

**BACKGROUND**

- 6.1** The Department of Transportation and Public Works is responsible for the construction, maintenance and operation of Provincial roads and bridges, including the planning and management of highway projects. The Provincial highway system consists of over 23,000 kilometres of roads and 4,100 bridges. This does not include roads and bridges which are the responsibility of municipalities.
- 6.2** The Department's strategic goals related to highways, as outlined in its 2005-2006 Business Plan, are to enhance the value and safety of the transportation system and to provide infrastructure and related policies necessary to support the economic growth of the Province.
- 6.3** The Department's Highways Branch, which represents approximately 80% of the Department's budget and staff, is comprised of two divisions. The Engineering and Construction Division is responsible for activities related to the highway capital construction program, including planning, engineering design, tendering and construction. The Maintenance and Operations Division undertakes activities such as snow removal, surface repair, asphalt patching, and ditching and graveling. (See Exhibit 6.1). The Province is divided into four districts for highway operations purposes, each served by a district office and multiple field offices.
- 6.4** The Department spent \$163.4 million on major highway and bridge construction and repaving projects in 2005-06, the majority of which were contracted out to private-sector companies. The Department also spent approximately \$58.1 million on highway and bridge maintenance activities.
- 6.5** The average age of pavement on provincial roads is 21 years, compared to the Canadian average of 14 years. A 2001 Department study concluded that Nova Scotia's roads and bridges needed about \$3.4 billion in capital construction work over 10 years (see Exhibit 6.2). While capital spending has increased significantly in recent years, it has not been at the level determined by the study to be necessary to halt the overall deterioration of the Province's highway system (see Exhibit 6.3).
- 6.6** Once a road has been constructed, maintenance and periodic rehabilitation activities are required to preserve the structure. Timing of maintenance and rehabilitation activities is critical to minimize costs. Preventative treatment costs less per kilometer than surface rehabilitation. As a rule of thumb, rehabilitation costs are approximately 50% more when lifecycle preventative maintenance strategies are not employed. If allowed to deteriorate too far, significant expenditures can be required to bring a road back to an acceptable condition. The Department's prioritization strategy is to focus on the worst roads first. This

is a reflection of the high average age of the Province's roads, and that many are beyond the point of preventative maintenance and require surface rehabilitation.

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## RESULTS IN BRIEF

**6.7** The following are the principal observations from this audit.

- The Department has long-range, short-term and annual plans for highway projects. Processes for review and updating of long-range and short-term plans have not been developed.
- The Department has determined that annual funding for capital highway projects is currently not sufficient to meet the Province's long-term highway transportation system needs. Accordingly, the Department has prioritization processes for selecting highway projects. However, processes and information systems used by the Department are not sufficient to ensure that the projects selected will contribute, to the fullest extent possible, toward the accomplishment of the Department's strategic objectives.
- There are regular reporting and monitoring practices for highway projects. However, there are weaknesses in the information and reporting systems which could compromise the security and accuracy of the data collected and reported.
- The Department has an appropriate project management methodology for highway projects. However, we noted instances where the Department's project management methodology was not consistently applied. The Department has developed project review processes which would provide assurance that staff are carrying out their duties and managing highway projects in accordance with the Department's policies. However, no project reviews were performed during the previous year.

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## AUDIT SCOPE

**6.8** In August 2006 we completed a broad scope audit of the planning and management processes for highway projects at the Department of Transportation and Public Works. The audit was conducted in accordance with Section 8 of the Auditor General Act and auditing standards established by the Canadian Institute of Chartered Accountants, and included such tests and procedures as we considered necessary in the circumstances.

**6.9** The objectives for this assignment were to assess:

- the adequacy of long-range and annual planning processes and information in place to ensure highway projects contribute toward accomplishing the Department's strategic objectives;

- the Department's accountability framework and related project performance measurement system for highway projects; and
- the adequacy of project management processes for planning, executing, monitoring and controlling, and completing highway projects.

- 6.10** Our audit focused on processes used for highway projects under the Department's capital program. Accordingly, we did not examine the practices used for smaller highway projects that are considered maintenance in nature, nor activities relating to the operation of the highway system (see Exhibit 6.1). Highway projects included in our audit comprise the roadways and any bridges and overpasses that are part of the road system.
- 6.11** Our audit included interviews with management and staff; review of systems, processes, and policies; examination of other documentation deemed to be relevant; and testing of project files. Criteria were developed to assist in the planning and performance of the assignment.
- 6.12** The criteria used in our examination of the Department's project management practices were derived from the Project Management Institute's *A Guide to the Project Management Body of Knowledge* (PMBOK Guide, Third Edition). The PMBOK Guide documents generally accepted project management knowledge and practices that are applicable to most projects, most of the time. There is widespread consensus about the value and use of these practices. Other criteria used were developed specifically for this assignment. Criteria used in this audit were discussed with senior management of the Department and accepted as appropriate.

