

V.6. Infrastructure Implementation Plan (Division des Ponts et Tunnels)

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V.6. INFRASTRUCTURE IMPLEMENTATION PLAN (DIVISION DES PONTS ET TUNNELS)

1. INTRODUCTION

The road network, which falls under the jurisdiction of Ville de Montréal (the city), consists of close to 600 engineered works and related structures¹ (overpasses and underpasses, bridges, ramps, walkways, noise barriers, tunnels, retaining walls, snow sheds and other types of structures). For the purposes of this audit, the term “structure” is used to designate all these.

The city’s responsibility in this matter falls within the legal framework of the *Municipal Powers Act*, among others, which states that the municipality has jurisdiction over public roads that are not under the management of the governments of Québec or Canada, or their departments or agencies, including bridges and other structures.

In certain cases, responsibility for a structure may be shared between the city and other entities, most often the Ministère des Transports du Québec (MTQ). The *Act respecting roads* stipulates that the MTQ is responsible for maintaining “that part of an infrastructure that acts as a bridge for a municipal road which passes over a road which is under the management of the Minister,” with the exception of the roadway, sidewalks, railings and lighting, which remain the responsibility of the municipalities.

As to the structures for which the city is fully responsible, the legal framework in force following the merger and reconstitution of certain municipalities on the Island of Montréal implies splitting responsibility for road network into two categories (arterial system and local system). Structures located in the arterial road system fall under the jurisdiction of the city in which they are located (main city or related cities), while structures located in the local road system fall under the jurisdiction of the boroughs or related cities involved. Some substructures of common interest where structures may be present (e.g., bicycle paths, Parc Jean-Drapeau and others) fall under the jurisdiction of the agglomeration.

According to an assessment filed by the Direction des transports in September 2010, the replacement value of the entire inventory is \$3 billion. Such an inventory progressively loses its

¹ In civil engineering, engineered works or a related structure is a special work, as opposed to a building. For example, it provides a communications lane (road, railway line) to cross an obstacle. It can also be, among other things, a bridge, an overpass or a tunnel. It can also provide reinforcement as is the case, for example, of a retaining wall.

value. In fact, structural material begins to deteriorate as soon as it is put into service. Factors such as traffic volume, loads over the allowable limit, ice, severe weather, de-icing salt and vehicle collisions all contribute over time to deterioration of structures.

Data currently in inventory at the Division des ponts et tunnels shows that the structures for which the city is responsible are aging. In fact, nearly 65% are over 50 years old. To assess their degree of deterioration, the city conducts regular inspections, which allow it to act in cases of urgent safety concerns and plan the action required to preserve the useful life of structures and maintain them in good condition.

Under the present circumstances, the planning process is all the more important because the city is facing major deficits in maintenance and restoration of these structures. In September 2010, the Direction des transports estimated that \$82,000,000 would need to be invested annually over the next 10 years to reach the point at which 85% of the assets would be in good condition. However, delegated budgets are tight and fail to meet all the needs that have been identified. It is vital that the right choices are made and that approved investments have maximum impact.

The challenge at the planning stage, therefore, is to determine as efficiently as possible what work needs to be done on each of these structures and to decide on the best time to do the work based on the life cycle of the structures, while being mindful of the need to maintain service for users and keeping within a limited budget.

2. AUDIT SCOPE

The main purpose of our audit of the infrastructure implementation plan projects was to ensure that the work carried out on the city's infrastructure was based on specified priorities. The audit scope covered the infrastructure of the local water and sewer system, the arterial road system, as well as bridges, tunnels and related structures.

The assignment was divided into two phases. This first report deals with the city's actions to maintain and up-grade bridges, tunnels and other related structures under its responsibility because of their strategic importance to the transportation safety of passengers and goods. We examined how responsibilities are shared in the jurisdictions of various levels of government: agglomeration, city and boroughs. We also analyzed the planning process implemented by the Division des ponts et tunnels of the Direction des transports.

