to ensure that the surface condition rating information that is collected and recorded is complete, accurate and timely. Some of the key controls include the following:

- A Surface Condition Rating Manual has been developed to provide guidance.
- A Standardized Surface Condition Rating worksheet is being used.
- Student Raters are trained and evaluated before they complete any surface condition rating worksheets.
- Student raters work in teams of two to ensure there is consensus on their ratings.
- Student raters are paired with different raters periodically to ensure consistency of ratings throughout the City.
- The evaluation of the student raters quality of work is done periodically and feedback is provided to help correct any deficiencies.
- The Pavement Management Analyst supervises the work of the student raters.
- The Pavement Management Analyst verifies 100% of the surface condition ratings.
- Pavement Management Analyst performs exception testing on surface condition ratings after the data has been entered into the Asset Registry Pro in VEMAX.

Maintaining Information on the Roadway Condition

Our audit testing revealed that the Surface Condition Worksheets are not always updated with changes made as a result of the review by the Pavement Management Analyst. Instead, the changes are made directly into the VEMAX Asset Register Pro database. There are also no written procedures about how changes are to be made to the data in VEMAX and GIS. This could lead to unauthorized changes or mistakes going undetected. This can also result in confusion over which rating (the one in VEMAX or the one on the worksheet) is the correct rating. We also noted computational errors on the worksheets. These did not result in significant changes in the condition rating of the segment, but they do serve to undermine the quality of the data being collected and reported. We also found that some key processes are manual. The completion of Surface Condition Rating Worksheets and updating the system for new development construction, maintenance, reconstruction and rehabilitation work are all done manually. Automating the Condition Rating worksheet could reduce the chances of computational errors if certain data fields (e.g. General Condition Rating, Exit Vehicle Distress Rating for Cracking and Spalling) were calculated automatically. Automating the information collection and transfer for new development work should also be explored. There may exist an opportunity to link the collection of this information and the updating of VEMAX Asset Register Pro records through the new GEO Media system.

Condition Rating Criteria

The condition rating criteria used to evaluate pavement can vary considerably between municipalities as the criteria that affect roadways condition and their relative weighting vary due to climate and other environmental differences. We compared the criteria used by the City of Winnipeg to

those used in Edmonton. Edmonton uses the APWA PAVER rating system, which is a widely accepted surface condition rating system developed by the American Public Works Association. We noted that PAVER includes more than twice as many criteria than does the City of Winnipeg. The APWA PAVER model breaks down cracking and spalling characteristics into more defined categories than the City of Winnipeg model. At the same time, the City of Winnipeg looks at a wider breadth of criteria, including drainage and curb condition as a part of their rating. Public Works management identified two main reasons for the differences:

1. Public Works does not have sufficient budgeted resources to evaluate more criteria; and
2. The criteria used are the best indicators of surface condition for the City based on the knowledge and experience of Public Works staff and the expertise of VEMAX representatives.

The completeness and accuracy of condition ratings for the pavement inventory is critical to ensuring the effectiveness of the Asset Management System. From our review of the Training Manual, we noted that most criteria are adequately defined with the exception of the general rating category. Presently there is no formal definition of what constitutes “New”, “Good”, “Fair” and “Poor” in the Training Manual. We were later provided working definitions that guide the raters and are used in the VEMAX software. The lack of formally documenting the general condition ratings can lead to inconsistencies in the general ratings from student rater to student rater, affecting the accuracy of the condition rating data.

Reliance on Pavement Management Analyst

We also observed that the Pavement Management Analyst is solely responsible for maintaining the inventory and condition ratings on the VEMAX Asset Register Pro module. He is also solely responsible for maintaining the VEMAX PPT module and the data that is contained and generated by it. This reliance on one person, with no credible back-up, exposes Public Works to a significant risk with respect to being able to continue with the program on a timely basis in the event of this key person’s departure. This is compounded by the lack of documentation of the processes and procedures. Without adequate documentation on where and how ratings were arrived at, there is very little back-up in the event of the loss of the electronic data or the Pavement Management Analyst. This loss of knowledge could result in significant disruption in the use of pavement condition information while the department restored the data or trained a new Pavement Management Analyst.

Recommendation 4

a) We recommend that Public Works Department automate, to the extent possible, the collection and transfer of condition information to the Pavement Inventory Database.

Management response

The Public Works Department agrees with this recommendation. This is a work in progress. We will detail our progress and ongoing plan in the Asset Management Audit Implementation Plan.

b) We recommend that the Public Works Department include definitions of “New”, “Good” “Fair” and “Poor” for the General rating of a pavement segment in the Training Manual.

Management response

The Public Works Department agrees with this recommendation, and is currently working on these definitions. We will include the revised definitions in the Asset Management Audit Implementation Plan.

c) We recommend that the Public Works Department endeavour to cross-train a second person with respect to the duties and responsibilities of the Pavement Management Analyst.

Management response

The Public Works Department agrees with this recommendation. This recommendation

will be implemented as part of Recommendation #27 – overall succession planning in the Streets Maintenance and Engineering Divisions. Details to follow in the Asset Management Audit Implementation Plan.

Knowledge of Asset Performance and Reliability

Understanding "why" some pavements perform better than others is key to building and maintaining a cost-effective roadway system. Public Works needs to be able to determine what the past performance of the pavements were and what the current and predicted performance of the pavement will be in order to determine the most effective and efficient course of action in managing the roadway assets. Many variables influence the performance and reliability of the roadway system assets, including climate, construction material properties, pavement structure, traffic, age and current condition of asset. Currently, Public Works has not collected enough years of condition data to reliably predict the performance and reliability of the roadway and bridge assets based on historical data. The Department is currently using standard deterioration curves based on pavement types, road classifications and current condition to predict the performance and reliability of the infrastructure assets. These deterioration curves were developed in consultation with industry experts and experienced Public Works staff and were designed to reflect the local conditions. Public Works staff, as part of the condition ratings process, compare the actual condition ratings to what was predicted by the system to determine the accuracy of the deterioration curve. Adjustments are made to the deterioration curves, where necessary, to reflect the actual data. The process of revising the deterioration curves is iterative, and Public Works expects to improve on the accuracy of the curves as they collect more years of data. However, the process is not documented adequately. No standard forms are used to document and authorize changes. There is a risk that errors or unauthorized changes can be made to the deterioration curve without being detected.

Knowledge of the performance and reliability of physical treatments is also a key component of an asset management program. Public Works has used the same process of estimating the extent to which the treatment extends the current deterioration curve of the segment, through consultation with experts. The Department has recently begun to track the effectiveness of treatments but currently does not have enough years of data to support the prediction of the effects of the physical treatments on the extension of life of the pavement segments.

Recommendation 5

a) Public works should document the revision process for pavement deterioration curves.

Management response

The Public Works Department agrees with this recommendation, however the processes are currently under revision and documentation is on-going. More information to follow in the Asset Management Audit Implementation Plan.

Knowledge of Asset Utilization and Capacity

We found that the Engineering Division does not include traffic data in the Geo Media system. Currently the pavement database (VEMAX) does not include traffic data (e.g. estimated annual average daily traffic and the percentage of commercial vehicles) or capacity information. This information is collected and tracked by the Public Works Transportation Division for most regional streets and on a more global basis for local streets, but the information is not linked to Geo Media or VEMAX. The Engineering Division must request this information from the Transportation Division. When resources are available, the Engineering Division has indicated that it intends to include this information in the Geo Media and VEMAX databases. Staff informally consider traffic data when prioritizing asset maintenance and construction projects based on their knowledge of the particular roadway. Currently, the Engineering Division obtains

traffic data from the Transportation Division for the streets that are identified as candidates for major reconstruction. This is done to design the roadway with the appropriate specifications to accommodate the traffic flow and to plan for minimizing the effect of the construction on the flow of traffic. The collection and inclusion of traffic data in the Geo Media and VEMAX databases would help to better predict the deterioration of a segment as significant changes in the volume and vehicle type that use the roadway impact the rate of deterioration of the pavement. The Engineering Division should concentrate its efforts on including traffic data relating to regional streets in the Geo Media and VEMAX databases since it is estimated that the regional street system carries 80% of all vehicle traffic.

Recommendation 6

We recommend that the Engineering Division secure and record traffic data and capacity information for the regional streets in the Geo Media and VEMAX databases.

Management response

The Public Works Department agrees with this recommendation. On our Regional street system, traffic is a major factor in physical deterioration and we need to ultimately link our deterioration curves to traffic usage, in order to better project intervention points.

In addition, where available, capacity information could be linked through GEO Media, providing a measure of functionality of the street system.

We will review the opportunities for this connection and provide our progress and ongoing plan in our Asset Management Audit Implementation Plan.

Knowledge of Asset Value

Knowing the value of infrastructure assets is important because it bears a direct relationship to the cost of providing current services and provides a basis for estimating maintenance and replacement costs over the long term. The issues of current and future affordability and financial sustainability of infrastructure must be a major focal point in the decision-making process.

Several methods have been used to establish the value of municipal infrastructure assets. The two main methods are historical cost and replacement cost.

Historical Cost

The main advantage of historical cost is that it is a reliable measure. It represents the actual transactions and events that took place at the time of construction of the asset. Historical cost has been generally accepted by accounting standard setters around the world; it is well understood, and is still the preferred method of accounting for all capital assets. Public Works does have some records of the historical cost of the assets but they are not easily retrievable, reliable or complete. The records are kept in separate files (paper) and the information on actual costs may only go back to 1990. As well, the files may not include all the information on the treatments and upgrades applied over the life of the asset. The Department planned to compile this information and enter it into the GIS system; however, the process required significant staff resources to complete and the cost of collecting, verifying and entering this data into the GIS system was determined to exceed the usefulness of this data. From a public sector perspective, it has been argued that using historical cost is meaningless, given the long life characteristics of infrastructure assets. In addition, because infrastructure assets need to be replaced on an ongoing basis, many are of the view that the costs of using infrastructure assets should be based upon its current cost (replacement cost), rather than an allocation of its original cost. Therefore, and especially for long-lived infrastructure assets, historical cost may not be the most relevant information for decision makers.

Public Works should determine if compiling the historical costs of the current roadway

and bridge infrastructure will be required to meet future external financial reporting requirements before it completely abandons the project. If the information will be required the Department should consult with Corporate Finance on how to best proceed given the limitations on the historical cost information available.

On a go forward basis, historical costs for each segment should be tracked and recorded in the VEMAX and/or GEO Media systems to help with the valuation of the roadway and bridge asset inventory for accounting purposes.

Replacement Cost

For the purposes of renewal planning, replacement cost is generally the preferred method of quantifying the value of an asset. Public Works uses the replacement value to estimate the value of the roadway and bridge asset inventory. The replacement value is determined by estimating the re-construction costs of the current inventory based on current specifications, methods, construction and materials costs. For regional and local streets it is easier to estimate a per lane kilometre cost based on the type of construction material, but for bridges a separate estimate for each bridge has to be performed to reflect the unique design and requirements of each bridge. The current estimated costs are the same costs that are used for the capital budget estimates and are based on current project cost information. The Department plans to update this estimate every three years as the process is very time consuming and the changes in the value of the inventory should not change significantly from year to year. However, the change in value from year to year would be valuable in determining the budget for maintenance costs, because the maintenance budget should be increased to reflect changes in inventory value. As well, establishing a method of accounting for the cost of infrastructure assets is required before the City can recognize the cost of use of the assets (depreciation). There are developments in local government accounting standards that will likely require municipalities to report on the cost and use of the infrastructure assets in their annual financial statements. (The preferred cost basis to report in the financial statements is historical cost but replacement cost is seen as an acceptable alternative). This requirement has already gained support in the United States. We also note that Edmonton already reports on the replacement value of its assets annually.

Public Works has performed an asset valuation based on replacement costs for 2000 and 2003. The total replacement value of Public Works' Bridges and Roadway infrastructure assets was $5,275,060,550 (2003 $'s) in 2000 and $4,862,000,000 (2003 $'s) in 2003. This shows a decrease in the replacement value of $413,060,050 over this period of time. This is contrary to what would normally be expected (i.e. an increase in the replacement value) given the new infrastructure associated with the growth of existing and new residential developments and the inflationary effects on construction costs. This anomaly is mainly due to the fact that the inventory data of the infrastructure assets is getting more accurate. The figures in 2000 involved more estimates than the 2003 inventory figures that were almost entirely based on actual measurements.

A major risk associated with infrastructure assets in the public sector, both from a management and a citizen point of view, is the issue of replacement. Information about replacement should be given to decision makers. Maintaining the service capacity of the roadway system is at the heart of asset management. The City of Winnipeg should endeavour to provide this information on an annual basis and report it in a manner that year-to-year comparisons can be made.

Recommendation 7

a) Public Works, in consultation with Corporate Finance, should determine what method of valuation and costing of the existing roadway and bridge infrastructure will be required to meet future external financial reporting requirements. On a go forward basis, historical costs for each segment should be tracked and recorded in the VEMAX and/or GEO Media systems to help with the valuation of the roadway and bridge asset inventory for accounting purposes.

Management response

The Public Works Department agrees with this recommendation. Details to follow in the Asset Management Audit Implementation Plan.

b) The replacement cost for each segment should be recorded in the VEMAX and/or GEO Media system to assist with timely reporting of this information and to provide more complete information in the optimization calculations. Public Works should also endeavour to provide this information on an annual basis and report it in a manner that year-to-year comparisons can be made.

Management response

The Public Works Department agrees with this recommendation. Details to follow in the Asset Management Audit Implementation Plan.

c) The Department should also establish a method of recognizing the cost of use (depreciation) of the Roadway and Bridges infrastructure.

Management response

The Public Works Department agrees with this recommendation. Details to follow in the Asset Management Audit Implementation Plan.

Determining the Work to be Done

Municipal infrastructure decision making is not only about the allocation of scarce resources, it is also knowing when to intervene in an asset's life cycle to maximize economic return. The best practice is to treat the right road at the right time with the right treatment. This approach requires more funding than is available to most municipalities but is the long-term lowest cost approach.

Identification and Prioritization of Needs

Stagnant revenue growth and a growing demand for maintaining and expanding the quality of municipal infrastructure have placed enormous strain on municipalities to develop methods for prioritizing infrastructure asset investment alternatives. Decision-makers at the municipal level are constantly engaged in comparing alternative courses of action. In the context of limited funding, it is crucial that priorities are established both objectively and relative to municipal and corporate policy objectives. To do this, the decision-making process and the models that support it must be rational. An infrastructure asset management plan is an excellent method by which the prioritization of asset management alternatives can be objectively assessed while being correlated with strategic policy objectives.

It is important to develop a financial plan that demonstrates how revenues will cover the projected costs for infrastructure asset management including renewal. It is also important to project renewal costs over at least one life cycle of the asset so that a financial plan can be developed that anticipates any projected increases in cost.

Sustainable development has been defined as "meeting the needs of the present generation without compromising the ability of future generations to meet their own needs" (*InfraGuide*, 2003b). An asset management plan should identify a financial plan to sustain the assets. The financial plan should ensure that resources are available to rehabilitate and ultimately replace the assets at the optimum time to achieve the lowest life cycle cost. This requires that the potential for unintended costs be consistently monitored.

Asset Management Plan

Multi-year planning improves engineering and economic decision making, because it enables the City to evaluate the long-term impacts of accelerating or postponing projects from one year to another, to evaluate the trade-offs between lower-cost treatments that have to be paid for now versus costlier treatment that will need to be paid for later and the impact of diverting funds to preventive maintenance.

Considering the costs and benefits of preservation-oriented investment strategies in the context of other investment options is particularly important because the City's roadway system has matured and is now deteriorating in response to usage and environmental factors. Preservation can be defined as a customer-focused program of activities to provide and maintain serviceable roadways. The goal of infrastructure preservation is to cost-effectively and efficiently improve asset performance as measured by attributes such as availability, surface condition, safety, and service life.