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## PRINCIPAL FINDINGS

### Long-range and Annual Planning for Highway Projects

- 6.13** We assessed the Department's long-range and annual planning processes for selecting highway projects. We sought to determine if the planning processes resulted in the selection of highway projects that contribute toward accomplishing the Department's strategic objectives. We reviewed the Department's 2005-06 Business Plan and examined various highway project planning documents and the processes used to develop them. We concluded that the Department's strategic objectives are at such a high level that all highway projects contribute toward their accomplishment. However, we could not conclude on whether the planning processes for prioritizing highway projects ensured that projects selected would contribute to the fullest extent possible toward the Department's strategic objectives. The Department does not have systems in place, such as a pavement management system, to make this determination.
- 6.14** **Long-range plans** - The Department conducted a study in 2001 to determine the funding requirements necessary to maintain and develop the Province's highway system over the following ten years. The study looked at five major program areas:

system expansion, pavement preservation, new paving, gravel road rehabilitation, and bridge rehabilitation and repair. It assessed the needs in those areas for the coming decade and the financial implications, and indicated where priorities should be placed under alternative funding scenarios. The study concluded that about \$3.4 billion in capital construction work over 10 years was needed (see Exhibit 6.2). Detailed information on potential highway projects was developed to support the study. Internal documents supporting the ten-year needs study were updated in 2004-05 for Departmental information purposes.

- 6.15** The Department also developed and documented a Primary Arterial Highway System Vision for 100 series highways. This plan has a long-term focus on expansion of the primary highway system to enhance and support the economic growth of the Province (see Exhibit 6.4). A framework for determining which projects should have priority was developed and is updated periodically.
- 6.16** In January 2005, the Department prepared a draft of a three-year planning document that identifies highway project priorities with expected funding allocations. At the time of our audit, the document had not been finalized. Management intends that the three-year plan be updated annually. However, processes for review and updating have not been put in place. The Department also has planning documents specific to other programs, such as the Steel Truss Bridge Program.

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### **Recommendation 6.1**

**We recommend that processes be established for the review and updating of long-range and shorter-term highway plans on a timely basis to provide for use of current information in the prioritization of road projects.**

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- 6.17** **Annual plans** - The Department develops an annual highway construction program document based on its mid- and long-range plans and other considerations, including availability of funding. The Department receives block funding approval from Executive Council for most of the program components through the tangible capital asset approval process. Other funding is provided through the annual Department budgeting process.
- 6.18** Projects are prioritized through the use of defined and weighted criteria, which vary based on the type of project (see Exhibit 6.5). Information on prospective projects is collected and reviewed by head office management and staff. Projects are balanced across the four districts in order to distribute work in accordance with the location of available resources, considering both Department and contractor resources. Management indicated that recommended projects are presented to the Minister for approval.
- 6.19** Changes may be made to the annual plan during and after the approval process, for a variety of reasons. The Department indicated that procedures have recently been established for documenting changes to the annual plan.

- 6.20** Following approval of the annual highway construction program, and prior to tendering, capital repaving projects may undergo a review process which establishes the rehabilitation approach and methodology to be used and any other special considerations for the project. The review process facilitates the preparation of precise and accurate project tender documents.
- 6.21** Not all eligible projects are reviewed, mainly due to insufficient lead time prior to tendering. In 2004, 32 of 71 eligible projects (45%) were not reviewed. In 2005, 51 of 95 projects (54%) were not reviewed.