The planning process determines the preservation needs of the structures. It includes the inventory, condition assessment, needs identification and prioritization. We then looked at the programming component, which consists of coordinating and scheduling the actions to be carried out and allocating the necessary funds.

We did not verify the condition of the structures as such, or the degree of risk involved or the relevance of the projects considered as priorities.

Our audit dealt mainly with investment project planning for 2010, but we also took into account information from 2008 and 2009.

3. FINDINGS, RECOMMENDATIONS AND ACTION PLANS

The Division des ponts et tunnels implemented a priority planning process for managing structures under its responsibility. Our audit revealed certain shortcomings, however, regarding:

- updating the division of powers
- inaccessibility of certain inventory data
- partial completion of the annual inspection program
- obsolescence of the inventory data management system
- absence of a decision support function in the inventory data management system
- integration of maintenance, repair and restoration functions into a comprehensive action strategy
- need to add a cost-benefit analysis when prioritizing projects
- accountability for the impact of project reports
- absence of approval for a desired level of service
- consequences of underfunding in recent years

Because of these shortcomings, the Direction des transport is not positioned to make optimal use of public funds by planning the right action at the right time to preserve the structures.

3.1. DIVISION OF POWERS

3.1.A. Background and Findings

We should clarify here that jurisdiction over and responsibilities for structures is divided among several of the city's decision-making bodies and business units. From the *Act to amend the Charter of Ville de Montréal* (December 2003) to the *Act to amend various legislative provisions*

concerning Montréal (June 2008), responsibility for the road network has been divided into two main categories:

- Depending on their location, structures in the arterial system were under the exclusive jurisdiction of the city or related cities
- Structures in the local system were under the jurisdiction of either the boroughs or cities concerned

Structures of common interest, such as those in Parc Jean-Drapeau and some bicycle paths, were under the jurisdiction of the agglomeration.

As shown in Table 1, arrangements were made to divide responsibility based on expertise and resource availability rather than on location:

- Following an offer of professional services made to each borough, the Direction des transports Division des ponts et tunnels was assigned to inspect structures in 2008 and subsequent years and undertake any mitigating measures required.
- Under By-law 08-055,² City Council delegated to each of the borough councils the responsibility for maintaining the arterial system, especially minor maintenance of bridges and tunnels (cleaning, minor structural repairs, emergency signposting, removal of loose material, and the like.)

Table 1—Division of Responsibilities for Managing Structures and Budget Allocations

	Investment		Maintenance		Inspection	
	Responsibility	Capital budget	Responsibility	Operating budget	Responsibility	Operating budget
Local system	Borough Directions des travaux publics	City Direction des transports	Borough Directions des travaux publics		City Direction des transports ¹	
Arterial system	City Direction des transports		Borough Directions des travaux publics ²		City Direction des transports	
Structures of common interest³	City Direction des transports		Borough Directions des travaux publics		City Direction des transports	

¹ Function transferred by the boroughs following approval of an offer of professional services (Resolution CM08 0660).

² Power delegated by City Council under By-law 08-055.

³ Structures located in the Ville de Montréal only.

In short, boroughs are responsible for maintaining structures, regardless of their location, and receive operating budgets to perform this activity. The Division des ponts et tunnels, on the other

² City council by-law concerning the delegation to borough councils of certain powers relating to the arterial road system.

hand, is responsible for inspecting all structures, including those in the local system, and receives budgets accordingly.

The investment aspect remains problematic because, under applicable acts and by-laws, the boroughs currently have jurisdiction over planning and management of investment projects for structures in the local system. According to the stakeholders we met, however, the complexity of these structures requires state-of-the-art expertise that is not available in the boroughs. In fact, several of these structures, such as the la Concorde Bridge, the Île Sainte-Hélène Overpass, Monk Bridge and the Jolicœur Bridge over the Aqueduc Canal, are mid- to large-size structures.

FINDING

Given safety and road network functionality issues, as well as the need for specific technical expertise, the Division des ponts et tunnels retains the planning and management functions for all investment activities, including structures in the local system. The three-year capital plan (TCWP) prepared by the Division des ponts et tunnels and related budget have always included all structures in the local system, even though boroughs have jurisdiction over them. This has created a non-compliant situation.