Infrastructure preservation programs represent a departure from traditional approaches to infrastructure maintenance in which deficiencies are addressed first. Preservation seeks to reduce the rate of deterioration. Over the long run, the preservation approach is less time consuming and costly than the traditional, reactive approach. However, a strategy of preservation may be more difficult to justify

because the public expectation is that the worst roads receive attention first. As well, the public often considers pavement preservation treatments as fixing something that isn't broken. It is incumbent upon the Department to demonstrate how preservation in the long run will result in lower costs and better road conditions.

An asset management plan must also include a financial plan to sustain the assets. The financial plan should ensure that resources are available to rehabilitate and ultimately replace the assets at the optimum time to achieve the lowest life cycle cost. The asset management system acquired by the Public Works Department has the capability to produce reports that answer the following questions:

- What funding is required in future years to achieve target levels of service?
- What will be the future condition of the network given projected funding levels?
- How much additional funding will be required in the future to compensate for budget cuts?
- How will the condition of the pavement network change if funds are diverted to preventive maintenance?

Public Works has started to develop a comprehensive five-year asset management plan for the roadway and bridges infrastructure. At this time, long-term plans are in the process of being established and the plan is to use the asset management system to help develop the optimal long-term plan for roadways. Public Works does know the capital budget that has been allocated to the Department for the next five years. Using this information and the asset management system, management should develop answers to these questions and provide this information to Council.

Recommendation 8

Public Works should continue developing the asset management optimization model and use the optimization capabilities of the system to develop a long-term asset management plan that outlines the needs and priorities as well as the implications of not adequately funding these needs and priorities. This information should be presented to Council to facilitate decisions about priorities and funding.

Management response

The Public Works Department agrees with this recommendation. Details to follow in the Asset Management Audit Implementation Plan.

Selection of the Optimal List of Projects

The Public Works Department is using an asset management model to guide its decision-making (see Appendix 6 for a full description). In determining the work to be done, the Department must consider the asset features and evaluate the asset condition and asset use to determine what physical treatment options can be applied to preserve the asset features and condition and provide the desired level of service.

The Public Works Asset Management Model



Life Cycle Cost Analysis

When developing the optimal list of projects, it is important to evaluate potential projects based on the costs incurred over the life of the project. One of the recommendations in the *Strategic Infrastructure Reinvestment Policy* (SIRP) report of May 1998 was "that all capital programs for new or rehabilitated infrastructure be subjected to life cycle costing analysis to determine the most cost effective options for consideration". This recommendation was to be phased in over a three-year period where, at the third year, life cycle cost analysis would be considered for all capital projects.

The life cycle cost analysis (LCCA) technique is a widely accepted and useful project evaluation tool. Simply stated, LCCA is an evaluation of costs incurred by the City and the user over the life of the project. It allows the analyst to conduct comparative analysis between and among various alternatives. Comprehensive LCCA includes all the economic variables essential to the evaluation: user costs such as delay and safety costs associated with maintenance and rehabilitation projects, capital cost, and life-cycle maintenance costs. Despite its acceptance, it currently is not applied in many cities. This is because there are some significant impediments to implementing engineering economic analysis in general. The main concerns surrounding implementation of LCCA by cities focus on the following technical issues:

- selecting an appropriate discount rate;
- quantifying user costs;
- securing credible supporting data, including traffic data;
- projecting costs and transportation demand throughout the analysis period;
- estimating salvage value and useful life;
- estimating maintenance costs and effectiveness; and
- modeling asset deterioration.

Typically, there are several alternatives for renewal of a roadway system and each alternative could produce a different service life and different capital cost. The life cycle costs (including renewal cost, future maintenance costs, and future renewal costs) as well as social costs for each alternative need to be estimated to identify the preferred alternative.

Public Works is currently in the initial stages of implementing life cycle cost analysis as a project evaluation tool. The asset management system used for roadways in

Public Works is called VEMAX Performance Prediction Technology (PPT). VEMAX (PPT) assists with the identification and prioritization of needs. The VEMAX asset management optimization model has the capability to select an optimal project list. Public Works has addressed some of the technical issues noted above but has not addressed others. Public Works has developed estimates for renewal costs, future maintenance costs and future renewal costs based on the collective experience and advice from experts from VEMAX. This information is input into the VEMAX Performance Prediction Model software and is used in the optimization modeling that is performed. As part of the implementation of the VEMAX PPT asset management model, Public Works is modeling asset deterioration and the effect of treatments on the useful life of the assets. Public Works revises its model based on information gathered about the actual costs of maintenance and rehabilitation and the actual extension of service life as a result of these treatments. This information is entered into the system as cost information and the deterioration curves are modified to take into account the actual results achieved. Both are essential components in determining the optimal solution with respect to what maintenance and renewal work needs to be done and when it needs to be done. Public Works also projects travel demand and is able to secure credible supporting data such as traffic data from their Transportation Division. In addition, Public Works is currently required to project all maintenance costs over the life of all large projects that require approval from Council. However, Public Works has not applied a discount rate when calculating future maintenance costs over the life of the assets. They have also not quantified user costs nor have they estimated the salvage value of their roadways when calculating costs over the life of a project.

Implementing a preservation strategy for roadways and bridges works best when Councillors, senior administrators, Public Works managers and the public fully understand the cost-effectiveness and return on investment from such a strategy. The use of tools such as life cycle cost analysis is one way to demonstrate this. Results from such analysis have the potential to show that implementation of a preservation strategy may cost less over the life of an asset than the traditional “worst first’ approach that waits until the deficiencies are evident.

Recommendation 9

We recommend that Public Works continue their work on implementing life cycle cost analysis as a project evaluation tool and address the technical items noted above to fully implement life cycle cost analysis. Life cycle cost analysis should be carried out on all capital programs for new or rehabilitated infrastructure.

Management response

The Public Works Department agrees with this recommendation, especially since it is consistent with the mandate provided by the Strategic Infrastructure Reinvestment Policy Report (SIRP), adopted by Council in 1998.

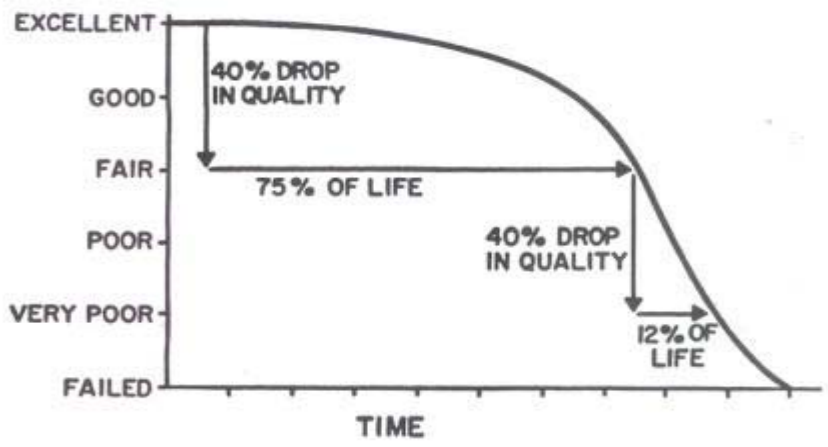
This feature will evolve with the on-going with maturation of AM systems & processes. We will provide a further analysis with details in the Asset Management Audit Implementation Plan.

Deterioration Modeling

An important feature of multi-year prioritization analysis is its ability to predict the condition of the roadway into the future. A “Deterioration Curve” is a model of how the condition of segments that belong to a Pavement Class will deteriorate over time (on average). With a Deterioration Curve defined for a Pavement Class, individual road segments can be compared to the curve to determine performance and life expectancy. The deterioration models are required to perform life cycle cost analyses, which take into account the maintenance and rehabilitation costs that a roadway requires over its design life. Sufficient data is required for the department to be able to utilize the deterioration models and to

prioritize and optimize the choice of treatments for a given budget or given level of service. The deterioration curves are most accurate when they are developed from local historical data. Deterioration modeling starts with the condition assessment from previous years as well as the present year. If there is sufficient data, a model of how the roadway deteriorates over time can be provided. The deterioration model makes it possible to predict the roadway's condition into the future. This ability is important to the analysis because a roadway that is predicted to deteriorate at a faster rate should be given priority for maintenance over an element predicted to have normal wear. The deterioration models can be used as part of the analyses system, to perform "what if" scenarios on the system, predicting the performance of the roadways into the future under a variety of treatment schemes.

Typical deterioration curve for a pavement



Source: Michigan Department of Transportation

* Deterioration curve presented for illustration purposes only. The figures used are not necessarily representative of actual deterioration curves used by the City of Winnipeg.

Public Works established a panel of external and internal experts to develop an initial set of deterioration curves for both regional and local streets based on the following:

- traffic use;
- traffic mix (trucks, buses, etc);
- condition of pavement;
- structural integrity of the roadway;
- climate/environment; and
- age of the roadway;

The initial deterioration curves were used to estimate the service life of a street as if no maintenance work had been carried out on it. Deterioration curves were also developed based on the maintenance work that had been carried out on a street. Depending on when and which treatments are applied, the life of the asset is extended and the curve is moved further out. Curves were developed to determine how much the life of the asset would be extended by applying the specific treatment at a specific time. To achieve the lowest cost in the long run it is necessary to determine the work or projects that should be undertaken at a specific point in time in the life of a roadway or at a specific condition state. To assist in this determination, some municipalities have established "trigger values". Trigger values

are usually associated with specific pavement preservation treatments (such as sealing cracks in asphalt and concrete pavement or sealing joints in concrete pavement) and are related to the need to apply a preservation treatment at the right time to be effective, or before the pavement reaches a condition where a different, more expensive treatment, would be required.

Trigger values have been established in Hamilton and, to a lesser degree, in Edmonton. Hamilton has developed very specific trigger values based on their measure of the Overall Condition Index (50% Surface Condition Index + 50% Ride Comfort Index). They have established trigger values for both rehabilitation and reconstruction based on the functional class of the roadway. Edmonton's trigger values are based on a Pavement Quality Index. (PQI is a composite score derived from an amalgamation of the surface distress, road roughness, and structural adequacy ratings.) The trigger value for major arterial roads is 5.0 and for all other roads 4.5. This difference reflects the increased risk that accompanies higher speeds and traffic volumes. Public Works management advised us that they are working towards developing trigger values that are specific to the City of Winnipeg. The primary reason given for the delay in establishing trigger values is the lack of staff resources.

The Public Works Department is currently using the deterioration models to determine their needs for the purpose of calculating the infrastructure deficit for roads and bridges. Deterioration curves are not being used, however, to determine what work should be done. The Department should, as soon as sufficient data is available, utilize the deterioration models to prioritize and optimize the choice of treatments for a given budget or a given level of service.

Recommendation 10

We recommend that Public Works establish trigger values specific to the City of Winnipeg. We also recommend that the Department should, as soon as sufficient data is available, utilize the deterioration models to prioritize and optimize the projects identified in the asset management plan.

Management response

The Public Works Department agrees with this recommendation. However, we feel it should be noted that, for preventative maintenance work this is precisely how our pavement rating system was developed. That is, the threshold measurements for all of our pavement distress severities and extents – ***except for*** *General Condition – are based upon the thresholds for current maintenance work practices.*

For Capital work, the distresses collected are "binned", and then grouped into condition states, with different condition states requiring different degrees of renewal. At this stage, this method still requires extensive field checking, but as part of the continuing evolution of our asset management systems, we are investigating how the current pavement rating systems can be better used for selection of capital project work. Part of the solution involves improving the definitions of our renewal treatments, so that we can fine-tune the bins and then select the treatments more accurately. We will provide further details of our on-going investigation in the Asset Management Audit Implementation Plan.

Current Method of Selecting Projects

Because of the complexity of multi-year planning procedures, it is often easier for municipalities just starting to implement pavement management systems to use short-term planning and prioritization procedures. Short-term planning does not enable the projection of future network condition. However, it is possible to obtain historical network performance trends. Also, the backlog of projects and the annual change in the backlog can provide an

indication of whether the road system is deteriorating or improving.

It is expected that some projects may not be funded because of limited funding; therefore, the project list needs to be prioritized. There are many ways to prioritize projects. The priority levels, together with roadway classes, already convey basic priorities. It is easier and preferable to prioritize projects that belong to the same priority level and roadway class than to prioritize projects across priority levels and roadway classes. To be credible, the process of identification of needs and prioritization must be consistent, transparent, and logical.

The Public Works Department does separate the work into the regional and local streets categories. Projects are evaluated within the roadway categories. Public Works uses the condition assessment ratings to establish a list of potential projects to develop its project plans.

Selection of Capital Projects

Currently the yearly planning process for capital projects is based primarily on needs. The Department uses the VEMAX system to identify all the fair and poor road segments for both regional and local streets and a list is generated. The streets on the list under consideration are then physically inspected and reviewed by a panel of Public Works Engineering Staff who consider the following criteria when developing the final listing:

- area renewal;
- traffic flow;
- presence of a bus route;
- schools; and
- planned utilities work.

The selection of regional street segments for capital works is based on need with consideration given to the impact on traffic flow. The selection of local streets for capital works is based on allocation of funds to each City Ward based on the percentage of fair and poor segments in the Ward compared to the City as a whole. A list of the recommended segments for inclusion within the capital budget is produced for both regional and local streets.

Streets Maintenance Projects

Streets Maintenance projects include the following maintenance activities:

- thin bituminous overlay;
- gravel road maintenance;
- pothole patching;
- asphalt repair;
- concrete restoration;
- asphalting (primarily on regional streets);
- joint sealing;
- curb repair;
- pavement raising;
- cold planing;
- ditch/culvert maintenance;
- paved alley maintenance;
- railway crossing maintenance; and
- sidewalk maintenance.

Physical treatments may be applied to both local and regional streets. For corrective maintenance related repairs, regional streets, due to their nature, are intended to provide a higher level of service and therefore are attended to as soon as possible.

One of the primary physical treatments for the preservation of local streets is the “Thin Bituminous Overlay (TBO)” program. The condition assessment ratings are used to determine the street segments that qualify for this program. The street segments that are rated in the mid-range fair to mid-range very good, are used as the starting point. Streets must be non-regional, concrete surface, high use collector streets or high use residential streets to be considered for this program. Priority is also given to structurally sound streets that have conditions of fallen crown (drainage), spalling, surface wear and joint deterioration, with generally good grade lines. (All of these accelerate the overall street deterioration and greatly increase maintenance costs if not addressed.) Once the potential streets are identified, a formula

is used to allocate the funds to be spent in each ward based upon the Ward's share of road segments that meet the criteria for TBO treatment. A list of street segments is developed for each ward and the list is reviewed with the Ward Councillor.

The Division also conducts routine maintenance work on all streets. Routine maintenance primarily involves asphalt repair. Road Patcher trucks drive the streets in a particular area and patch potholes and/or road joints that require maintenance work.

For the remaining physical treatments, the selection of street segments for maintenance work is done in one of two ways. The first way is through the identification of a safety concern. Work that is required to keep a street safe is given priority. Safety related repairs are generally identified by Public Works staff or the public through the Department's customer service line. If safety related work is required, it is done as soon as possible. The second way is through the review of the regional and local street segments from the asset management system that are considered to be in good or fair condition. The management of each of the City's three districts uses asset management strategies established by the Division to select street segments and treatments based upon the condition of the street, the funding available and staff abilities.

The development of the short-term plan as described, while practical, is not optimal. The VEMAX asset management system is still under development and is not being used to develop an optimal work plan that can result in efficiencies and lower costs over the long-term. Although reasonable, given the maturity of the VEMAX system, the bulk of the plan (capital) is primarily based on a worst first basis. In addition, much consideration is given to carrying out projects based on a fair distribution of budget dollars to City wards. In a time where resources are insufficient and where many projects need to be carried out within a ward, the overall effect of this is likely minimal. However, if the asset management system is used to its potential to develop an optimal solution for the City overall and more funding becomes available, ward allocations will likely have to be ignored to achieve the optimal solution.

In the future, when the VEMAX system has matured, the Department will be able to consider the entire streets network (for both regional and local streets) and determine how best to allocate the budget (both Capital and Operating) to projects that will enable the City to manage the roadway assets in the most cost-effective manner.

Recommendation 11

We recommend that Public Works continue to develop the VEMAX asset management system and use it to develop the optimal list of projects as soon as possible.