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**Recommendation 6.2**

**We recommend the Department establish criteria for determining which repaving projects should undergo a rehabilitation review and have such projects reviewed prior to tendering to ensure the most appropriate and economical rehabilitation measures are used.**

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- 6.22** **Information processes and systems** - The Department gathers information from a variety of sources to develop its annual and longer-range plans, including priority recommendations from its district offices and technical data such as road conditions and traffic volumes. As indicated in paragraph 6.18, staff analyzes and interprets the information and assigns priority to projects based on weighting of relevant factors. However, we noted that the Department does not have the information and systems in place to ensure the most appropriate highway and bridge projects are selected, and that available funding is used to maximize the benefits from investment in highway projects.
- 6.23** The Department recently acquired a bridge management system to maintain inventory, inspection and other data on the Province's bridges. When fully operational, the system is expected to support the selection of priority bridge projects through the use of deterioration and costing models, and the provision of a *health index* for each structure. The system is expected to allow the Department to explore the impact of a range of funding options on the overall state of the bridge inventory and present options for rehabilitation of each structure.
- 6.24** In the 2001 ten-year study (see paragraph 6.14), the Department identified the need for a similar system for pavement management. Such a system would integrate the data and information gathered on the road inventory to enable the Department to more effectively identify projects that will maximize the benefit from its investment in road construction and rehabilitation.

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**Recommendation 6.3**

**We recommend that the Department work toward fully implementing the bridge management system on a timely basis. In addition, the Department should adequately address similar information needs for its management of pavement.**

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## Accountability Framework and Performance Measurement

- 6.25** We examined the Department's accountability framework for highway projects. We concluded there is an appropriate accountability framework. Roles, responsibilities, authority and accountability are assigned through job descriptions, manuals, on-the-job training, supervision and performance evaluations. The manuals and other documents provide sufficient guidance and direction on managing highway projects. We noted that some job descriptions have not been updated for many years. We advised the Department that job descriptions should be updated on a timely basis to reflect current roles and responsibilities and organizational structures in the Department.
- 6.26** We also looked at the performance measurement systems for highway projects and found there are regular reporting and monitoring practices. However, there are weaknesses in the information and reporting systems which could compromise the security and accuracy of the data collected.
- 6.27** There are a number of information and reporting systems used by the Department for managing its highway projects which are based on a variety of technologies. The systems are not fully integrated, resulting in the same data being entered into more than one system. Some of the systems are out-dated. Passwords and other security measures are not used for most of the systems. In many cases, data must be gathered from various systems and consolidated into spreadsheets for reporting purposes. This is a time-consuming and inefficient process.
- 6.28** In 2004-05 the Department undertook a Highway Capital Management Program (HiCaMP) study to look at business processes and underlying data requirements for managing the Department's highways and bridges capital program. In addition to the weaknesses noted in paragraph 6.27, the HiCaMP study reported deficiencies related to cash flow forecasting, timeliness of reporting, and project cost information.
- 6.29** The long-term goal of the HiCaMP project is to provide more timely management information, to improve accessibility and integration of data, and cash flow forecasting. There is a three-year implementation plan for this project, with an estimated cost of \$1.8 million to \$2.3 million and annual licensing costs of \$420,000. Completion is planned for 2009.

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### Recommendation 6.4

**We recommend that the Department work toward fully implementing the highway capital management information system on a timely basis.**

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## Project Management Processes

- 6.30** Our audit examined the methodology and practices used by the Department to manage its highway projects. Our examination included determining the project

planning, executing, monitoring and controlling, and closing procedures used by the Department, and comparing them to the Project Management Institute's *A Guide to the Project Management Body of Knowledge* (PMBOK Guide, Third Edition). We concluded that the Department has an appropriate project management methodology for highway projects.

- 6.31** The Department has developed project review processes which would provide assurances that staff are carrying out their duties and managing highway projects in accordance with the Department's policies, as specified in the field manual and other documents. Project reviews may involve a detailed examination of a completed contract and its project records, or a summary review of records for a project in progress. However, we noted that no project reviews were carried out on highway projects during the previous year.
- 6.32** We examined six highway projects to determine if the project management methodology and practices described to us were being followed (Exhibit 6.6). The projects were selected to include each district in the Province, significant program areas, and supervision by different project engineers. Our work included an examination of project records and discussions with project staff.
- 6.33** We found instances where there were differences in the way the Department's project management methodology had been applied. For example, there were inconsistencies relating to file documentation and the use of diaries and project schedules. For one project, we were unable to determine if the project management methodology and practices were followed due to insufficient documentation and unavailability of a project staff member who was no longer working for the Department. Required project documents, such as the project engineer's diary, pre-job minutes and job ledger were not completed, not properly prepared, or were missing from the files and could not be located. We were informed that the initial project engineer left the Department before the project was completed, and a second project engineer completed the project.