To formalize the situation, however, a project is under way at the Direction des transports to recommend that City Council declare itself competent to manage structures in the local system. This is possible under Section 85.5 of the Charter of Ville de Montréal, which allows City Council to declare that it is competent to exercise a jurisdiction assigned by law to a borough if it is in the city's general interest and applies to all boroughs. The proposal must be approved by a two-thirds majority of council members if the period in question exceeds two years.

3.1.B. Recommendations

We recommend that the Direction des transports encourage City Council to assume jurisdiction over the management of structures in the local system so that it can manage all investments in compliance with the legal and regulatory framework.

3.1.C. Action Plan of the Relevant Business Unit

[TRANSLATION] “Consult the Service des affaires juridiques et de l'évaluation foncière and the boroughs to evaluate various scenarios for sharing jurisdiction. (Planned completion: June to October 2011)”

Submit a proposal to the Direction générale associée – Développement et opérations to guide the decision-making bodies.” (Planned completion: December 2011 to March 2012)

3.2. INVENTORY DATA

3.2.A. Background and Findings

The first step in planning priority projects is to draw up an inventory of structures. The Division des ponts et tunnels uses a database that was implemented in 1992 to maintain inventory and log results of summary inspections. It includes a fact sheet for each structure, which contains the following information:

- site of the structure and borough where it is located
- geometry (length, width)
- type of structure (e.g., slab-girder, portico, arch bridge, other)
- city’s responsibility – complete or partial (shared responsibility based on a memorandum of understanding with adjoining cities, the MTQ, rail or other company)
- year of construction
- status – active or non-active (closed or demolished structures)
- presence of public utilities
- load bearing capacity (date of the last assessment and indication of load limits)
- comments specific to the structure

In addition to this fact sheet, there is an electronic file and a paper file for each structure. The file includes general information, inspections, drawings, studies, photos, actions taken and correspondence. In 2007, the Commission of Inquiry into the Collapse of a Portion of the la Concorde Overpass recommended that municipalities with populations over 100,000 adopt a comprehensive online system containing all the records and data relevant to the structure, including inspections and repairs. In recent years, the Division des ponts et tunnels has made efforts to collect the maximum amount of data on each of the structures. According to the information we obtained, however, in some cases the files are incomplete.

FINDING

As-built drawings are missing for a few structures, some of which were built several years ago and others that have undergone recent repairs, e.g., seven cases where work was done in 2007 and 2008. These drawings are required to plan future maintenance and repair work. The Commission of Inquiry into the Collapse of a Portion of the la Concorde Overpass recognized the importance of such documents when, in 2007, it recommended that *“for all structures built in Québec, the supervisor of the work be required, upon delivery of the completed structure, to assemble all the documents associated with the work and the structure, including [...] the ‘as-built’ drawings...”*

The availability of these drawings helps manage risks to user safety and project costs. When these drawings are missing, inadequate work may be done or studies may become necessary to compensate for missing data, thus incurring cost overruns.

In 2010, for example, \$225,000 was authorized to hire a consulting firm to assess the load bearing capacity of a particular structure. To limit damage, the firm used a specialized exploration method to locate the structural frames. According to the information we received, if the firm had had access to good as-built drawings, approximately 50% of these exploration costs could have been avoided.

In another case, a structure is currently showing major signs of deterioration, but it is impossible to predict the consequences because the city has no drawing on file. The structure is supposed to be demolished in a few years to make way for redeveloping the intersection where it stands but, because of the uncertainty caused by the lack of drawings, demolition work must be moved forward to ensure the safety of users.

In general, when an external firm is contracted to supervise work, the technical specifications include a clause that requires the firm to provide as-built drawings. According to stakeholders, however, this element is often neglected in the final stages of the work, in spite of the requirement.