Management response

The Public Works Department agrees with this recommendation. Details to follow in the Asset Management Audit Implementation Plan.

Controlling Costs

The Department should have a management control framework in place to control the costs of managing and maintaining physical assets.

Financial Management

Financial Planning and Budgeting

The Budget is the key communication document in Civic government. Every municipality prepares a budget to preserve pavements, and every municipality has some sort of planning that precedes budgeting. The quality of the planning and budgeting processes has a major impact on the condition of the pavement network and on the life-cycle cost of maintaining it. The link between planning and budgeting is important. Planning should provide the basis for, and substantiation of, the budget. The budget should be based on well-documented pavement preservation needs.

Improved communication with elected officials about the state of the roadway assets and the consequences of asset deterioration and failure is vital in bringing about successful infrastructure investment decision-making. Information that should be reported to Council includes

- the consequences of different budgets in terms of pavement condition;
- specific projects that will not be done because of funding limitations;
- the quantity of unfunded needs (infrastructure deficit); and
- changes in unfunded needs from year to year.

In addition, network performance trends (annual spending per square metre of pavement) should be monitored and reported. Expressing infrastructure needs in a manner that clearly shows the effect of each funding or planning decision allows the Department to substantiate its recommended priorities. It also allows decision makers to evaluate the consequences of their decisions. Providing and communicating measurable outcomes allows municipalities to ensure their funding decisions have the desired effect and, if necessary, gives them leeway to adjust planning goals and priorities.

Council has received several key reports that deal with infrastructure needs including the *Strategic Infrastructure Reinvestment Policy (SIRP)* report, two bi-annual *State of the Infrastructure* reports and the *Financing Infrastructure Preservation, Challenges and Opportunities* report. Council adopted the SIRP report but did not approve the budget to allow for all the approved initiatives to go forward. The *Financing Infrastructure Preservation, Challenges and Opportunities* report outlined funding requirements for infrastructure preservation rather than annualized actual funding levels as well as identified several potential sources of dedicated funding for infrastructure preservation work. In the future, the Department plans to provide an annual *State of the Infrastructure* report and, with the maturity of the asset management system, should be able to provide the information noted above.

In addition, Public Works should be providing Council with analysis of various alternatives and options to assist in its decision making process. Reports should be generated on an annual basis that outline what impacts the current funding decisions will have on the condition of assets, the level of service, and future maintenance and reconstruction requirements and costs. For example, what is the effect on the condition of the roads if the current funding levels are continued? What is the effect, in terms of dollars, of delaying preventative maintenance and what does $1 today translate into ten years from now? Most of

the information to perform this analysis is available, although the reliability of some of it has not been established due to the fact that data has not been collected for a long enough period to accurately predict the deterioration curves specifically for Winnipeg roadways.

One of the purposes of the asset management system is to provide better information to managers, Council and the public to facilitate more informed policy and budget allocation decisions. Public Works should strive to be a leader by providing this level of analysis to decision makers. It is critical that Council know the consequences of the decisions it makes. Without these reports the true impact of funding decisions will not be known.

Recommendation 12

a) We recommend that the Department work towards enabling the Asset Management System to develop reports that

- show the consequences of different budgets in terms of pavement condition;
- list the specific projects that will not be done because of funding limitations; and
- track the quantity of unfunded needs, and changes in unfunded needs, from year to year.

Management response

The Public Works Department agrees with this recommendation. We already do this, to a certain extent; however, we will analyze all Capital and Operating preservation spending and provide details of the analysis in the Asset Management Audit Implementation Plan.

b) In addition, Public Works should be providing Council with sensitivity analysis on the various alternative options available to assist in the decision making process.

Management response

The Public Works Department agrees with this recommendation. As mentioned, we have already done this several times over the years; however, we will produce a format for reporting this on an ongoing basis and provide details in the Asset Management Audit Implementation Plan.

c) Public Works should also work towards providing more long-term information on infrastructure assets to use in determining what will be required to maintain the current level of service over the longer term.

Management response

The Public Works Department agrees with this recommendation. We already do this, to a certain extent; and provide details of the analysis in the Asset Management Audit Implementation Plan.

City Budgeting Process

In an ideal world, infrastructure assets would be funded based upon demonstrated need. In other words, need should drive funding. Unfortunately, few Canadian municipalities have the financial resources to meet their current infrastructure funding needs. Regardless, the establishment of overall infrastructure funding needs is a useful and valuable benchmark even in the absence of the funds required to do the actual work. The budget should be established based on an asset management plan. Information from the asset management plan should be presented to Council at the beginning of the process to allow Council to determine the priorities for the City as a whole each year and to allocate the budget accordingly. Councillors should be presented an “optimized” project listing that includes both the regional and local streets. The selection of projects to be included in the budget should be based on the efficient allocation of resources for different purposes (e.g. infrastructure, preservation, expansion of capacity, environmental protection, and increased safety) and to different assets (e.g. pavements or bridges). The efficient allocation of resources, and the ability to

evaluate the consequences of different budget allocations, is a principal premise of asset management. Any deviation from this "optimal solution" should be analyzed and reported to Council as to its effects on the change to the overall condition of the roadways and the long-term cost to maintain the roadway assets.

Currently the budget process at the City of Winnipeg is top-down. For the operating budget the department is given a target budget number, usually based on the prior year's budget with salaries adjusted for inflation. A general decrease or increase is applied that is usually equally applied to all departments. The Streets Maintenance Division then assigns money to programs within the target budget levels. For the capital budget, a target level is given, usually based on the five-year forecast from the previous year's capital budget. The Engineering Division goes through a process to assign projects within the target levels. Pavement preservation needs, other roadway needs (alleviate traffic congestion, public safety, etc.), and coordination of the streets works with utilities and other City departments are considered in selecting projects once the budget level has been established.

Recommendation 13

Best practices for developing budgets suggest that the asset management plan and an optimized list of projects should be considered prior to establishing priorities and the setting of budget target levels. The information presented to Councillors should include an optimized listing of roadway construction and maintenance projects to be completed throughout the City.

Management response

The Public Works Department agrees that the asset management plan and the optimal list of projects should be considered prior to establishing the priorities and setting budget target levels. It should be noted that constraints such as geographic wards distribution or inter-governmental funding of specific programs or projects may result in deviation from the optimized list. As such, we would need to present the impacts of such deviations on the pavement systems' (Regional and/or Local) levels of service.

Project/ Program Budgeting Process

Capital Budget

The capital project/program budgeting process followed in Public Works is carried out in a logical and methodical manner and is done with an eye to ensuring that projects are completed in the most effective and efficient manner. The Budget Call Letter informs Public Works of the Budget target for the year. The Engineering Division identifies capital projects from a list of streets that meet the criteria for renewal.

The Public Works Department capital budget is broken down into two main categories. The first category is Projects: this consists of larger separately identified capital projects, typically regional roadway renewal or construction, with specific budget amounts attached to the project. Each project is accounted for separately. The budget allocated to a specific project is restricted to that project until the project is closed. Once a project is complete it is closed, and the surplus funds are returned to the General Fund for all City departments to access.

The second category is Programs. The use of Programs was instituted in part to provide more flexibility over the use of capital funds. Programs are more general than Projects and cover areas like Bridge Repair and Local Streets Renewal. In the Program portion of the capital budget, a budget amount is established for the whole program, and this program may involve specifically identified smaller scale projects or may simply identify areas of the City. Public Works attempts to provide a breakdown of the work the Program budget will cover when the information is available, but this is not always done. Typically, the Program budget is broken down into several contracts (e.g. a $10 million program divides the work into ten contracts of $1 million

worth of work) that are tendered out. These contracts are assigned project numbers and the costs associated with each contract are tracked by Public Works in an Excel spreadsheet and by Corporate Finance in the Projects Module of PeopleSoft. Currently, the projects under a Program are accounted for using two methods. One is where the project is allocated a portion of the budget and the costs are tracked according to that budget. The second method involves assigning a project number to the Program with all projects under the Program rolled up for accounting and reporting purposes. In this case, the full program budget is assigned to the parent project number and the other projects under the program have project numbers assigned to them to record the costs but have no budget attached to that specific project. However, to ensure the program budget is not exceeded, the sub-projects are linked to the parent project. This method offers the greatest flexibility within Program reporting. Under the budget for a Program, once a project is completed, the surplus funds, if any, may be used for other projects within the Program and are not returned to the General Fund.

Recommendation 14

We recommend that Public Works allocate program budgets to separate projects with budgets for management purposes. These budgets should be developed when the project is approved and should be monitored throughout the life of the project. This practice will ensure that the Department can determine how effectively projects are managed financially and enables the Department to demonstrate that the program is being run effectively and efficiently.

Management response

The Public Works Department agrees with this recommendation, and we are already working towards this. We will detail our progress and ongoing plan in the Asset Management Audit Implementation Plan.

Operating Budget

The Streets Maintenance Division is responsible for the operating budget relating to roadway maintenance and repair. The operating budget is split into Programs. The Programs are

- Pothole Patching,
- Restoration Concrete,
- Pavement Raising,
- Asphalt Repair,
- Curb Repair,
- Joint Sealing,
- Cold Planing,
- Asphalt Resurfacing,
- Thin Bituminous Overlay (TBO),
- Gravel Road Maintenance,
- Ditch/Culvert Maintenance,
- Paved Alley Maintenance,
- Railway Crossing, and
- Sidewalk Maintenance.

The maintenance budgeting process followed in Public Works is also carried out in a logical and methodical manner. The Budget Call Letter informs Public Works of the budget target for the year. Historically, the program budgets used to be determined based on the previous year's budget (i.e. last year's budget less any general budget adjustments) but, over the past few years, Streets Maintenance has been using a needs based budget process to determine the allocation of budget funds among the different programs. Through this process, they consider the condition ratings of the roadway network and also the outcome of strategy sessions to ensure that their budget accurately reflects the goals and focus of the department. The difference between the needs based budget and the actual budget is captured in a deferred maintenance budget, which is currently only used for departmental purposes. The programs in Streets Maintenance are not broken down into separate projects for accounting purposes in PeopleSoft, but some of the programs are broken down into different projects in order to tender portions of the work out to contractors.

Recommendation 15

We recommend that the Streets Maintenance Division include the Deferred Maintenance budget with the Corporate Budget Submission to inform senior administration and Council of the amount of required maintenance that must be deferred as a result of funding restrictions and the impact that this will have on the condition of the roadways.

Management response

The Public Works Department agrees with this recommendation. Details to follow in the Asset Management Audit Implementation Plan.

Monitoring and Reporting on Financial Performance

Monitoring the Cost of Projects

Capital

Management's primary financial concern is monitoring how the total spending of the Division or the Department compares to the budget. The Department's financial performance on each project does not garner the same amount of attention. Management does receive informal updates of the status of capital projects and, although the information is available in the Projects Module of PeopleSoft, they do not formally monitor the financial performance of projects. The Department does not report to Corporate Finance on a monthly basis on the progress and status of capital projects as required. Council did require that a financial status report be prepared and submitted to the Standing Committee on Fiscal Issues and all members of Council every four months for the Provencher Bridge. However, we found that there is no requirement for the Department to report to Council periodically on all major capital projects (i.e. in excess of $10 million).

The informal reporting with respect to the performance and status of projects is consistent with the culture in the Public Works Department. Management is comfortable with receiving information on projects orally as opposed to a standardized written report. Actual costs are not compared against Council approved budgets as project budgets can be and are routinely changed to accommodate any anticipated overages. The process for making the adjustments to the approved budget is well established and parameters and procedures are set out in the Standard Procedures issued by Corporate Finance. Under the current method of informal reporting, however, there is no evidence of review by management and senior management. This could result in the status of a project not being accurately reported or cost overruns at the end of the project with little opportunity to take action to deal with the causes.

The Department does not routinely perform financial variance analysis on project results. The practice of holding projects open also impacts the timeliness of the evaluation of the financial results achieved on projects. The cost and budget information is tracked in Excel spreadsheets and PeopleSoft and is monitored mainly to ensure budgets are not exceeded. The information relating to project costs is maintained by the Capital Accounting Technician but is only reviewed to ensure that payments do not exceed the budget. We were also advised that the project managers also maintain their own spreadsheets relating to project costs and are not using the Projects Module in PeopleSoft.

Overall, the lack of formal, standardized financial reporting for capital projects and programs makes it difficult to demonstrate or evaluate the financial management of the projects and programs. We were unable to determine the variance between actual costs and the Council approved budget because of the changes made to the project budgets during the term of the projects. As well the practice of holding projects open delays the analysis of the financial results achieved on the project. Because of the restrictions on the use of surplus funds there is a tendency for Public Works to leave projects that are essentially complete

with surplus funds open, thus preserving the surplus funds for use on other department projects that may be over budget. In our review of open projects, we found one project that has been left open for more than ten years.

Streets Maintenance Projects/Programs
The Streets Maintenance Division's focus is ensuring that all the allocated funds are utilized without exceeding the budget. Otherwise, unspent funds are returned to the General Fund and there is a risk of having the next year's budget adjusted downward to reflect the lower level of spending. The main reason that Streets Maintenance Division may be unable to spend the full budget relates to weather conditions rather than a lack of need for maintenance work. Streets Maintenance accumulates costs, which consist primarily of labour and equipment expenses, for the programs through TKMMS and Excel Spreadsheets. The labour and equipment data is compared to Work Activity Guidelines as it is entered daily from daily work records to monitor any negative trends. This analysis is performed on an informal basis and is not documented.

Streets Maintenance does monitor its costs as compared to budget in PeopleSoft for the primary purpose of ensuring that their spending is on target to utilize their budget for each program without exceeding the budget. They do not conduct formal analysis or generate standard reports on the effectiveness or efficiency of the programs. This analysis would consider if they rehabilitated the planned amount of lane kilometres within the budget, what level of improvement to the roadway condition resulted from maintenance work, how in-house costs per maintenance treatment type compare to contracting out the work, etc.

Overall, there is a lot of information in the system (TKMMS and MMS) about actual costs for different types of maintenance work and the expected costs of that work. The main purpose of the Department's analysis of this information is to ensure accuracy of the guidelines to assist with the budgeting of resources and work planning, although this review is not documented. This analysis is performed on an annual basis. This does help ensure that the information used in the optimization model (VEMAX PPT) is accurate. However, there exists a significant opportunity to generate a series of standardized reports on actual performance against the guidelines and budget that is not currently being done on a regular basis. This is due in part to the fact that the collection of the data is fairly new, particularly in relation to linking it to specific procedures performed on specific segments, and staff are reluctant to use these as standard performance measures. Operationally, Streets Maintenance monitors the labour and equipment data being entered into the TKMMS system and ultimately uploaded into PeopleSoft for financial reporting purposes to ensure the accuracy of the data and to identify any negative cost trends. This review is done on an informal and ad-hoc basis.

As the Public Works Department moves to more program-based budgeting because of the flexibility in the allocation and use of budget funds it offers, standardized financial monitoring and reporting requirements need to become more formalized to demonstrate that the Department is completing the work required within the established budget (i.e. ensuring a program funded to rehabilitate a certain amount of lane kilometres of a regional roadway system actually rehabilitates that amount of roadway). This has the benefits of being transparent to Council and the public and providing a solid foundation of information for future managers.

Recommendation 16

a) Public Works should develop a set of standardized reports on financial performance of projects and programs. At a minimum these reports should be produced monthly and should include "actual costs to date", "original budget", "amended budget" and "percent complete". In addition, variance analysis, with explanations for cost overages should be conducted on a regular

basis and be reported to the appropriate level of management. This is becoming increasingly important, since Public Works is moving towards more program-based budgeting rather than project-based budgeting. Public Works and Corporate Finance should continue their efforts at automating this reporting process through the Projects module of PeopleSoft.

Management response

The Public Works Department agrees with this recommendation, and we are already working towards this. We will detail our progress and ongoing plan in the Asset Management Audit Implementation Plan.

b) The Department should establish a process to ensure that projects are closed on a timely basis following completion.