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**Recommendation 6.5**

**We recommend that the Department reestablish its project reviews as a means of providing assurance that management of highway projects is consistent throughout the Province and in accordance with the Department's policies. Further, the reviews should ensure complete and consistent file documentation is maintained for highway projects.**

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**CONCLUDING REMARKS**

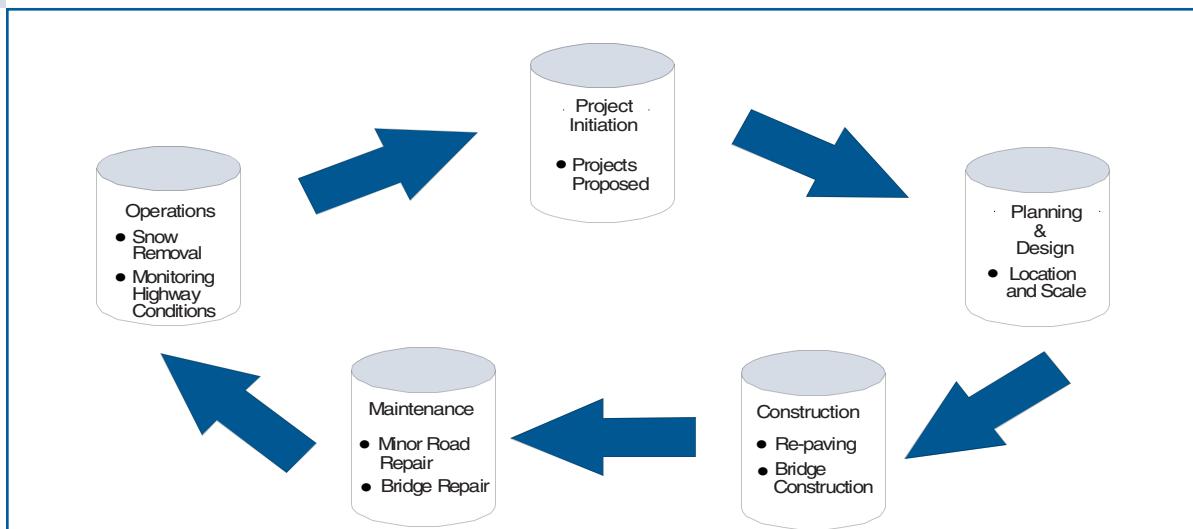
- 6.34** It is important that the Department's resources be used to maximize the benefits from the Province's investment in highway projects. The Department has planning and prioritizing processes for selecting highway projects that contribute toward accomplishing the Department's strategic objectives. However, systems and

information are not sufficient for the Department to determine if the projects selected contribute to the strategic objectives to the fullest extent possible. There is a need for the Department to complete its various information technology projects as soon as practical to provide the information it needs to select and manage highway projects.

- 6.35** The Department's project management methodology for highway projects is appropriate. Weaknesses in information and reporting systems need to be addressed to ensure projects are adequately monitored. In addition, project reviews need to be reestablished to help ensure full and consistent application of Department policies in the conduct of highway projects.
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### Project Life Cycle



Source: Department of Transportation and Public Works

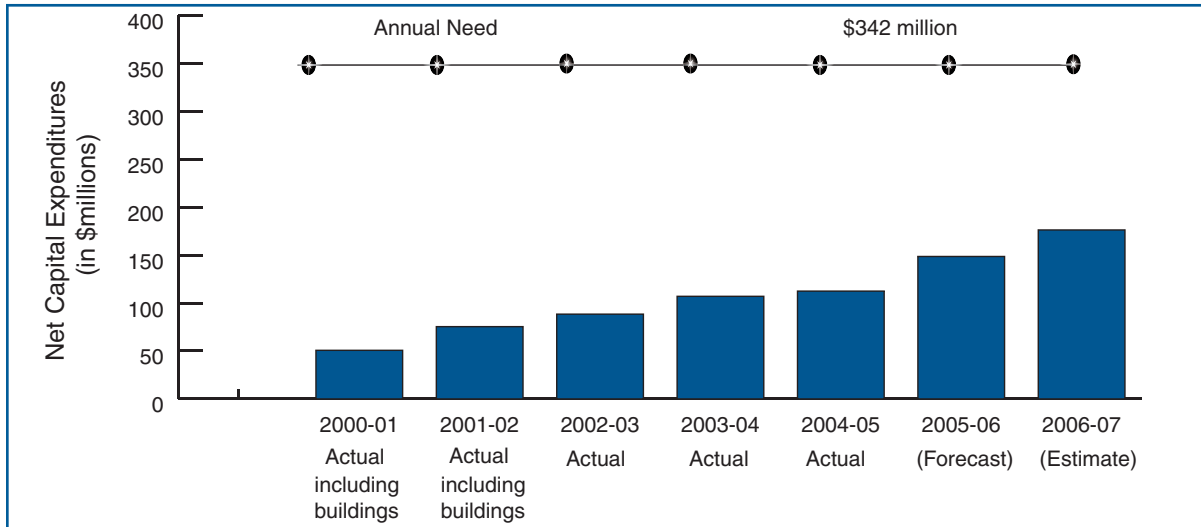
### Summary of 10-Year Capital Construction Needs by Highway and Bridge Program Area