To solve this problem, a clear process must be set up to make site supervising firms accountable so that, in future, as-built drawings are systematically filed with the Division des ponts et tunnels, in accordance with the recommendation of the Commission of Inquiry into the Collapse of a Portion of the la Concorde Overpass.

We found an example of technical specifications for professional site supervision services dating from 2004, which stipulated withholding 10% of the fees, which would be paid upon delivery of as-built drawings. This process could be persuasive, but it was not repeated in the later contracts that we examined.

3.2.B. Recommendations

We recommend that the Direction des transports define and implement a clear process to procure as-built drawings and systematically put them on file when work is completed to have comprehensive data for planning future action and avoiding cost overruns.

3.2.C. Action Plan of the Relevant Business Unit

[TRANSLATION] “Review the roles and responsibilities of all departments with the Direction des travaux publics and establish a process to require and recoup as-built drawings. (Planned completion: October 2011)”

Review, with the Direction des travaux publics, current and completed contracts to retrieve the as-built drawings. (Planned completion: April 2011)

Together with the Direction des travaux publics, examine current professional service contracts to establish measures that would encourage the delivery of as-built drawings. (Planned completion: May 2011)

Revise the technical specifications for professional services and the standard work requirements to include delivery of as-built drawings for awarding future contracts.” (Planned completion: September 2011)

3.3. ASSESSMENT OF STRUCTURE CONDITION

The data management system fact sheets and electronic files describe the physical features of the structures. Managing these assets, however, also relies on specific knowledge of the condition of each structure. A yearly inspection program and other assessments should be carried out to ascertain the condition of the structures, especially those that are aging. The management system must also have the functional capacity to store historical results of inspections to indicate the rate at which the structures are deteriorating. This will provide a general idea of future work needed in the short, medium and long terms.

3.3.1. YEARLY INSPECTION PROGRAM

3.3.1.A. Background and Findings

We should first clarify that a structure is made up of several elements or components. For example, a bridge is comprised of the following elements: abutments, bearings, piers, expansion joints, beams, deck, sidewalk, roadway surface, barrier and structure walkway.

The Division des ponts et tunnels database includes an inspection record for each structure. The division carries out regular inspections to update this information and provide a comprehensive picture of the condition of the structures for which the city is responsible.

During this inspection, a score is assigned to each element based on a variety of factors (significance, size, material defect, functional defect.) The scores are then added up to establish the overall deterioration score for the structure. Based on the assigned deterioration score, the structures are then grouped into five categories. Table 2 illustrates the situation as of January 10, 2011.

Table 2—Quantity and Percentage of Structures by Category as of January 10, 2011

Status	Deterioration score	Features	Structures	
			Quantity	Percentage
Critical	≥ 80	<ul style="list-style-type: none"> • Several defective elements • Non-functional structure that sometimes requires complete or partial closing • Short-term response required 	12	2%
Defective	40-80	<ul style="list-style-type: none"> • Some defective structures • Partially functional structures 	44	8%
Poor	25-40	<ul style="list-style-type: none"> • Elements show signs of deterioration • Functional structure 	38	7%
Deteriorated	8-25	<ul style="list-style-type: none"> • Limited number of elements showing deterioration • Functional structure 	81	15%
Good	0-8	<ul style="list-style-type: none"> • No elements showing signs of deterioration • Functional structure 	380	68%

Source: Division des ponts et tunnels.

A yearly inspection program examines the condition of structures to determine the type of assessment needed and its recurrence. If a structure has a score above 40, or includes the critical functional score as a main element, a yearly general inspection is scheduled to ensure

the safety of users. For structures presenting specific problems, additional assessment may be carried out (e.g., ongoing remote monitoring, assessment of load bearing capacity, follow-up of cracking).

The 2010-2011 Direction des transports action plan aimed at a general inspection³ of all structures on a four-year cycle (25% each year) and a quick inspection⁴ during the year of all structures not part of the general inspection. The 2010-2011 action plan reflects the objectives of the different divisions that make up Direction des transports and has not been approved by the city's decision-making bodies.