Management response

The Public Works Department agrees with this recommendation, and we are already working towards this. We will detail our progress and ongoing plan in the Asset Management Audit Implementation Plan.

c) The Department should report to the Standing Policy Committee on Fiscal Issues and Council on the financial status of all major capital projects over an established dollar threshold (e.g. $10 million). This process should be similar to the process already established for the Provencher Bridge project.

Management response

The Public Works Department agrees with this recommendation; however this process is already in place for major projects. The change we would implement would be a formal policy or directive of the Department. We will detail our plan in the Asset Management Audit Implementation Plan.

Coordination Practices

All Public Works managers have, at one time or another, been exposed to public complaints about the lack of effective coordination among the organizations that work on the right of way. The problems associated with effective coordination are significant since various components of the infrastructure are installed at different times, with different expected life cycles, differing degrees of maintenance, and management by different staff groups. This presents a significant technical and communication challenge in minimizing cost to maintain and maximizing the value of infrastructure investments. There is little that is more disturbing to the public than to see a significant infrastructure project in progress, and to observe the reinstatement of the pavement surface only to have the entire street dug up again for an entirely different purpose a short time later. While technical explanations for this phenomenon can be offered, the perception of waste and inefficiency in the service delivery of infrastructure works is an inevitable outcome. It is therefore important for the various renewal programs to be coordinated to the maximum extent possible.

There are a wide variety of coordination practices in use among municipalities. Despite the variety, the intent in each municipality's practice was similar: to provide more effective coordination among the various utilities (both internal and external). Some of the benefits relating to improving coordination practices include

- **Reduced costs** – the net effect of improved coordination includes reduced project costs through efficiencies of scale and avoidance of repeat repair costs, primarily in the pavement repair area. Since funding allocations are often made on overall affordability criteria, more efficient use of funding enables more projects to be implemented, thereby reducing the infrastructure deficit.
- **Increased sensitivity of infrastructure managers to considerations in other infrastructure areas** – the inevitable result of many of the improved coordination techniques is improved education, and sensitivity of

infrastructure providers and project managers in one utility area of the needs and considerations in other areas. This, in turn, leads to improved decision making, even before any specific coordination efforts are undertaken.
- **Improved coordination of long-term infrastructure works with development-related works** – this capitalizes on the possible efficiencies and the benefit of having new development works fund some long-term infrastructure priorities.
- **Improved public perception** – poor coordination reduces the public image of infrastructure providers. As public perception is invariably reflected in a local council's attitudes and actions, any improvements in co-coordinating efforts have long-term benefits to all public service providers.

Best practices in Coordination include

- Multi-Year plans
- Formal committees
- Coordination of development-related works

The Public Works Department does employ some practices listed as best practices for capital projects. For example, the Department prepares a 5-year plan and uses the Underground Structures Committee to assist in the coordination of development related and maintenance projects.

Restrictive Practices

Best practices in this area include

- Permit requirements
- No-Cut rules - a moratorium on all excavation within the pavement surface for a specific period of time after a pavement overlay
- Pavement restoration procedures
- Pavement degradation fees - a fee charged to an agency cutting the pavement in addition to the repair cost to account for the reduced service life of the pavement infrastructure as a result of the excavation process

In this regard, the Public Works Department does require permits for work on roadways by utilities and pavement restoration by the utilities and other City departments to restore the pavement to its original condition after their work is complete. The City encourages the utilities to utilize Public Works for this restorative work on a cost recovery basis. This helps ensure the work is done to acceptable standards and is not just a patch job.

The Public Works Department does not believe that "no cut rules" are practical. Therefore, the Department is evaluating the implementation of pavement degradation fees once they have enough data on the effects of utility cuts to support a fixed charge. By providing the necessary incentives and forums these coordination and restrictive practices help to ensure that maintenance and capital programs can be carried out in the most efficient and effective manner.

Utilidors and Trenchless Technology

Utilidors are common trenches where the utilities install the necessary cables and equipment to supply their service to residential and business customers. By using a common trench, the cost of digging the trench is spread out amongst all the utilities and only one portion of the roadway is disturbed when repairs and maintenance work needs to be performed. Trenchless technology is a means by which service lines can be pushed or pulled through the ground to the service site without digging a trench, therefore minimizing the impact on the condition of the roadway surface above, resulting in lower maintenance costs for the roadway and limited disruption to the public. Public Works encourages the use of utilidors and trenchless technology to the extent possible, and where economically feasible.

Public Works undertakes sufficient coordination practices to ensure, to the extent possible that there is minimal work

done that will be affected by other organizations' construction and maintenance activities that will require the repair or reconstruction of recently renewed roads and bridges.

Recommendation 17

We recommend that in the light of the impractical nature of implementing and enforcing no-cut rules, Public Works implement degradation fees that encompass the cost to restore the roadway surface to original condition and the cost in terms of decreased service life of the road segment due to the cut. Public Works should support the amount charged for the degradation fees by empirical evidence from VEMAX to ensure fairness in assessing cost to all parties concerned.

Management response

*The Public Works Department agrees with this recommendation. Such charges **are** allowed by a ruling of the CRTC (Ledcor vs. City of Vancouver). We are currently investigating and will provide details of the analysis in the Asset Management Audit Implementation Plan.*

Project Management

Project management is the art of directing and coordinating human and material resources throughout the life of a project by using management techniques to achieve predetermined objectives of scope, cost, time, quality and participation satisfaction. It is the application of knowledge, skills, tools and techniques to project activities in order to meet or exceed stakeholder needs and expectations from a project. It is a balancing of competing demands, competing stakeholder interests, identified requirements (needs) and unidentified requirements (expectations). The management of construction projects requires knowledge of modern management as well as an understanding of the design and construction process. Construction projects have a specific set of objectives and constraints that have to be considered and addressed at each stage of the project.

Project management needs are changing. Project delivery options such as design/build projects and public-private partnerships are new project delivery options that have to be considered by the City staff and consultants providing project management services in the cost-effective delivery of a capital program. These options have become increasingly popular in the last five years for delivery of large-scale projects. Such options may help resolve financing problems for large-scale, costly projects in order to minimize their impact on the capital program. Technology is also providing solutions to reduced staffing levels and budgets. Computer applications for project management, design, drafting, geographical information systems and records management are allowing organizations to effectively deliver their services.

The Engineering and Streets Maintenance Divisions both utilize a mix of in-house resources and external consultant resources to conduct the work. Some of the areas of Project Management that were identified as risks on the Risk Profile include

- Contract Management
- Construction Contracts
- Project Risk Management
- Supply of Services and Materials
- Impact of the Collective Bargaining Agreement
- Maintaining Reliable and Appropriate Equipment

Contract Management

The Public Works Department uses contractors for a variety of work. The Engineering Division is responsible for all the roadway and bridge capital projects while Streets Maintenance Division is responsible for the maintenance programs including the TBO Program. The Department hires consulting engineers to manage most of the capital projects and some of the major maintenance programs. Engineers within the Engineering and Streets Maintenance Divisions provide the overall project management. The consulting

engineers perform the surveying and ensure the work quality is as specified: essentially, they manage the project from an operational level, serving as the primary liaison between the Department and the construction contractor.

Consulting Engineers
There are many reasons for securing the services of consulting engineers including the following:

- The Department does not have the in-house expertise for the specific project.
- The Department does not have the capacity to accommodate the workload. With a finite construction season, Public Works must conduct multiple projects simultaneously.
- There is a desire to remain flexible. It is easy not to renew a contract; it is more difficult to lay-off staff during slow periods.
- There are cost savings because the workload fluctuates significantly, depending upon the season; it would be too expensive to retain all the staff required during peak periods for the entire year.

The Department employs the direct assignment method for securing the services of the Consulting Engineers. The cost of these services represents a significant portion of the total project cost (14% to 16% of the total project costs depending upon the complexity of the project). The Department does not comply with some of the requirements set out in the new *Materials Management Policy (Administrative Directive No. FM-002)* for contracting for Consultant Services in the following areas:

- The reasons for assigning work to a specific engineering consultant are not documented and kept on file.
- The evaluations of consulting engineers have not been done on a regular and timely basis. The Department has started to evaluate the performance of some of the consulting engineers at the end of the project for the current year. A standard form is being developed to provide a more consistent basis for evaluation and to facilitate aggregating the findings.
- The results of the evaluations are not compiled into a report format summarizing the relative performance of each consulting engineer firm to use as a basis for assigning future projects to the most qualified consulting engineering firm. These reports are an essential component of demonstrating to the public and the consulting engineering community that, in the absence of a competitive bidding process, projects are being assigned based on merit rather than favouritism.

In addition, the fee paid to consulting engineers should be competitive with the market. The Department should consider using a competitive bid process for some projects to ensure that the fee paid on direct assignment is reasonable. They should also compare the fees to other City departments and other municipalities as well as to fee guidelines provided by their respective professional associations (APGEM – Association of Professional Engineers and Geoscientists of the Province of Manitoba). This would add the necessary transparency to the process to demonstrate to the public that they are, in fact, receiving value for their money.

The current practice of direct assignment, without demonstrating that past performance and cost have been adequately considered, exposes the Public Works Department and the City to questions about the fairness of the process for assigning work to consulting engineers and the appropriateness of the fees paid.

Recommendation 18
The Public Works Department should enhance the documentation of the process for assigning work to consulting engineers. This process should include documented formal evaluations of the consulting engineer's work and qualifications and an evaluation of the fee structure that involves a comparison to in-house costs, other

jurisdictions, industry standards and market rates.

Management response

The Public Works Department agrees with this recommendation. A formal evaluation process exists, which needs to be reviewed, updated, and used by all project managers.

We will work with the Water & Waste Department and other affected Departments to further develop the process. This process will include a regular (say, 5 years) update to cost comparisons. We request that the Audit Department assist in the validation of the process. Further details will be provided in the Asset Management Audit Implementation Plan.

General Contractors

The Engineering Division uses general contractors to perform the construction work associated with capital projects. Streets Maintenance Division uses contractors for a variety of work including the work associated with the TBO program, snow clearing, and to supplement Public Works staff for other streets maintenance work. The hiring of general contractors for capital projects is done for the following reasons:

- The Department does not have the in-house expertise.
- Public Works does not have the capacity to accommodate the workload.
- The Department wants to remain flexible.
- There are cost savings. The workload fluctuates significantly, depending on the season; it would be too expensive to retain all the staff required during peak periods for the entire year.
- It would be too expensive for Public Works to purchase the specialized equipment required for major capital works such as asphalting and concrete paving. The construction companies have to make large capital investments in the equipment and, in order to recoup the costs, the equipment has to be utilized on an ongoing basis. Public Works would not be able to utilize all the equipment needed on a continuous basis unless it was hired out for non-City work.

Construction Contracts

The best practices for construction contracts include the following:

- Project and construction management responsibilities are defined.
- Design responsibilities (including performance specifications and express warranties as to the design) are defined.
- Subcontractor considerations or clauses are included.
- Completion date for each stage are established.
- Penalties for delays are used.
- Adherence to workplace health and safety regulations is required.
- Scheduling of work in a manner to pose the least disruption to the public is expected.
- Quality standards are defined.

Public Works employs the best practices in its construction contracts. The Department uses a standard contract or bid opportunity that contains specific clauses:

- Project and construction management responsibilities are defined.
- Design responsibilities (including warranties) are outlined by requiring all design work to be in compliance with the City's Standard Construction Specifications.
- Subcontractor considerations are articulated.
- Substantial completion dates are specified.
- The contractor is required to demonstrate adherence to the Workplace Safety and Health Act and has the responsibilities of a Prime Contractor in accordance with the Act. Additionally, for contracts that exceed $250,000, effective January 1, 2005, the City require bidders to submit independently verified proof of an appropriate safety program in

accordance with the Workplace Safety and Health Act.
- The quality standards are defined and all construction work is required to be in compliance with the City's Standard Construction Specifications.

Standard clauses in the Standard Bid Opportunity could be better enforced and/or clarified:
- Penalties for delays are in the Liquidated Damages clause. Penalties for quality shortfalls are not specifically outlined but are generally covered by stating that the work must be in compliance with the City's Standard Construction Specifications and in the Warranty section. However, Public Works has been reluctant to impose penalties for delays in the past and is just currently starting to impose penalties on a limited basis. The reluctance to impose penalties on contractors for breaching terms of the contract in the past are due to the departmental culture and an associated budget that could accommodate these delays. In the current fiscal environment and with increased public scrutiny, the City can no longer afford to allow contractors to breach performance clauses since it has a direct impact in terms of increased costs and public dissatisfaction. Also, by not enforcing the terms in the contract, the fines associated with these breaches no longer effectively function as a deterrent to this behaviour.
- There are clauses in the Standard Bid Opportunity under the Schedule of Work section that can be used to stage the project in order to ensure the least disruption to the public; however, the clause relating to specifying the staging of the project work is usually only included for major projects. Including the staging of projects to provide the least disruption to traffic and the public should be considered in all contracts to the extent possible.

Recommendation 19

a) We recommend that terms in the contract that help to ensure work is performed in a timely manner be more consistently enforced and that any related fines be imposed and collected. This acts as a deterrent and helps to ensure that contractors operate in an efficient manner.

Management response

The Public Works Department agrees with this recommendation. We will be more widely and consistently exercising our current authority through existing standard contracts.

b) In addition to liquidated damages, Public Works should explore the feasibility of a lane closure charge to ensure contract work is performed in a manner that poses the least disruption to the public and traffic. Reference should be made to other municipalities that have implemented these fees for guidance in setting the amount.

Management response

We will investigate lane closure charges in 2 parts: I – legality & possibility of adding a clause to our own street and bridge renewal contracts; II – utilities' capital projects. For part II, please note that the CRTC ruling (Ledcor vs. the City of Vancouver) disallowed lane rental fees for telecoms; however, the Federation of Canadian Municipalities is appealing this ruling. This ruling, one way or the other, may not apply to lane usage for utility ***work*** *(as opposed to simply the use of space to run the cables), and that would have to be investigated. We will provide further information in the Asset Management Audit Implementation Plan.*

Project Status Reporting

There is little formal reporting on the status of projects. The engineers responsible for managing the projects or programs keep the managers and Department Head apprised of the progress of projects primarily on an

informal oral basis. The current practice provides no evidence of managerial review. Formal reporting on the status is important when assessing the performance of the contractor, project manager and consulting engineer. Formal documentation of project status provides the necessary support to demonstrate to Council, senior management and the public that the work is being adequately managed.

Recommendation 20

We recommend that Public Works develop a set of standard formal reports that clearly outline the status of a project and/or program. This report should be distributed on a monthly basis to management and should include the percentage completion, costs to date against budget, projected completion date, and projected completion costs.

Management response

The Public Works Department agrees with this recommendation. We should be able to incorporate this report into the comprehensive report being developed which will also accommodate #16. Details to follow in the Asset Management Audit Implementation Plan.

Materials and Supplies Contracts

Public Works also uses contracts to purchase materials such as concrete and asphalt. The primary reason for this is that the initial capital investment for concrete and asphalt plants is prohibitive. In order to recoup the investment, Public Works would have to be in competition with the private sector to sell the products to other customers.

The new *Materials Management Policy (Administrative Directive No. FM-002)* outlines the delegations of authority related to procurement and contract administration. There are approval limits for the different types of contracted services, specifically for the supply of consultant services. In general, if a contract is for a supply to the City and is under $5,000, the department head may award the contract with or without the solicitation of competitive offers. For anything over $5,000, the supply must be initiated through the competitive offer process. This includes materials and the services of general contractors and construction companies. The Department Head of Public Works has a special award authority for the contract of supply to the City of up to $2 million.

The process in place for contracting supply of materials and general contractor services is in compliance with the new *Materials Management Policy*. The Department uses the Solicitation of Competitive Offers process to contract for supply. In conducting business this way, and by taking the lowest credible offer, Public Works helps to ensure that the process is, and is perceived to be, fair and that the City is getting the value for its money in securing these supplies of materials and services.

Supply of Services and Materials

One of the risks identified by Public Works management related to the possibility that the demand for contractor resources and materials could exceed the supply, resulting in a supply shortage or significant cost increases. Senior Public Works staff advised us that they have thought about this to some extent but have never had any problems with this issue to date. However, the current climate in the City of Winnipeg appears to be changing as more large construction projects are on the horizon that may have an impact on contractors and suppliers of construction materials. Public Works does not have a formal plan in place to minimize the effects of a shortage of contractor services and supplies.