Highway and Bridge Program Area	10-Year Needs (\$ millions)
System Expansion - primary highway	\$789
System Expansion - secondary highway	260
Pavement Preservation - 100 series highway	301
Pavement Preservation - secondary highway	1,132
New Paving	78
Gravel Road Rehabilitation	301
Bridge Rehabilitation and Repair	563
	<b>\$3,424</b>

Note: Over the 10 years from 2001, the Department determined that it should spend in total an average of \$342 million per year to improve highways and bridges.

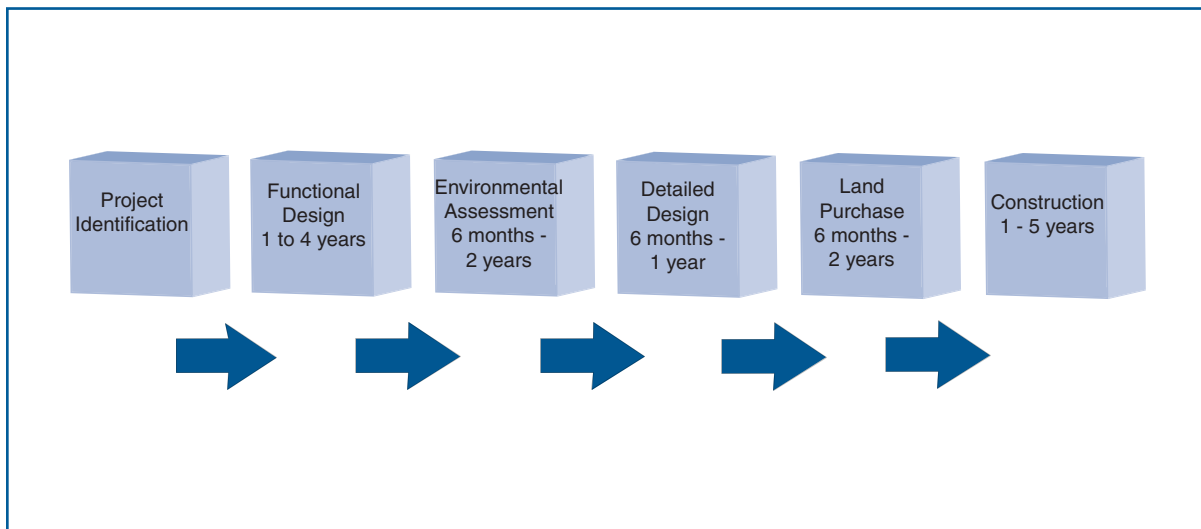
Source: Department of Transportation and Public Works' Report on Nova Scotia's Primary and Secondary Highway Systems: 10-Year Needs, May 3, 2001

### Net Capital Expenditures on Highways and Bridges



Source: Department of Transportation and Public Works

### New Highway Development Timeline



Source: Department of Transportation and Public Works

### Project Prioritization Processes

Selection of highway projects to be included in the Department’s capital program is based on priority ranking of projects within each program category, as limited by budget funds allocated to each category.

**Repaving projects** - The Department’s individual district offices recommend a list of projects, ranked according to their priorities. The proposed project areas are evaluated for physical condition through collection and analysis of various technical data. Ratings and weightings are applied for surface roughness (30%), pavement condition (35%), traffic volumes (20%) and maintenance/service considerations (15%), to determine the priority ranking of projects.

**Construction/expansion on the 100 series highways** - Highway planning staff review the list of projects included in the primary arterial highway system plan. Key factors considered in the prioritization of these projects are access control, number of lanes, traffic volume, level of service, collision rate and average speed. Weightings are applied for traffic volume (25%), collision rate (30%), speed (10%) and policy (35%). The policy factor includes, among other things, subjective considerations relating to economic impact.