The targets set are in keeping with the practices set out in the MTQ inspection manual, which suggests a two- to four-year interval between general inspections. In 2010, 48 planned general inspections (22%) and 35 planned quick inspections (10%) had to be postponed to 2011 (see Table 3).

Table 3—Status of the Annual Inspection Program for 2010

Inspection	Planned	Completed	Deferred (work under way)	Rescheduled to 2011
General	214*	145	21**	48**
Quick	331***	296	—	35

* 25% of inventory in addition to structures whose condition requires a general inspection for safety purposes.

** 15 quick inspections carried out as a compensatory measure.

*** All structures for which a general inspection was not planned.

Source: Division des ponts et tunnels.

³ The general inspection of a structure consists primarily of visiting the site to determine the inspection method to be used, conducting a "close-up" inspection of the structure and drafting an inspection report.

⁴ The quick inspection of a structure consists primarily of visually inspecting the structure and drafting an inspection report.

FINDING

The Division des ponts et tunnels also anticipates that not all 2011 planned inspections will be carried out, because in January:

- the division experienced administrative delays in awarding a contract to an outside firm to conduct inspections that exceeded the capacity of the division's internal staff. According to the information obtained, even if the contract were awarded in the next few weeks, it would be difficult to meet the planned schedule, given the time constraints;
- the division determined that it would not have the internal staff needed to conduct 100% of the planned inspections unless it received approval for the creation of new positions. A staffing request was made, therefore, to the Direction des transports in August 2010, but no confirmation has been received to date. On a positive note, the division can count on an extension to fill these positions and integrate and train new employees to be ready to carry out the inspections. There would thus be a time lag in the schedule of planned inspections.

FINDING

Based on the information obtained, the division's targets for the number of structures to be inspected were not met in 2010 and will likely not be met again in 2011 because of a lack of adequate staff (internal and external). Consequently, the information in the database on the condition of the structures not yet inspected is out of date.

The yearly inspection program plays a strategic role in providing data on the condition of structures, ensuring that they are functional and safe, and detecting problems that require short-, medium- or long-term response. When the condition of a structure requires it, for example, measures are taken to remedy defects and ensure the safety of users (restricting loads, prohibiting overweight loads, closing traffic lanes, installing guardrails to make barriers safe, closing walkways or pedestrian tunnels no longer in use) while awaiting repairs, rehabilitation or demolition work.

3.3.1.B. Recommendations

We recommend that the Direction des transports take the steps required to complete its yearly inspection program within the established timeframe so that it will know the current conditions of structures and plan appropriate responses in a timely manner to ensure the safety of users.

3.3.1.C. Action Plan of the Relevant Business Unit

[TRANSLATION] “In an effort to maintain annual inspection program operations:

- Carry out inspections in sequence based on current priority response criteria (the first of which is the safety of users) (**Planned completion: under way**)
- Continue the current process to evaluate the awarding of a second inspection contract in the 10-11416 call for offers (**Planned completion: under way**)
- Begin the process of awarding new inspection contracts from the existing professional service framework agreements (**Planned completion: May 2011**)

Remark: The process to add five new positions for this purpose has been completed. The Direction des transports is currently hiring.”

3.3.2. DATA MANAGEMENT SYSTEM

3.3.2.A. Background and Findings

Even if the inspection program was completed each year, a major problem still exists. We concluded that the inventory data management system fails to meet current needs. Users also qualify the system as obsolete, especially because:

- It does not allow all the information collected during general inspections to be entered and processed (the system is designed for summary inspection results).
- It does not save the details of earlier inspections (access is only to results of the last inspection).
- It does not include a data analysis function or way to model various investment scenarios.

Because electronic tools are not available, data that is essential to decision-making must be compiled by hand. For example, while the Division des ponts et tunnels has compiled an inspection history to track structures' deterioration over time and identify future trends, it has not been updated each year.

Consequently, in the absence of data from earlier inspections, the current inventory data management system can only provide a static picture of the condition of the structures. Historical data would enable the Division to look at how the deterioration has evolved over time, make projections for coming years and better manage any detectable risk of rapid deterioration.