Although the Department has not developed a formal plan to deal with the shortage of contractor services and supplies, it has developed alternative methods to mitigate the impact. One of the methods that would be used to address this issue would be to specifically invite contractors from other provinces to bid on projects. It is also felt that if there were a problem with a shortage of contractors, the Manitoba Heavy

Construction Association would assist to minimize the effects this would have on the City's road construction program. The Department also recognizes that costs may increase as a result of a shortage of contractors so is careful not to pay more than what Public Works believes is a good value for the work that is conducted. They have, in the past, withdrawn from projects when contractors were in short supply and either waited to do the project at a different time or re-evaluated the project and developed a different design. The methods identified by the Department to deal with contractor shortages are reasonable given the low likelihood of critical shortages in the near future.

Project Risk Management Process

Risk management is a process essential to the successful management and completion of a project. All projects should have risk management activities documented in a systematic manner. Risk management is an integral part of project management and should be thought of as a component of any project management methodology rather than as an independent activity distinct from other project management activities. Not all projects require the same level of risk management because of the differences in size or complexity. All significant projects, however, should include formal, comprehensive risk management activities; smaller, less critical projects may require only a scaled-down risk effort.

Public Works always considers project risks when a project is designed but this is done to varying degrees. In some cases a formal risk analysis is carried out, and in others it is done informally depending on the type and scope of the project. Public Works has carried out a formal risk analysis in the past for some of the recent bridge projects, with the assistance of a consultant, and has developed a project risk management process manual that is currently in draft format. The process they have established uses the *Corporate Risk Framework* and the risk analysis process developed by the Audit Department. In this manual, they intend to include a section explaining when a formal risk analysis should be carried out and when it may be done informally. This will depend upon the size and scope of a particular project. For smaller projects, they intend to recommend the use of a checklist type of risk analysis and, for larger projects, they will use the formal process as described in the draft manual.

Recommendation 21

We recommend that Public Works complete the project risk management process manual and distribute it to all concerned. At a minimum, all projects should have some documentation that indicates that risk management activities were undertaken.

Management response

This is done for major projects now, however the Department agrees that the process needs formalizing for the rest of the programs and projects. We will detail our progress and ongoing plan in the Asset Management Audit Implementation Plan.

Maintaining Reliable and Appropriate Equipment

Streets Maintenance Division identified a risk that there could be an inability to obtain and maintain reliable and appropriate equipment. Streets Maintenance is required to work with Fleet Management Agency to obtain and maintain the equipment they require to carry out their work. Streets Maintenance indicated that since Fleet Management Agency was created and assumed responsibility for supplying equipment for Streets Maintenance the process has been more efficient and effective. Initially Streets Maintenance had some concerns relating to how fees for the use of the equipment were developed. The process was not collaborative and they felt that all issues were not considered when the fees were established. As a result, equipment costs charged to Streets Maintenance have increased and this has had a negative effect on the Streets Maintenance budget. There are currently discussions underway between Fleet Management Agency and Streets Maintenance to address these fee

decisions, which is a positive step to working collaboratively with Fleet Management Agency.

Streets maintenance does not track the amount of down time resulting from equipment breakdowns or unavailability of equipment supplied by Fleet Management Agency. This information would provide a gauge of how well Fleet Management Agency is providing their service. However, overall, Streets Maintenance is satisfied that they are able to obtain and maintain reliable, appropriate equipment in order for them to do their job.

Recommendation 22

Public Works should be evaluating the performance of Fleet Management Agency in providing reliable vehicles and equipment at a reasonable cost.

Management response

The Public Works Department agrees with this recommendation and will work with FMA's other customers to establish and utilize a process for ensuring competitive rates. Details to be provided in the Asset Management Audit Implementation Plan

Quality of Work

The Department, while controlling costs, needs to ensure that work is of appropriate quality.

Quality Standards and Assurance

The two main decision-making concerns during the implementation stage of a project are the selection of construction agents (in-house, contractors) to carry out the work and inspection procedures during construction. Poorly built and maintained roads are both expensive and inconvenient to taxpayers. The service life, future maintenance costs, level of service and user costs are directly related to the quality of work performed on roads. The principle that the delivery of safe and effective roadways is a duty owed to the taxpayer is the basis for a quality assurance program. In order to obtain a reasonable degree of quality assurance for the City, minimum design standards and specifications should be established and enforced. All roadway activities, planning, designing, constructing, and maintaining, should be accomplished to ensure an acceptable level of performance.

Since most local governments have limited resources for inspection, sampling and testing, a quality assurance program must depend upon assistance from many individuals external to the City. Such a program, therefore, must include the activities of consulting engineers who perform construction engineering services, materials testing laboratories, and contractors who perform the actual work. The efforts of all of these participants should be coordinated by a comprehensive set of design standards, specifications, sampling and testing guides, warranties and maintenance standards. However, the existence of these control mechanisms alone is not enough; the City must be sufficiently organized, staffed and trained to ensure compliance on the part of all concerned.

Benefits of Quality Assurance

Quality assurance measures should result in the following benefits to the City of Winnipeg:

- **Greater value for money spent** — Quality assurance should ensure that the public receives the performance for which it has paid. Conversely, quality assurance should identify areas where more quality is being bought than is really needed.
- **Decreased maintenance costs** — It is commonly accepted that roads and bridges that are well built to begin with will not be as expensive to maintain during their service lives.
- **Improved performance** — If designs and specifications are properly prepared and the quality of construction is well controlled then the end product should perform as expected. Service, as an element of performance, includes rideability, traffic capacity, load carrying capacity and safety.
- **Fairness to all concerned** — Quality assurance programs cannot be for the sole benefit of the City of Winnipeg. Developers, contractors, suppliers and consultants all must be able to conduct their business at a fair profit. Everyone should benefit by clearly establishing what is expected, how it will be verified and the consequences of non-compliance. By knowing what the standards are from the beginning, those dealing with City of Winnipeg can afford to do their job right the first time. When too much personal discretion and judgment is allowed for contractors or staff, the Department is open to charges of favouritism and misuse of public funds. Quality assurance establishes clear rules and procedures and provides proven checks and balances.

The Public Works Department has established and made public quality standards that detail the specifications and materials required for roadway construction and maintenance. These specifications apply to all capital projects, new developments, and external and in-house maintenance for roadways, lanes and sidewalks.

Capital Projects, New Developments and Contracted Maintenance

Overall, quality assurance is satisfactory for external and in-house capital projects, new developments and contracted maintenance projects. For capital projects, an engineer from Public Works is assigned to manage each project. The project manager primarily relies on a consulting engineer to be responsible for quality assurance on the project. For the majority of the projects it is an external consultant, but sometimes it is an in-house consulting engineer. The consultant is responsible for on-site inspection of the work. The level of inspection is stated in the consultant agreement and is determined by the type of work performed. The formal inspection process includes a number of inspections at specified times during construction, a final construction acceptance inspection, and a final inspection at the end of the warranty period before the project is officially accepted. During construction, weekly meetings are held with the project team including the project manager and the consultant to discuss the progress of the project and to raise any issues. Minutes of these meetings are taken and are included in the project file. If there were a reason for any work to be done that does not conform to the City's specifications, it would be discussed at these meetings. In addition, testing is done on many of the components of the project and is the responsibility of the consulting engineer. External agencies are hired to perform tests on asphalt, concrete and compaction. The consultant receives the test results and ensures that they meet the required specifications. Documentation relating to the policies and procedures to be followed by the project manager, however, was limited. The Department recognizes this and the project management manuals for capital projects are currently being updated.

For new development construction, a consulting engineer is hired and paid by the developer but works on behalf of the City as required in the contract documents. The consultant ensures that the specifications are met through on-site inspections and testing. A staff member, usually an Engineering Technologist from Public Works, is assigned to oversee the new development and meet weekly with the consulting engineer and by phone when required. At the end of the project, Public Works carries out a final inspection before the project is handed over to the City. The consultant maintains a file containing all the necessary documentation, including all testing relating to the project. The Public Works Department also maintains a file with the necessary documentation relating to the project. Again, the documentation relating to the policies and procedures that are to be followed by the Engineering Technologist assigned to oversee the development was limited. The Engineering Division is in the process of completing documentation relating to the policies and procedures that are required to be followed by the Engineering Technologist.

The various states of completeness of formal guidance on the project management process are a result of divisions not making this a priority. Efforts among all participants in the quality assurance process must be aligned and coordinated. A specific set of guidelines such as documented policies and procedures regarding project management including inspections would assist in this respect. The lack of or limited documentation with regard to the project management process results in inconsistent approaches to the work performed. In addition, the quality of work provided may suffer, resulting in higher maintenance costs over the long-term.

Recommendation 23

We recommend that Public Works complete the documentation of the quality assurance and inspection process and procedures and

include them in the *Project Management Manual.*

Management response

The Public Works Department agrees with this recommendation. Details to follow in the Asset Management Audit Implementation Plan.

Streets Maintenance

Maintenance work carried out on City streets is the responsibility of the Streets Maintenance Division of Public Works. Some of the work is carried out by Streets Maintenance staff, and some is carried out by external contractors. Consulting engineers are hired to manage contracted maintenance work on the TBO program and for curb repair. Public Works relies on the consultants to ensure quality by inspecting the contractors' work according to the City's specifications. However, certain work carried out by contractors, such as joint and crack sealing, is inspected by Public Works. The Public Works inspector is on-site with the contractor's crews on a daily basis. The inspector reviews the work to ensure specifications are being met and also to measure the work completed for payment purposes. The inspector notes his observations in a journal but does not complete a formal inspection report. As a result, formal tracking of quality does not occur and is not documented.

Interviews with Street Maintenance management and staff regarding quality assurance on in-house maintenance work indicated that the quality of maintenance work might not be adequate. A process is in place whereby Asset Management Area Coordinators (AMACs) randomly check to see that the quantity of work, which was entered into the TKMMS system, was reported accurately. However, they do not report on the quality of the work performed. Management relies heavily upon the foremen to ensure the quality of the maintenance work performed. However, a 2003 report entitled *Restoration of Paved Surface Utility Cuts: Quality Assessment Study* indicated that quality standards were not being met. Training was provided to Public Works staff in response to this report, but interviews with management and staff indicated that quality has not significantly improved. We were also advised that no formal inspection process relating to in-house maintenance is in place in Public Works. Senior staff were unable to provide any evidence that the quality of the maintenance work has improved. We were further advised that this division was in the process of developing a formal inspection process, but no solid plans were provided.

The quality of in-house maintenance work is the responsibility of the foremen. We were advised that area supervisors, who are responsible for the foremen, have limited time to ensure that the foremen are doing their job properly. In addition, we were advised that the area supervisors and the foremen are not being held accountable for the work they perform.

The quality assurance process for streets maintenance work needs to be improved. Poor quality maintenance work results in an asset that will not perform as expected and in citizens not receiving full value for their tax dollar.

Recommendation 24

We recommend that the Street Maintenance Division develop a formal quality assurance process that will ensure that maintenance projects are meeting the required specifications. This process must include adequate supervision, inspection, documentation and follow-up if specifications are not met.

Management response

The Public Works Department agrees with this recommendation. With details to follow in the Asset Management Audit Implementation Plan.

Construction Warranties

In addition to quality control and quality assurance procedures, many municipalities use construction warranties. Warranties provide a catch-all provision to ensure basic construction quality. Warranties are

important for pavement preservation treatments where the construction procedures and the selection of materials are difficult to specify and enforce (e.g., for sealing cracks in asphalt concrete pavements and for micro surfacing). Best practices indicate one to three year warranties for “thin” paving work and up to five-year warranties for rehabilitation and reconstruction work.

The principal notion behind warranties is that they motivate the contractor to do a better job if they have an ongoing responsibility for the quality of the work. The contractors are motivated because they do not want to incur the expense of correcting problems during the warranty period. The primary potential benefit of warranties for municipalities is higher quality with lower costs over the life of the product (life-cycle cost). Warranties also lower the municipality’s risk by providing assurance that the contractor will correct early failures from material or workmanship that may have escaped notice during construction. Warranties also induce a higher concern for quality by contractors, and suppliers of construction materials.

The use of long-term warranties is a common practice in Europe and has been based on providing an end result. Warranties may have a higher initial cost, because contractors may increase their initial bids to include contingency funds for correcting problems during the warranty period. However, warranties may result in lower life-cycle costs than those of traditionally contracted projects because there is an improvement in the quality of the initial project. Some industry experts believe that, in practice, even the initial cost of a warranted contract is comparable to that of a non-warranted contract, allowing the municipality to obtain a warranty at no additional cost.

The warranty clauses used in the General Conditions for the Supply and Delivery of Goods and the Provision of Services and the warranty clauses used in the General Conditions for Contracts both indicate that the contractor warrants that the work will be free from any and all defects or deficiency during the warranty period. The warranty period in both cases is for one year, unless otherwise noted in other sections of the contract.

We reviewed six contracts for the provision of various streets works and four contracts relating to the supply of materials. Warranty clauses were included in nine of the ten contracts. There was no warranty clause included in the tenth contract, but there were penalties built into the contract for non-performance.

The warranties for five of the six contracts, relating to street works, were either two years or one year on asphalt and two years on pavement reconstruction. On the other contract the warranty was for one year. The warranty for the supply of structural steel was for two years, for the supply of Aggregate Material (gravel) one year and for the supply of cement also for one year.

The City of Hamilton indicated that their municipal contracts carry a 24-month maintenance warranty period. The City of Edmonton’s standards documents indicated warranties of 24 months for Transportation and Streets contracts and 12 months for all other contracts excepting public roadway surfacing which are for 24 months.

The construction contracts for roadways provide a catchall provision to ensure basic construction and includes minimum acceptable specifications for materials used in maintenance and construction work. They do not cover, however, an acceptable period of time for development, rehabilitation and reconstruction work. Although Winnipeg’s warranty provisions are in line with Hamilton and Edmonton, one and two year warranties on development, rehabilitation and reconstruction work are not adequate to determine the quality of work that has been provided to the City. It is unlikely that any significant structural or surface problems will develop in the first or second year after a roadway has been constructed. The result of poor workmanship may not show up for several years after the completion of the project.

Poorly constructed roadways will require significant maintenance work and/or rehabilitation or reconstruction earlier than expected. Both result in higher costs to the City in the long term. The *InfraGuide* indicates that best practices suggest five-year warranties for rehabilitation and reconstruction work.

Public Works management advised us that it is difficult to increase warranties when they are similar in other municipalities. Contractors argue that the warranties are in line with other municipalities and have lobbied the politicians in this regard. Nevertheless, we believe that it is in the public interest to pursue this matter further.

Recommendation 25

Public Works should develop a case for a proposed increase to the warranty period for rehabilitation and reconstruction work and present this information to the construction industry and Council with a view to increasing the warranty period.

Management response

The Public Works Department agrees with this recommendation, however, we will be including new construction (development work) in our analysis. Details to follow in the Asset Management Audit Implementation Plan.

Human Resources

Succession Planning

Succession planning establishes a process that recruits employees, develops their skills and abilities, and prepares them for advancement, while retaining them to ensure a return on the organization's training investment. Succession planning involves the following:

- Determining requirements – identify key positions and future direction to support business objectives, considering organizational demographics.
- Identifying characteristics necessary to fill key positions – what skill sets are required now and into the future.
- Assessing internal talent and identifying gaps – identify qualified candidates to fill key positions and identify where gaps exist.
- Developing training/mentor program – provide training to qualified candidates and establish necessary mentor program.
- Measuring results – monitor the effectiveness of the program.

In the past, succession planning typically targeted only key leadership positions. In today's organizations, it is important to include key positions in a variety of job categories. With good succession planning, employees are ready for new leadership roles as the need arises, and when someone leaves, a current employee is ready to take on the challenges of the position. In addition, succession planning can help develop a diverse workforce, by enabling decision makers to look at the future make-up of the organization as a whole.