**Bridge projects** - Bridges are inspected and assessed by the Department’s engineers. Priority is determined based on condition, serviceability and operational factors. Condition is determined by detailed inspection using a national bridge inspection standard protocol and is weighted at 50%. Serviceability assesses things such as clearances, roadway alignment and width, and traffic volume considerations, and is weighted at 35%. Operational factors are determined by each district and include importance of the bridge to the community and maintenance considerations. Operational factors are weighted at 15%.

**Other project categories** - Project prioritization is based on the priority recommendations from district offices, together with other factors, as applicable, such as collision statistics and traffic volumes.

Source: Department of Transportation and Public Works

## Bridge and Highway Projects Examined for Compliance with Project Management Methodology

Exhibit 6.6

Program Area and Type of Work	Project	Contract Amount
<b>Construction on 100 series highways</b>		
Subgrade construction, grading and gravelling	Highway 103, from approximately 2.0 km East of Exit 5 to approximately 1.0 km West of Exit 5; approximately 2.9 km	\$3,743,250
<b>Repaving - other 100 series highways</b>		
Full depth reclamation with expanded asphalt stabilization and asphalt concrete repaving - method specification	Minesville Road from Trunk 7 southerly to Route 207, approximately 7.1 km	\$1,281,110
Upgrading, gravelling and repaving - end product specification	Route 223, from Highway 125 to 200 m east of Scotch Lake Road; approximately 6.60 km	\$2,155,263
Pulverization, gravelling and asphalt concrete patching and repaving - end product specification	Route 289, from Southside Road easterly to the intersection of Route 336, approximately 11.1 km	\$2,389,170
Pulverization, gravelling, asphalt concrete patching and repaving - end product specification	Sissiboo Road, from Trunk 1 in Weymouth to Gilbert's Cove Road, approximately 10.8 km	\$1,782,895
<b>Truss Bridge Replacement</b>		
Construction of bridge and approaches	Lower Eel Creek Bridge (CUMO79) located on Route 301 west of Trunk #6	\$2,458,783

Note: Contract amount is amount tendered by successful bidder and does not include any contractor extras or Department of Transportation engineering costs and contingencies.

Source: Department of Transportation

## DEPARTMENT OF TRANSPORTATION AND PUBLIC WORKS' RESPONSE

The Department would like to thank the staff of the Office of the Auditor General for their courtesies and professionalism while conducting their audit of our capital planning and management of highway projects. In general, the Department accepts and agrees with the findings of the audit. The audit outlines five specific recommendations for which we provide the following comments:

1. "We recommend that processes be established for the review and updating of long-range and shorter term highway plans on a timely basis to ensure current information is used in the prioritization of road projects".

The Department is in agreement with this recommendation and have recently developed a ten year funding allocation and capital capacity plan as well as started the development of rolling three year project plans for the major funding blocks outlined in the ten year plan.

2. "We recommend the Department establish criteria for determining which repaving projects should undergo a rehabilitation review and ensure such projects are reviewed prior to tendering to ensure the most appropriate rehabilitation techniques are used".

The Department introduced the above noted "peer review" process several years ago. It is our intent to apply it to all TCA repaving and rehabilitation projects for the secondary road system. The process is not particularly relevant to 100 series repaving projects which have more straightforward rehabilitation techniques or to small (i.e. non TCA) type repaving projects and it is not our intent to utilize the peer review process for these types of projects.

3. "We recommend that the Department work toward fully implementing the bridge management system on a timely basis. In addition the Department should adequately address similar information needs for its management of pavement".

The Department is continuing work on the development of its bridge management and inspection program. The Department launched a pavement management system project for the 100 series system in early fall of this year. Once the system is up and fully functional it will be expanded to portions of the secondary road system.

4. "We recommend that the Department work toward fully implementing the highway capital management information system on a timely basis."

The Department concurs with this recommendation and expects to start using portions of the HiCamp System in 2007/2008 and to have it full implemented by fiscal 2009/2010.

5. “We recommend that the Department re-establish its project reviews as a means of providing assurance that management of highway projects is consistent throughout the Province and in accordance with the Department’s policies. Further, the reviews should ensure complete and consistent file documentation is maintained for highway projects”.

The Department accepts the above noted recommendation. The staff who conduct the highway contract audits were utilized to conduct a series of RIM contract audits during the period of the OAG audit of our capital program. Management at the Department was of the opinion that as the RIM program has grown, some internal audit effort should be put into ensuring that RIM projects were carried out in a manner similar to the larger capital program audits. The RIM audits have been completed and the staff have returned to their more usual capital program audits.