FINDING

Given the obsolescence of its data management system, the Division des ponts et tunnels is unable to simulate multiple investment scenarios without considerable effort. This prevents it from setting optimal priorities and acting on the right structures at the right time. Currently, optimization is done manually by professionals, but only a few scenarios undergo simplified analysis.

Without the use of software that contains structure history, simulates aging, models various response scenarios and facilitates decision-making, the complexity of the structures and the many factors that need to be taken into account make this exercise especially onerous. The *National Guide to Sustainable Municipal Infrastructure*⁵ confirms, moreover, that identifying and prioritizing the needs of large municipalities cannot be done effectively without specialized software.

FINDING

During a September 2010 presentation to members of the City Council finance, administrative services and human capital committee, and the Agglomeration Council finance and administration committee (hereafter called “the finance committees”), the Direction générale acknowledged that the city’s diagnostic methods and tools for medium- and long-term planning needed to be improved and supplemented. This is true for the Division des ponts et tunnels structure management system, which lags behind some of the city’s other business units that are already using or developing this type of tool (Direction de la gestion stratégique des réseaux d’eau and Division gestion des actifs de voirie of the Direction des transports).

A project is under way to implement a new data management system. The Executive Committee has, in fact, approved an agreement between the city and the MTQ to use an MTQ structure management software package that would be adapted for the city’s specifications. Provision is being made for the software to include a strategic planning module that integrates a function that would simulate various scenarios to assist in decision-making.

However, the \$550,000 investment that was set aside in the 2010 TCWP to complete the project has been carried over to a later year. Lack of staff and the priority level assigned to it by the Service des technologies de l’information are two of the impediments mentioned to explain the

⁵ *National Guide to Sustainable Municipal Infrastructure*, [TRANSLATION] Priority planning and budgeting for the maintenance and rehabilitation of roadways, National Research Council of Canada, November 2003.

deferral. Because of uncertainties about its ability to complete the project, the Division des ponts et tunnels did not set out the means to complete this project, nor the related targets and specific indicators, in its action plan.

3.3.2.B. Recommendations

We recommend that the Direction des transports continue with plans to implement a new data management system, which includes a function to facilitate decision-making, to ensure that historical inspection data is available to analyze different scenarios and optimize structure management.

3.3.2.C. Action Plan of the Relevant Business Unit

[TRANSLATION] “Include implementation steps and timeline for the new management system in the 2011-2012 Division des ponts et tunnels action plan. (Planned completion: June 2011)

Submit this action plan to the Direction générale associé – Développement et opérations to be added to the city’s master plan and investment plan, depending on budget availability.” (Planned completion: December 2011)

3.4. NEEDS IDENTIFICATION

3.4.A. Background and Findings

As part of the planning process, needs identification points out responses that are considered necessary following inspection and then classifies them according to their priority. The various types of responses are described in Table 4.

Table 4—Types of Responses

Response	Description	Budget
Preventative maintenance	<ul style="list-style-type: none"> To prevent or slow the progression of damage that could result in premature deterioration Recurring or non-recurring responses For structures in good condition Optimal strategy for use of public funds 	Operating
Routine maintenance	<ul style="list-style-type: none"> To correct faults or damage that could lead to accidents or seriously harm the comfort of users Minor corrective work Priority response following an accident 	Operating
Repairs	<ul style="list-style-type: none"> When a structural element has reached an advanced stage of disrepair To maintain or improve its condition and avoid investing greater funds later on Ability to extend the structure's useful life and cost determine if a repair is relevant Effectiveness and durability of repair techniques determine how and when the response will be carried out 	Operating or Capital Asset (based on the scope of the work)
Major rehabilitation	<ul style="list-style-type: none"> To restore as new or to full functionality Non-standard reinforcement responses (structural damage), widening (geometric and functional damage) or reconstruction work. 	Capital Asset

Source: *Manuel d'entretien des structures*, MTQ, December 2010.