Because the Department has not made it a priority, there is no formal succession plan for the Department although informal succession planning has taken place. Given that 58% of the Department's staff will be eligible to retire by 2010, the Department and, as a result, the divisions under review may not be able to provide continuity of knowledge and skills in the future.

Recommendation 26

We recommend that the Public Works Department prepare a formal succession plan for the Engineering and Streets Maintenance Divisions.

Management response

The Public Works Department agrees with this recommendation. Details to follow in the Asset Management Audit Implementation Plan.

Training

A sound training development, mentoring and monitoring process should result in improved service provision and quality work.

Effective training-related processes are essential to ensuring that employees have the knowledge, skills, abilities and competencies required for their jobs.

Staff training within the Engineering and Street Maintenance Divisions appears to be adequate. The Safety, Health and Operator Training Branch is tasked with providing extensive equipment operator training to various positions within the Department. Training for supervisors, foremen, and technologists are provided by the Engineering and Streets Maintenance Divisions, Human Resource Development, Red River College and other external agencies. Although, the Safety, Health and Operator Training Branch has begun tracking employee training, the information collected is not complete because not all training that is being provided is being reported to the Branch. As a result, a complete training record is not being maintained for each employee and, as a consequence, the Department does not have all the necessary information about an employee's training record.

Recommendation 27

We recommend that the Public Works Department implement a reporting process so that complete and accurate employee training records are maintained by the Safety, Health and Operator Training Branch of the Public Works Department.

Management response

The Public Works Department agrees with this recommendation. Details to follow in the Asset Management Audit Implementation Plan.

Supervision of Maintenance Work

One of the purposes of supervision is to provide feedback on the performance of work. By monitoring and evaluating an employee's work, a supervisor can ensure that the work is performed according to the job standards. Monitoring of work and work performance is very important as it will provide information that will form the basis of quality control. It involves looking at what work has been done, what needs to be done and how it is being done. Evaluating work and work performance involves the assessment of standards, whether workers have performed, and whether the job or task is worth doing. It will also involve the identification of strong and weak points, encouragement of workers and any identification of training or support needs.

Although an adequate process is in place for supervision by the foremen on in-house maintenance work, it appears that the supervision is not working as it should. The lack of good supervision is linked to poor quality work and has been documented by the department in the report, *Restoration of Paved Surface Utility Cuts Quality Assessment Study (2003)*. We were advised that the Area Supervisors, who are responsible for the supervision of the foremen, have limited time to supervise them. The Foremen are responsible for ensuring that the crews are performing quality work. However, supervisors and foremen are not being held accountable for the lack of quality maintenance work. Although training was provided to address the concerns found in the report, the Division was not able to provide evidence that the quality of work had improved significantly. The impact of poor quality of maintenance construction is that the life of the asset will not perform as expected and, as a result, the citizens will not receive full value for their tax dollar.

Recommendation 28

Street Maintenance Division should ensure that the supervisors and foremen are held accountable for the quality of work performed on in-house maintenance work.

Management response

The Public Works Department agrees with this recommendation. See #25. Details to follow in the Asset Management Audit Implementation Plan.

Impacts on the Public and Staff

Roadway preservation work results in traffic disruption and additional fuel consumption as well as social costs including lost time and business opportunities, noise and air pollution, and other environmental impacts.

The Department needs to minimize the disruption and negative impacts on the public and staff related to work done on the roadway.

Coordination of Street/Lane Closures

All Public Works managers have, at one time or another, received complaints from the public about the lack of effective coordination among the various departments and utilities that restrict access to the right of way to perform preservation and maintenance work. The problems associated with effective coordination are significant as various components of the infrastructure are located at, near, or on the right of way. These assets have various expected service lives and require different physical treatments for maintenance, and are managed by different organizations. This presents a significant communication challenge in minimizing the disruption caused to the community while minimizing the cost of performing preservation and maintenance works.

Major Capital Projects

Public Works, through its Transportation Division, has established an Underground Structures Committee, which is a formal Committee designed to be a forum for review and coordination of roadway construction and maintenance and construction of underground structures by the utilities. This committee meets quarterly, and holds special meetings if necessary to discuss development related projects that are time sensitive.

In general, development related works are guided by *Plan Winnipeg*. For coordination of more specific development related projects the Underground Structures Committee reviews all development plans and distributes the plans to all affected parties (City of Winnipeg departments and the utilities) for their feedback and comments. The feedback is reviewed, discussed and plans are amended as required. These amended plans are then submitted for approval. In addition, Public Works also distributes its detailed project plans to the representatives on the distribution list for their comments and review when detailed plans become available. This process ensures that all affected parties have a chance for input and time to coordinate their activities with planned developments.

Public Works undertakes sufficient coordination practices to ensure, to the extent possible, that there is minimal disruption and wasted effort (i.e. completing work on a road that will be dug up to put in a water main the following year) caused by the construction/maintenance of roads and bridges relating to capital streets projects.

Streets Maintenance

Maintenance work can be divided into two categories: emergency or routine/ scheduled. In the case of emergency maintenance, the public utilities are often faced with re-establishing their services as quickly and efficiently as possible and disruption to traffic usually cannot be avoided. Because of the unpredictability of the time and location of emergency repairs, the coordination of smaller routine maintenance projects and emergency repairs is a more difficult challenge. For scheduled maintenance work, steps can be taken to help minimize the disruption to traffic by providing as much advance notice

as possible. The City's departments along with the public utilities do coordinate their scheduled maintenance projects through the Underground Structures Committee. The committee produces a Composite Construction List (the List). The List is to include all scheduled maintenance projects and the following information: location of the work, description of the work, the consultant and the administrator and an estimated start date and completion date. We reviewed the List and noted that there were many instances (59% of the projects) where the start date and end date were not provided. Having the location and the description of the work is very helpful information and a good starting point for discussions between the parties to coordinate their work; however, the omission of the start dates and completion dates makes it more difficult to use the List as a basis to coordinate projects. Although the process is in place to better coordinate routine maintenance work, problems in coordination arise, in part, because these organizations are trying to conduct their operations in the most efficient manner. There is a reluctance to change a work plan once a job has been scheduled to accommodate the work of other organizations because it may result in idle time for their staff and thus drive up their costs. Due to budget constraints, the focus of most organizations is on cost reduction, with limited consideration given to the effect of the work on traffic disruption.

The City has developed guidelines to coordinate work that affects traffic. The *Manual of Temporary Traffic Control in Work Areas on City Streets* outlines the requirements for temporary traffic control for City streets. It sets out the responsibilities of all City departments, public utilities and construction companies to provide "advance notice" to the Traffic Services Branch and the Customer Services Division Call Centre to enable the coordination of maintenance work affecting regional streets. Although there is a requirement for advance notice for work that will affect traffic on a regional roadway, the notification usually is only provided 24 hours in advance, if it is provided at all. If the work being performed is of an emergency nature, then the department cannot expect any advance notification due to the nature of the problem. However, information on emergency repairs is not always provided to the Traffic Services Branch. The lack of timely communication regarding the maintenance activities being undertaken on the regional streets can lead to significant traffic disruption that could be avoided or mitigated had the Traffic Services Branch been made aware of the situation.

Although better communication is necessary to improve coordination of work, through our discussions with the Department, the issue of who "owns" the right of way was identified as crucial to dealing with street closures. That is, who has the authority to control the work being done on the right of way at a particular time? The Transportation Division within the Public Works Department is responsible for right of way management. The compilation and distribution of information function exists now, but a comprehensive process for coordination of work in the right of way by City Departments, contractors, developers and utilities needs to be developed and implemented. This would require that a coordinator with the authority to control the right of way perform this function through the construction season. The Coordinator would take a proactive approach to obtaining information from the public utilities and City departments and recognize that appropriate notification of work is not always received.

Recommendation 29

We recommend that the Transportation Division develop and implement a comprehensive process for coordination of work in the right of way for City Departments, contractors, developers and utilities. We further recommend that the Department consider establishing a coordinator position to improve the coordination of maintenance work on the regional streets to minimize traffic disruption.

Management response

The Public Works Department agrees with this recommendation; details will follow in the Asset Management Audit Implementation Plan.

Communication of Street/Lane Closures to the Public

Public Works notifies the public of restrictions of use and lane closures affecting regional streets caused by road construction and major planned maintenance works through news releases, publishing information in the newspapers and on their website.

For most routine maintenance work *The Manual of Temporary Traffic Control in Work Areas on City Streets* requires that signs are to be set up just prior to starting the work, which does not provide the public with adequate time to plan alternate routes.

Although the City does have some established procedures and practices for ensuring the public is adequately informed about street and lane closures for the regional streets, the procedures are not always followed. The use of signage, displayed well in advance of planned maintenance on regional roadways (such as 48 hours prior to the work commencing) outlining lane closures would allow drivers adequate time to adjust their routes during construction.

Recommendation 30

We recommend that Public Works ensure that signs be displayed 48 hours prior to any lane closure/restriction of access to the regional streets due to planned maintenance work.

Management response

The Public Works Department agrees with this recommendation ***for planned work****. However, adoption will depend upon nature of project/expected length (time) of closure. We would also add signage at alternate access / egress points ahead of congestion (e.g. first or second major street prior to the closure). Details to follow in the Asset Management Audit Implementation Plan.*

Work Practices

The Department should have established work practices and guidelines for preservation and maintenance work on roads (right of way) that will minimize the impact of the work on the traveling public and businesses. Work practices that minimize the impact on the public and businesses include the following:

- Restrictions on street/lane closures for regional streets during peak hours.
- Continuous Work Process – Once a project is started which disrupts a lane of traffic or access to a business, the work is completed as quickly as possible without disruption. This includes completing required work at night or on the weekends.
- Providing incentives to contractors to complete work on time or imposing lane rental fees. Incentives involve the payment of a bonus to a contractor if they complete work early and a charge if they complete the work late. Lane rental fees are fees charged for taking a lane of traffic out of use during construction or maintenance work. It is primarily used as a mechanism to ensure that contractors or utilities conduct their work in a manner to pose the least disruption to traffic.
- System operation – includes awarding contracts early in the year, staging projects to minimize inconvenience to the traveling public and advancing projects because of new residential and industrial development.

Restrictions on Street/Lane Closures on Regional Streets

The Department has documented guidelines in the *Manual of Temporary Traffic Control in Work Areas on City Streets* that are to be followed regarding work on regional roadways (including bridges). One of the specific requirements is that traffic lanes on regional streets may

only be closed during peak hours for emergencies and long-term construction projects, wherein lane closures have been pre-approved by the Transportation Division. We found that these guidelines were not always followed when maintenance projects were undertaken on regional roadways. Work plans for maintenance projects should include work hour and lane closures restrictions. These restrictions should be followed by staff to ensure minimal disruption to traffic and business during construction and maintenance work. Without adherence to these policies and procedures, the City is unable to ensure that disruption to traffic and businesses is minimized. This can result in the City of Winnipeg receiving public criticism for traffic disruption that could be better managed.

Recommendation 31

We recommend that the work plan for maintenance projects include work hour and lane closure restrictions for work done on regional roadways and that these plans are followed to ensure minimal disruption to traffic and businesses during construction and maintenance work.

Management response

The Public Works Department agrees with this recommendation.
Details to follow in the Asset Management Audit Implementation Plan.

Continuous Work Process

The expectation is that work is to be conducted on all projects on a continuous basis, but some delays do occur due to multi-project work and weather delays. Some of the work practices employed by the utilities and City departments in the pursuit of efficiency can result in additional traffic disruption. There are instances where their work practices involve different teams to complete different tasks (i.e. one crew to do the maintenance work and one to do the clean-up work). The maintenance crew might complete the maintenance work a few days before the clean-up crew is available to patch up the road. The public then sees a lane that is closed with no one working at the site. This results in a negative public perception of the work practices of Public Works and the utilities. The utilities and the City departments have to strike a balance between cost effectiveness and disruption to the public and, in these instances, should employ other practices like covering the excavated portion of the roadway with metal plates in order to allow the lane to be opened until the clean-up crew can perform their duties.

Extended Work Hours

The City does not regularly utilize night work or shift work in order to complete construction in a timelier manner. Public Works performed an analysis for the Standing Policy Committee on Public Works of the viability of working extended work hours or double shifts in order to reduce the disruption to the public by infrastructure construction projects in a report entitled *Accelerating Infrastructure Construction Projects* submitted at the June 25, 2002 meeting. The matter of night work and multiple shifts were explored and, based on the analysis and Public Works recommendation, the Standing Policy Committee on Public Works passed a recommendation stating that “The City of Winnipeg not implement night and evening work on infrastructure construction projects – regional and local streets; sewer and water; bridges and structures – for the reasons articulated in the report.” Some of the reasons cited in the report were:

- Construction work is not permitted between 10:00 p.m. and 7:00 a.m. under Noise By-Law No. 2480/79.
- Undertaking work on major projects overnight does not mean that the street would be fully open to traffic the next day.
- Contractors, engineering consultants, utility companies, material suppliers, etc. do not have the staff resources to undertake work both day and night.
- Work at night has a number of problems relating to the significant investment in lighting plants required, safety of

workers and inability to perform certain tasks (i.e. surveying).
- Costs of night work would be prohibitive (night shift premiums, additional staff and extended hours of operation for material suppliers, equipment suppliers and plants).

The industry has lobbied that there is not enough construction work to justify having two shifts. Working two shifts would just result in the workers being laid off earlier. The industry also indicated that there is not a sufficient supply of skilled labour to accommodate two shifts. The reasons given for adopting the recommendation were clearly laid out, but they should be revisited to ensure that they are still applicable given the change in circumstances relating to increased construction activity in the City and the current economic climate.

We noted that other major cities like Edmonton and Calgary require major construction work to be performed at night on their major arteries and do encourage the working of extended hours and multiple shifts in order to speed up the completion date. The City of Winnipeg encourages contractors to work extended hours, but does not require it.

Recommendation 32
We recommend that the feasibility of working multiple shifts and/or working evenings be re-evaluated. We also recommend that some work practices be revisited to ensure the benefits in terms of efficiencies are not outweighed by the costs in terms of traffic disruption. Alternatives to a total lane closures should be explored.

Management response
The Public Works Department agrees with this recommendation in principle, and this will be considered on major works, but is subject to resource availability and cooperation of the utilities. Details to follow in the Asset Management Audit Implementation Plan.

Contract Incentives/Lane Rentals
Lane rental fees or contract incentives are methods used to help ensure that construction projects come in on time or ahead of time. These are financial incentives that are linked to the freeing up of a traffic lane upon completion of a project or stage or to the completion of a project. The lane rental fees are more of a deterrent for going beyond the completion date since charges are imposed for blocking a lane of traffic past the completion date for major projects or fees are assessed for the lane usage for maintenance work of utilities. Contract incentives are financial rewards that are linked to the early and/or on-time completion of a project. Both of these have the effect of providing an incentive for the project to be completed as early as possible. Public Works currently does not have lane rental fees but is looking into the possibility. We noted that Edmonton does impose lane rental fees. Public Works also does not use contract incentives but instead imposes a penalty in the form of liquidated damages for not meeting completion dates. We noted that Public Works does not assess penalties for liquidated damages very frequently.

Recommendation 33
We recommend that Public Works continue to expand its practice of using contract incentives and penalties. The Department should impose liquidated damages to ensure contracts are completed in an expeditious manner. Public Works should also consider introducing lane closure fees for regional street projects.

Management response
This option is related to #19 and we will explore it further with details to follow in the Asset Management Audit Implementation Plan.

System Operation

Accelerating the Awarding of Contracts
In the report *Accelerating Infrastructure Construction Project*" submitted at the June

25, 2002 Standing Policy Committee on Public Works, the Department recommended "that consistent with the motion of the Executive Policy Committee adopted by Council on December 12, 2001, early program approval, preliminary tendering, design and tender preparation be affected such that a substantial majority of the annual infrastructure construction program may be tendered and awarded during the months of February to May inclusive in each year". This was expected to result in better project scheduling, and less disruption to the public due to road works.