Comprehensive Response Strategy

In terms of needs identification and priority setting, the *National Guide to Sustainable Municipal Infrastructure* and the *Manuel d'entretien des structures* published by the MTQ (two reference tools for best practices) indicate a preference for using a comprehensive response strategy that examines the entire structure inventory. They suggest applying this strategy to determine and prioritize needs in the area of infrastructure preservation, i.e., accounting for maintenance as much as repairs and rehabilitation work.

The city's [TRANSLATION] Equipment and Infrastructure Policy takes a similar position, stating that the city determine its needs based on the condition of its assets, i.e., establish the preservation methods to be used and the corrective actions to be taken in the short, medium and long terms. The policy suggests classifying assets into categories based on whether the decision will be to:

- replace
- preserve, but make major repairs in the short or medium term
- preserve and perform routine maintenance
- stop all maintenance, postpone repair work and carry out more in-depth studies

It also recommends that a defined maintenance program be designed, providing specific information about the work to be done to protect and maintain the quality of all structures.

Inspection reports already provide those in charge of planning with a choice of a few preventative or routine maintenance activities (e.g., sealing cracks), repairs (e.g., replacing deck joints) or major rehabilitation (e.g., full reconstruction) to correct damage in partial compliance with the Equipment and Infrastructure Policy. The needs deemed important by inspectors are indicated in the database.

FINDING

Contrary to the provisions of the policy, however, structures are not systematically classified by category of response required. Although a structured preventative maintenance program is recognized as an optimal strategy for the use of public funds, no such program exists per se. This strategy prevents premature deterioration of structures that are in good condition and delays the moment when a greater investment will be necessary.

In reality, sharing of responsibilities between the Division des ponts et tunnels and the 19 boroughs is not conducive to a comprehensive response strategy. As previously mentioned, the Division des ponts et tunnels is responsible for determining work of a capital nature (repairs and major reconstruction work), while the boroughs are independently responsible for planning operational needs (preventative maintenance, routine maintenance and certain minor repairs). Sometimes the Division des ponts et tunnels will inform boroughs of requests for specific action in their jurisdiction and, conversely, the boroughs will bring action requiring more specialized expertise or equipment to the attention of the Division des ponts et tunnels.

FINDING

Allocating operating budgets to boroughs and investment budgets to the Division des ponts et tunnels is not conducive to integrated planning. The importance of performing preventative maintenance, paid for from the borough's operating budget, may be less obvious when the consequences of neglecting that work is reflected in the capital budget of the Division des ponts et tunnels.

FINDING

In summary, needs identification and priority planning are not being done according to a comprehensive response strategy as suggested by the:

- *National Guide to Sustainable Municipal Infrastructure*
- *Manuel d'entretien des structures* published by the MTQ
- Management practices stipulated in the city's Equipment and Infrastructure Policy

FINDING

Those in charge of planning have no assurance they are choosing the right responses for the right structures at the right time to optimise public spending.

By-law 08-055, adopted by City Council in December 2008, deals with the delegation to borough councils of certain powers related to the arterial system. The by-law contains an article that could have fostered a more comprehensive approach to the planning process, at least for structures located in the arterial system.

Article 6 of this by-law stipulates that the borough council must submit a report on March 15 and another on November 15 of each year to the Executive Committee and the assistant director general responsible for infrastructure. This report must indicate how the assigned activities were carried out (in particular, minor maintenance of bridges and tunnels in the arterial system, such as cleaning, minor structural repairs, emergency signposting, and removal of loose material, among others) and include technical information that will help develop output indicators for managing and maintaining the arterial system.

FINDING

This report could have served as a management tool to allow the Division des ponts et tunnels to consider borough maintenance activities on their arterial system structures in its planning process. However, article 6 of By-law 08-055 has apparently never been applied, as no report has been produced since it came into effect.

3.4.B. Recommendations

We recommend that the Direction des transports, together with the boroughs:

- prepare a comprehensive response plan to identify and prioritize needs, which integrates preventative and routine maintenance work, repairs and major rehabilitation to maintain structures in a desired condition at a better cost;
- design, document and implement a structured preventative maintenance program for all structures, in accordance with the Equipment and Infrastructure Policy, which came into force in January 2009, to prevent premature deterioration.