In consultation with the Manitoba Heavy Construction Association, the Consulting Engineers of Manitoba, Water and Waste department and the Public Works Department, a review of the tender preparation and capital program approval process was undertaken (no formal report was provided), and it was noted that tendering the majority of the construction work during the period February 1st to April 30th would better space project construction, minimize disruption to the public and allow for more competitive bidding. The review concluded that City departments would benefit by

- improved scheduling of works on and within the street right-of ways, resulting in less inconvenience to the public;
- better coordination of work;
- more time to assess the impact of road work on sewer and water infrastructure; and
- more time for quality control and technical review of designs and specifications.

We found that Public Works has implemented this recommendation by ensuring that the majority of their capital projects have close dates no later than May 15th.

Staging of Projects

Another method of minimizing traffic disruption is by planned staging of major construction and rehabilitation projects. Staging a project essentially requires breaking a project down into stages, where one stage must be substantially completed before the next stage is begun. Public Works routinely stages projects to ensure they pose the least amount of traffic disruption. Public Works stipulates the progression of work in their contracts when the project is expected to cause a significant disruption to traffic. Contracts will stipulate that a certain section of roadway work must be substantially completed before work on the next section can occur. Even if there is no clause in the contract with respect to staging, Public Works encourages the practice wherever feasible. A major example of staging a project was the work that was performed on Main Street. Public Works planned for this work to span several years with only one direction of lanes being worked on in sequence. They also ensured that the work was completed in stages, where they only closed down small sections of Main Street at a time and completely reconstructed the closed off section leaving the other sections open to traffic alleviating some of the traffic congestion caused by the construction activities. Public Works undertook a pilot project where they formed community committees to help in staging the work on Main Street to cause the least disruption.

Public Works also advances certain projects to take into account other planned major roadway works on adjacent routes and planned residential and industrial development. A few recent examples were the moving ahead by a year of the resurfacing on Waverly Street in anticipation of the increased traffic caused by the construction on the Kenaston underpass. They are planning to advance the construction planned on St. Anne's Road and St. Mary's Road to accommodate the residential development activities in the south-east of Winnipeg.

Public Works' current practices with respect to staging and advancing projects is consistent with best practices, and the Department should continue to utilize these

methods for minimizing the impact of their work on traffic and the public.

Recommendation 34

We recommend that Public Works continue with their current system operation practices to help minimize traffic and business disruption caused by the construction and maintenance of roads and bridges. Due to the significant impact that road construction can have on traffic and business, steps should be taken to formalize these practices into policies and procedures.

Management response

The Public Works Department agrees with this recommendation, and feels that implementation will be covered by the implementation of other recommendations. Details to follow in the Asset Management Audit Implementation Plan.

Employee and Public Safety

Public Works is required to comply with the *Workplace Safety and Health Act*, which has been legislated to protect workers and the public from risks to their safety and health arising out of, or in connection with, activities in workplaces.

The key duties of the employer include

- the provision and maintenance of a workplace, necessary equipment, systems and tools that are safe and without risks to health, so far as is reasonably practicable;
- provision to all workers of such information, instruction, training, supervision and facilities to ensure, so far as is reasonably practicable, the safety, health and welfare at work of all workers;
- ensuring that all workers, and particularly the supervisors and foremen, are acquainted with any safety or health hazards which may be encountered by the workers in the course of their service, and that workers are familiar with the use of all devices or equipment provided for their protection;
- conducting work activities in such a way as to ensure, so far as reasonably practicable, that the public is not exposed to risks to their safety or health arising out of, or in connection with the work activities; and
- ensuring that workers are supervised by a competent, experienced supervisor.

Public Works has a Safety Officer who has the responsibility to see that policies and practices are in place to ensure compliance with the *Workplace Safety and Health Act*.

Public Works holds annual training sessions for all returning and new seasonal employees, and permanent employees are also encouraged to attend. The training session covers such areas as safety standards, some common equipment training and other safety related topics. In addition to this annual training, the Department also has job specific training and holds regular tailgate meetings in which topics of workplace health and safety are discussed in addition to other work related issues. A record of when the tailgate meetings occurred and what topics were discussed is maintained and reviewed by the Safety Officer. Additional safety training is provided on an ad-hoc basis, where deemed necessary from a review of accident reports and statistics.

The Public Works Department uses the Safety Management Program as the guide to their safety program, which includes thirteen elements. Some of the key elements are: a safety statement, hazard assessment, safe work practices and procedures, inspections, accident investigations, training and communication. Audits are conducted every two or three years to determine how the Division or Branch is managing their safety program.

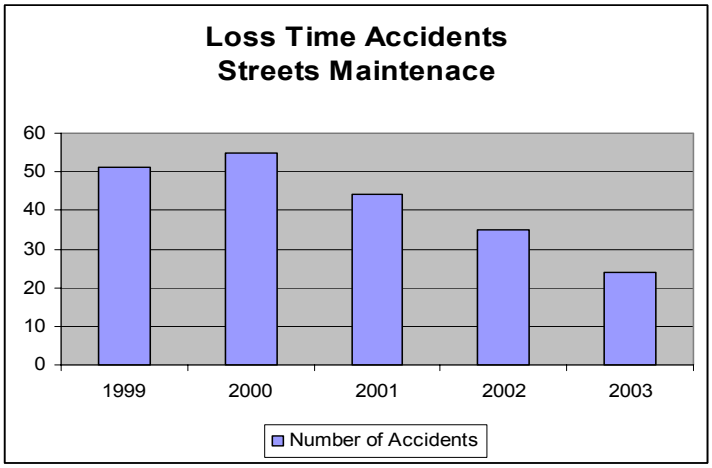
To help ensure the equipment they use is safe, there is a requirement for each operator of equipment to perform a “daily walk around” where the operator inspects the equipment for any visible safety hazards and maintenance issues. In addition to this, all Public Works equipment is maintained by Fleet Management Agency and detailed

maintenance records are kept and are reviewed as part of routine safety inspections, which are performed by the Safety Officer. These safety inspections are carried out on a quarterly basis. Crew inspections are also carried out. The Branch also monitors the safety reporting (i.e. injury reports, lost time reports, etc.) on a monthly basis and investigates causes of accidents if there is a negative trend occurring.

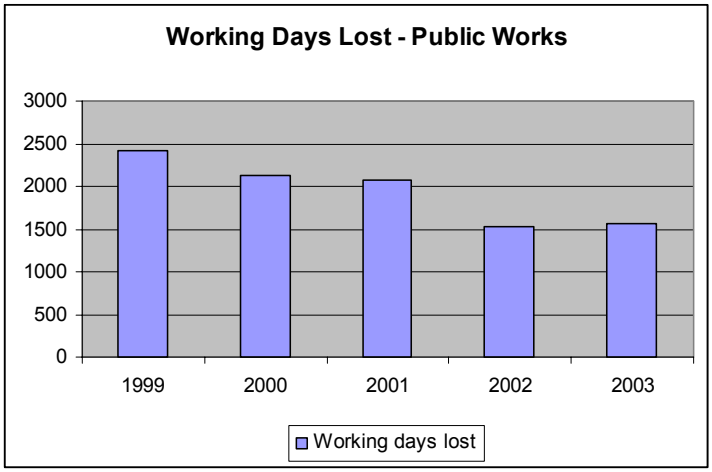
The Department has recognized the need to ensure that contractors hired by the City of Winnipeg are compliant with the Act. The Department has added a clause in the *Standard Bid Opportunity Document* that requires contractors to conduct their work for the City in a manner that is compliant with the *Workplace Safety and Health Act*. Part of this requirement is that the Contractor must have a safety program. To further enhance this requirement, effective January 1, 2005, all bidders on contracts with a value greater than $250,000 must submit verified proof of an appropriate safety program in accordance with *The Workplace Safety and Health Act*. In addition, failure to provide the proof in a satisfactory form within three business days of a request by the City will result in the bidder being determined "not qualified" for the award of the City contract.

The Department inspects contractors for compliance to the Workplace Safety and Health Act on an exception basis, meaning they usually only inspect the contractors they receive complaints against or that are known in the industry to have poor safety records. This is one area where the Workplace Safety and Health practices of the Department need to be improved for Public Works to be in full compliance with the Act, especially for contractors who have been awarded contracts for less than $250,000.

Since the establishment of the Safety Officer position at Public Works, the "loss time accidents" have been reduced by 50% over the period of 1999 to 2003 for the Streets Maintenance Division. A "loss time accident" is defined as an accident that results in a person being away from work 24 hours past the day of the injury.



"Working days lost" is defined as a full workday that cannot be worked due to an injury. The working days lost have decreased by approximately 40% from 1999 to 2003. Due to system limitations, we are not able to report these figures against the change in total hours worked. This is something that the Safety Officer is working on, since it would provide more complete information about the percentage of total time lost due to accidents compared to total hours worked.



Overall, with the exception of the responsibilities with respect to conducting safety audits within the Department and of its contractors, Public Works is undertaking the necessary practices to ensure that it is in compliance with the *Workplace Safety and Health Act*.

Recommendation 35

We recommend that Public Works develop procedures for regularly monitoring

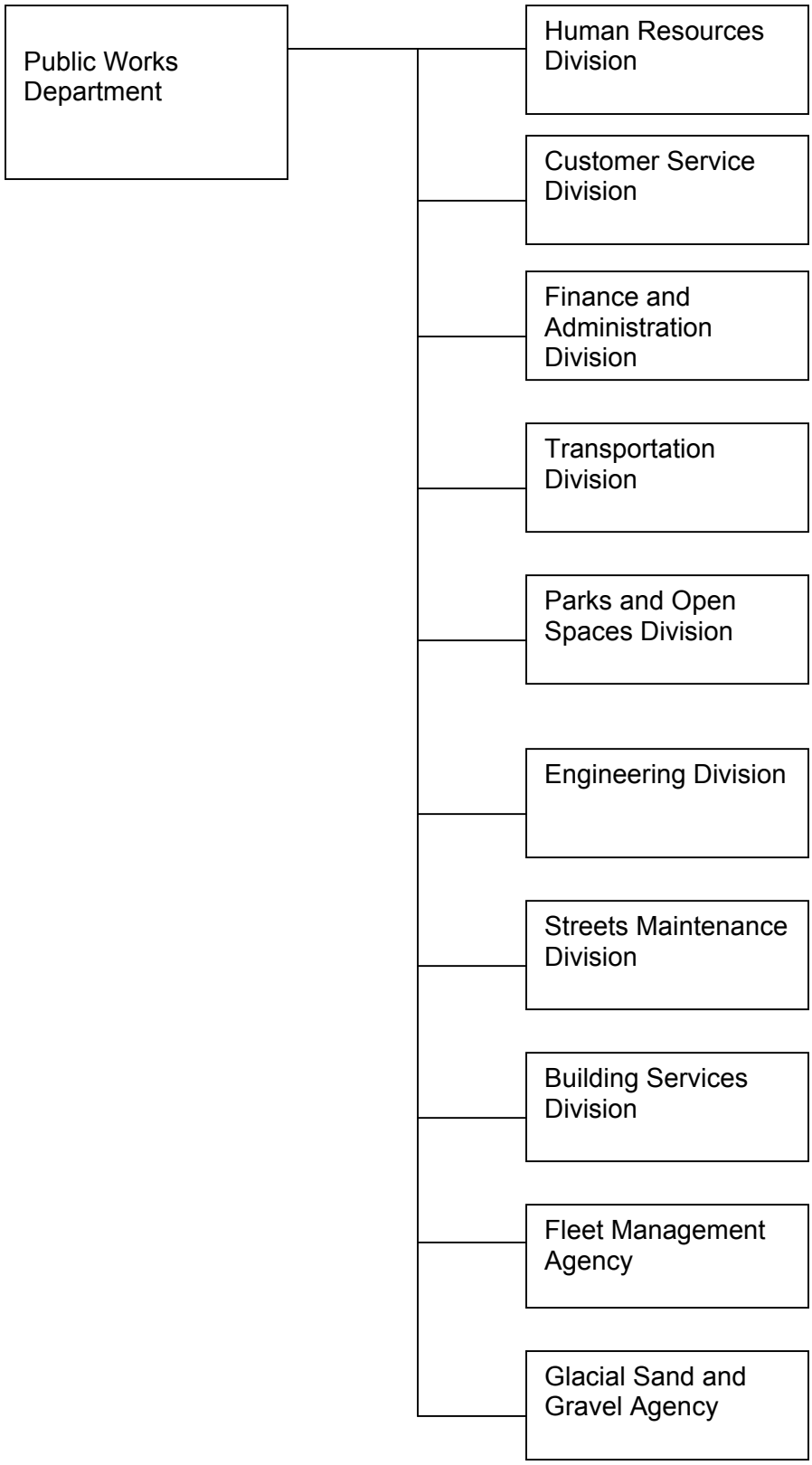
contractors carrying out work for the Public Works Department for their compliance with the *Workplace Safety and Health Act*. This is important, In particular, for contracts under $250,000 where the requirement of “verified” proof of an appropriate safety program is not a contract requirement.

We also recommend that comprehensive safety audits of how the Division or Branch is managing their safety program continue to be performed every three years to ensure compliance with the *Workplace Safety and Health Act*. In addition, we recommend that management should receive an annual report on the Department’s status with respect to the various sections of the Act based on the results of these audits and their regular inspection process. This report should summarize where Public Works is in compliance with the Act and where it is not. For the areas where it is not, specific actions should be identified that will move Public Works towards full compliance.

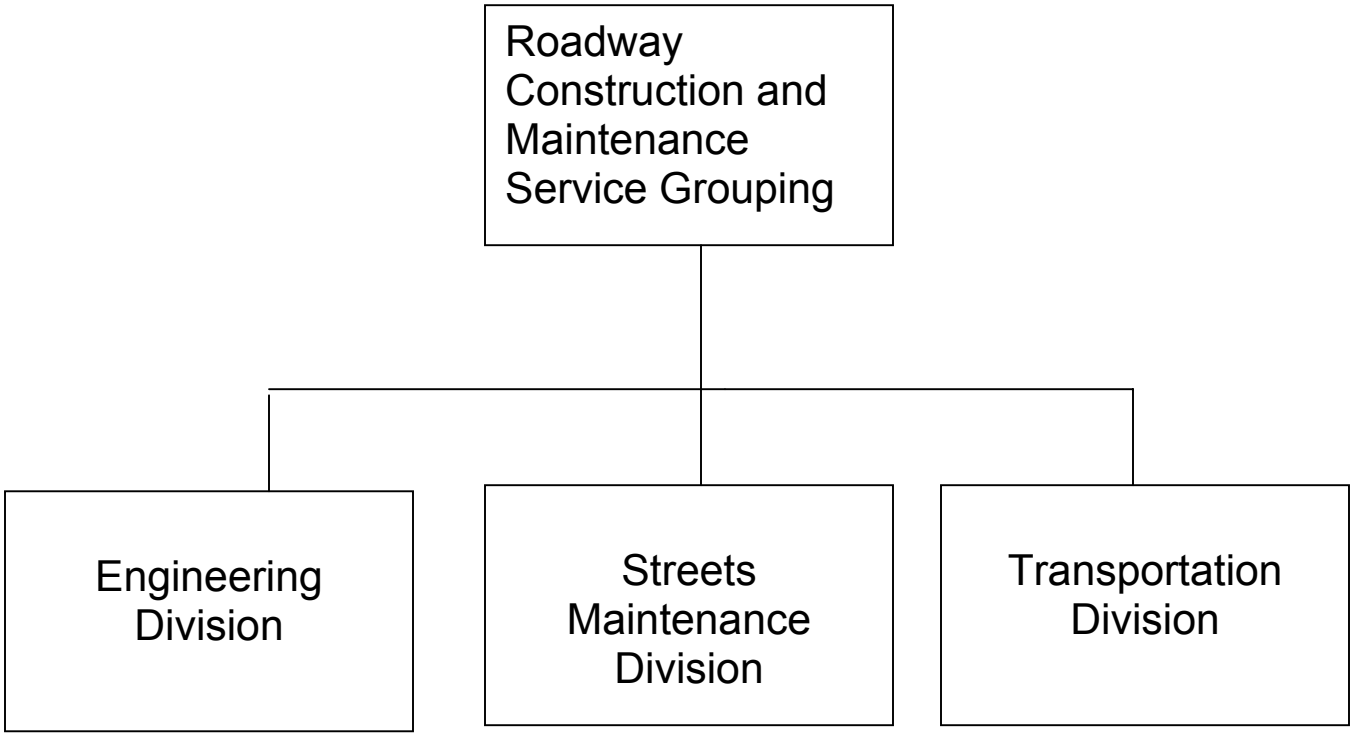
Management response

This is being done internally. Concern is that by doing same for contractor, we are assuming some of their liability as Prime Contractor. Safety compliance is contract compliance; formal status reporting does not necessarily add value.

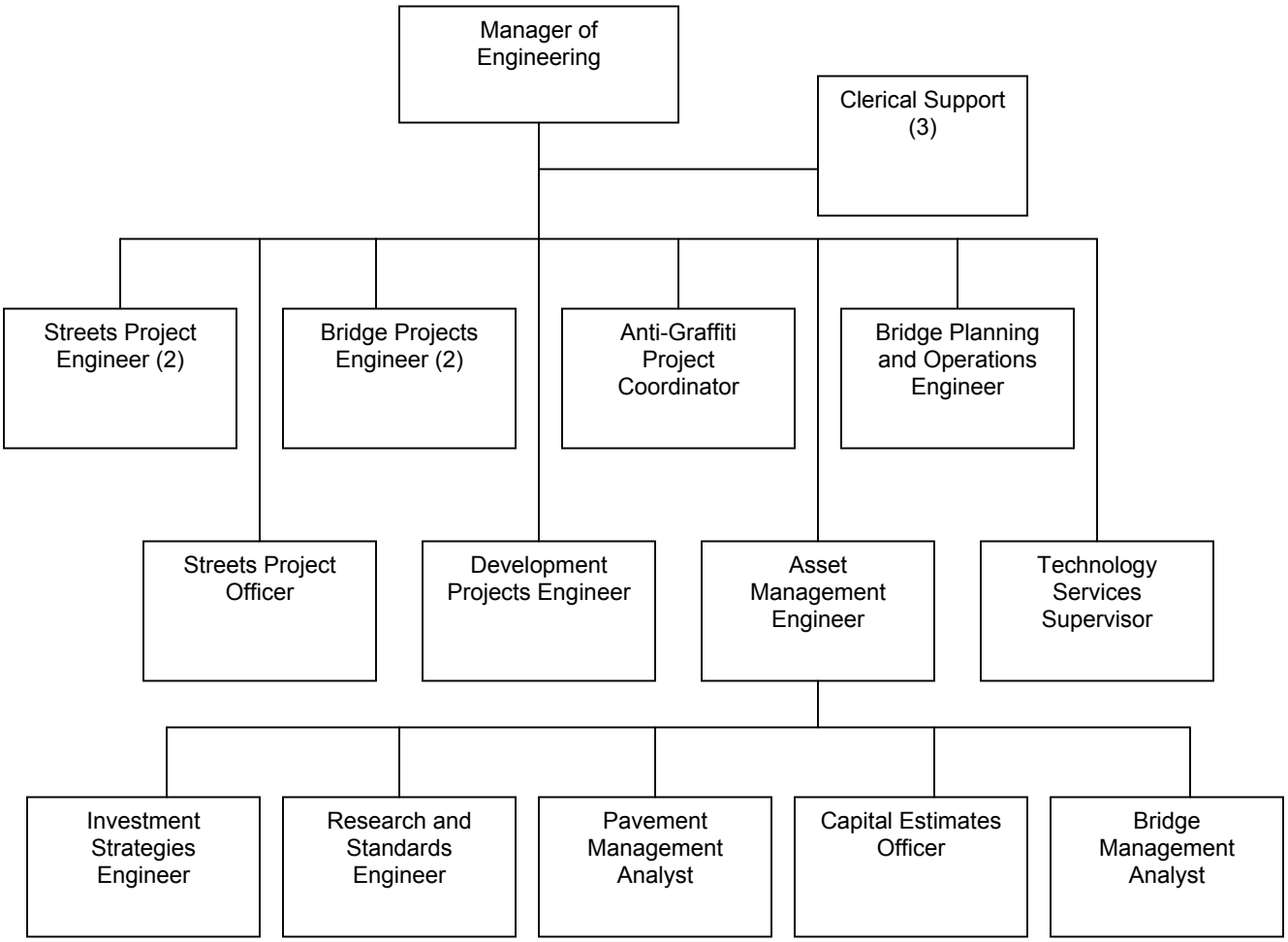
Appendix 1: Organizational Chart for Public Works



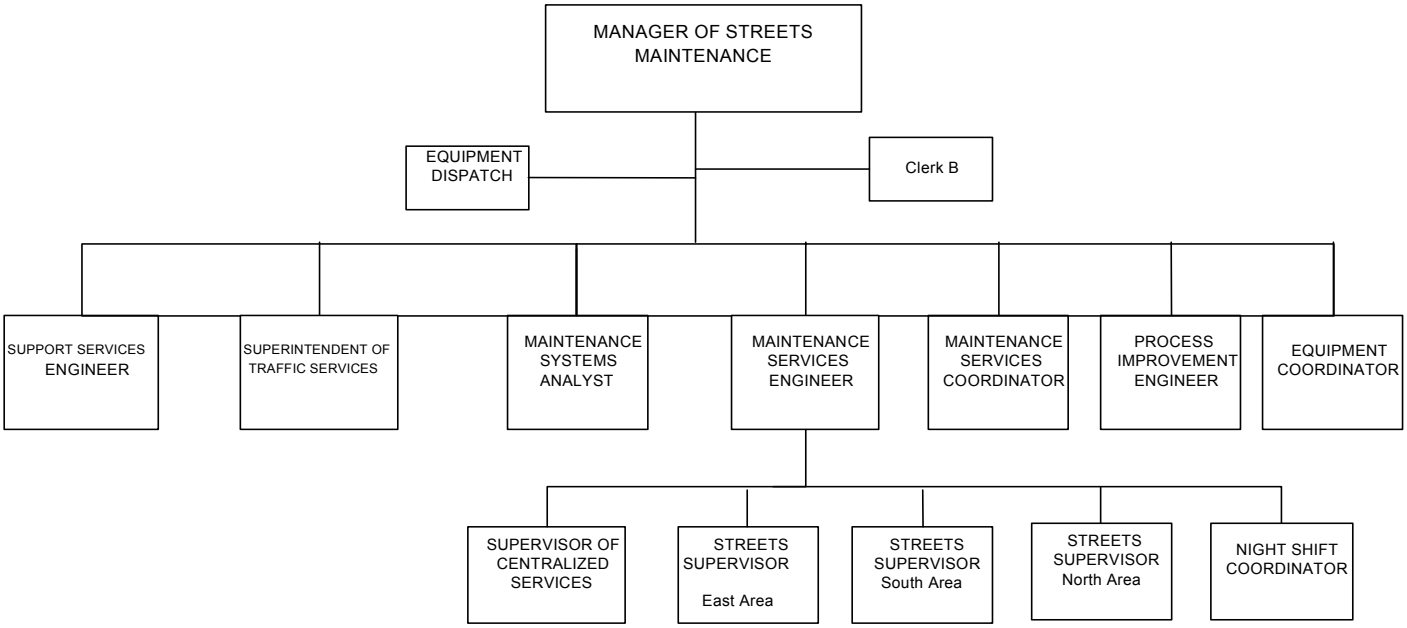
Appendix 2: Divisional Responsibility for Service Groupings



Appendix 3: Organizational Chart for Engineering Division 2003



Appendix 4: Organizational Chart for Streets Maintenance Division



Appendix 5: The Criteria of Control Model

> "*There is no such thing as perfect control and there is no such thing as free control… the challenge is to find the right balance*."—Michael Hammer

Since the objectives of our audit include assessing the adequacy of the control environment, we need to begin by explaining what we mean by control. Until recently, controllership was seen as the responsibility of financial staff, and was largely concerned with sound financial management. Modern controllership is based upon a much broader concept of control. It defines **controls** as all the elements that support the achievement of an organization's business objectives, and **risks** as obstacles that may inhibit or prevent an organization from achieving those objectives. Modern controllership consists of those aspects of management aimed at ensuring the organization is *in control*. The message is that *control is everybody's business.*

Formal or hard controls

- Regulations
- Policies
- Procedures
- Standards
- Direct supervision
- Duty segregation
- Physical security

But these controls alone do not guarantee organizational success. In the absence of a strong organizational culture, hard controls are not enough. Dramatic business failures in recent years have demonstrated that the best systems and processes are no substitute for an ethical workforce with competent leadership and clear objectives, staffed by people of integrity.

Informal or soft controls

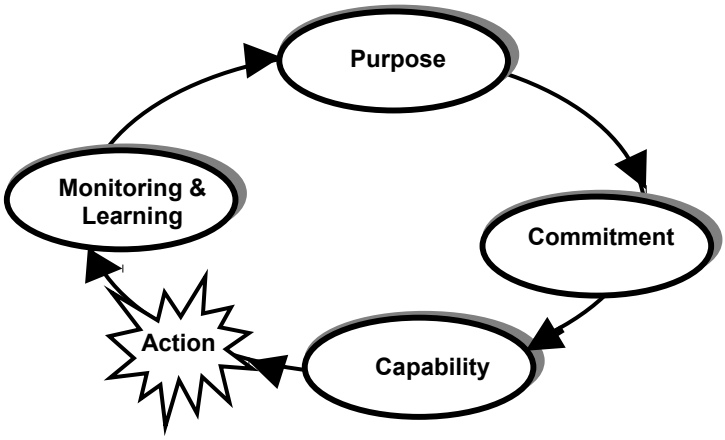
- Ethical values
- Clear objectives
- Leadership
- Competence
- Communication
- Performance measures
- Reward systems

Taken together, the formal and informal controls comprise the main components of a modern management control system.

A *control framework* provides a way of understanding the important elements of control. We used the control framework developed by the Canadian Institute of Chartered Accountants for the purposes of this review. The framework uses the *Criteria of Control (CoCo) Model* that employs twenty criteria and groups these into four essential components of control—*purpose,*

commitment, capability, and *monitoring and learning*. The model suggests that effective control over these components is essential to ensure the achievement of business objectives.

The CoCo Model



These control components are found in successful organizations where people

Have a sense of **purpose**

- They know where they are going and how they want to get there.
- They understand risk and opportunity.

Have **commitment**

- They respect and trust each other.
- They share a common vision and sense of what is right and wrong.
- They understand and accept their responsibilities.

Have **capability**

- They know their jobs and have the right skills, tools and systems to get things done.

Monitor what they do and keep **learning**

- They constantly learn from what they do to make things better.

The C*riteria of Control* in the *CoCo Model* can be used as a basis for understanding control in any organization and for making judgments about the effectiveness of control. The twenty detailed C*riteria of Control* follow.

Detailed Criteria of Control

Purpose

A1 Objectives should be established and communicated.

A2 The significant internal and external risks are faced by an organization in the achievement of its objectives are identified and assessed.

A3 Policies designed to support the achievement of an organization's objectives and the management of its risks should be established, communicated and practiced so that people understand what is expected of them and the scope of their freedom to act.

A4 Plans to guide efforts in achieving the organization's objectives should be established and communicated.

A5 Objectives and related plans should include measurable performance targets and indicators.

Commitment

B1 Shared ethical values, including integrity, should be established communicated and practiced throughout an organization.

B2 Human resource policies and practices are consistent with an organization's ethical values and with the achievement of objectives.

B3 Authority, responsibility and accountability should be clearly defined and consistent with an organization's objectives so that decisions and actions are taken by the appropriate people.

B4 An atmosphere of mutual trust should be fostered to support the flow of information between people and their effective performance toward achieving the organization's objectives.

Capability

C1 People should have the necessary knowledge, skills and tools to support the achievement of an organization's objectives.

C2 Communication processes support the organization's values and the achievement of its objectives.

C3 Sufficient and relevant information should be identified and communicated in a timely manner to enable people to perform their assigned responsibilities.

C4 The decisions and actions of the different parts of the organization should be coordinated.

C5 Control activities should be designed as in integral part of the organization, taking into consideration its objectives, the risks to their achievement, and the inter-relatedness of control elements.

Monitoring and Learning

D1 External and internal environments should be monitored to obtain information that may signal a need to reevaluate an organization's objectives or procedures and processes.

D2 Performance should be monitored against the targets and indicators identified in the organization's objectives and business plans.

D3 The assumptions behind an organization's objectives should be periodically challenged.

D4 Information needs and related information systems are reassessed as objectives change or as reporting deficiencies are identified.

D5 Follow-up procedures should be established and performed to ensure appropriate change or action occurs.

D6 Management should periodically assesses the effectiveness of control in its organization and communicate the results to those to whom it is accountable.

Appendix 6: The Asset Management Model

The Public Works Department is employing the asset management model shown in the figure. The business process for developing and monitoring the strategies for managing the public infrastructure involves assessing each component to develop an initial asset management strategy. Reassessing each component and its ultimate affect on community benefits, the primary asset management goal, will dictate whether or not the strategy is suitable.



Community Benefits – Community benefits are the cornerstone of an effective asset management system. This is why the community owns the asset. We must establish its value to the user through objective community and industry surveys, market research, rigorous economic analyses, and review of government policies.

System Performance – The performance of the asset tells us how well the expected community benefits are being provided. Examples of performance measures include

- Driving comfort (of streets, bicycle paths)
- Structural integrity (of bridges, buildings, streets)
- Building environment
- Visits/usage (of arenas, pools)
- Acceptable travel times (within the transportation system)
- Vehicle operating costs (for roads and bridges)
- Safe roadway travel
- Asset value

If an asset is not performing as expected (by the gauge of community benefits), we must examine why and may have to take corrective action by adjusting either the asset's features, its physical condition, or how it is used.

Asset Features – …are the physical and functional attributes that differentiate one asset class from another. Examples of how asset features can be described include

- *Classification:* major structures vs. pedestrian bridges, office buildings vs. arenas, Regional vs. Local streets…
- *Physical characteristics:* length and width of pavement, square footage of building space, …
- *Functional limitations:* load capacity of bridges and streets, occupancy limits of buildings…

Asset Condition – We must measure and monitor the condition of the asset, and understand the relationship between the condition and the performance measures set out for it. This will allow us to better evaluate what to do with the asset, including physical treatments (e.g. rehabilitation of a roadway) and/or management of use (e.g. reduce traffic, so that physical treatment can be deferred). Condition

can be based on physical parameters, reflecting structural capacity and/or serviceability of the asset, or financial parameters, which reflect the asset's worth to the community.

Asset Use – The current and future demands on the asset provide the basis for projecting changes in condition. Understanding how these demands affect condition guide the decisions and actions required to provide the required level of service for the asset.

Physical Treatments – …the treatment options (preservation strategy) that can be applied to preserve asset features and condition, and provide the desired level of service. Activities for asset preservation include:

- Preventative maintenance
- Routine maintenance
- Safety maintenance
- Rehabilitation
- Reconstruction

Physical treatments also includes calculating the life cycle cost, analyzing benefits versus cost, and implementing best practices when performing the preservation activities.

Management of Use – An asset's performance can be effectively managed to achieve community benefits by

- Strategic land use planning
- Managing its use through regulation or legislation – e.g. parking restrictions
- Managing the use of the existing asset to extend its useful life – e.g. traffic calming, building occupation limits
- Managing demand for use of the asset – e.g. traffic management.

Some examples of how the use of an asset can be managed include

- Temporary load restrictions, designated truck routes, turning restrictions, parking by-laws
- Central control of building systems
- Restricting hours of access to a facility

Asset Management Strategy – An asset management strategy considers economic benefits, funding levels, community service objectives, and sustainable development objectives to present a set of programmed actions for achieving asset performance objectives. We develop our asset management strategies by working through each of the components of the above business process for each asset, and in some cases, for each asset feature. However, only by re-evaluating each component over time, through a comprehensive review and monitoring program, can we ensure that our strategies are the best possible – those that satisfy our ultimate goal of maximizing the benefits to the community.