We recommend that the Direction générale associée – Développement et opérations ensure that the boroughs comply with the requirements of City Council By-law 08-055 concerning the delegation of certain powers related to the arterial system to borough councils to produce the structural maintenance data needed to draft the Direction des transports's overall response strategy.

3.4.C. Action Plan of the Relevant Business Unit

- **DIRECTION DES TRANSPORTS**

[TRANSLATION] "The Direction des transports establishes and prioritizes responses based on the city's issues and objectives for all road system assets (roadway, sidewalks, lighting, traffic lights and engineered works) according to its budget. Preventative and routine maintenance costs are charged to the operating budget, while rehabilitation expenses are charged to the TCWP.

Include needs prioritization and preventative and routine maintenance in the Division des ponts et tunnels global response strategy, taking into consideration activities related to the recommendation found in the "division of powers" section (audit report of the Direction optimisation des ressources et conformité réglementaire, dated March 17, 2011):

- *Prepare a strategy adjustment plan and add it to the division's 2011-2012 action plan (Planned completion: June 2011)*
- *Meet with boroughs to update the strategy and look into possible maintenance operation methods (Planned completion: September to December 2011)*
- *Prepare a preventative maintenance program and assess the resources needed to implement preventative maintenance (Planned completion: April 2012)*
- *Recommend a structured preventative maintenance program to the Direction générale associée – Développement et opérations that meets service and investment levels in the proposed corrective action, to respond to the Direction optimisation des ressources et*

conformité réglementaire audit report recommendation dated March 17, 2011 on the investment level (Planned completion: May to November 2012)

- *Document preventative and routine maintenance (Planned completion: July 2012)*

Apply the strategy with the boroughs.” (Planned completion: January 2013)

- **DIRECTION GÉNÉRALE ASSOCIÉE – DÉVELOPPEMENT ET OPÉRATIONS**

[TRANSLATION] “The Direction générale associée – Développement et opérations will implement the necessary measures to ensure that information is provided to the Executive Committee and to the Direction générale associée – Développement et opérations as required in Article 6 of By-law 08-055.” (Planned completion: November 2011)

3.5. PRIORITY PLANNING

3.5.A. Background and Findings

Each year, the Division des ponts et tunnels determines investment needs (repairs and major rehabilitation) based on the information contained in the inventory and the methods of analysis at its disposal. It assigns a priority to potential projects, first considering:

- projects where work has already begun
- condition of the structures (impact on user safety, structure lifespan and road network serviceability)
- projects in the study and preparation phase (preliminary project, plans and estimates)

It then adapts the project schedule to allow for opportunities that arise and work planned by its partners:

- other city rehabilitation projects planned
- city development or redevelopment projects
- projects with the MTQ on structures with shared responsibility

Justification for each potential project is documented in the project report. In general, the projects that we examined had been selected because of the structure’s state of deterioration and safety factors.

FINDING

The concept of “right time” rarely appears in analyses at the planning stage except in emergencies. For example:

- Compromises between less costly responses that need to be paid now and more costly ones that will have to be paid later are not evaluated.
- The impact of advancing or deferring response on related cost estimates is not assessed.

This financial information would be useful to those in charge of long-term planning in determining the appropriate timing for work to be done.

3.5.B. Recommendations

We recommend that the Direction des transports incorporate cost-benefit analyses into the planning stage, taking into account the date scheduled for the work, to determine the appropriate response and the best time to carry it out.

3.5.C. Action Plan of the Relevant Business Unit

[TRANSLATION] *“Integrate an analysis of general economic parameters into scheduling for 2013 and subsequent years pending implementation of the new management system. This analysis should be done for the projects and works that were prioritized in the first step of the technical analysis. (Planned completion: January 2012)*

Update the investment plan for rehabilitating roads and related structures.” (Planned completion: December 2011)

3.6. PROGRAMMING AND ALLOCATION OF RESOURCES

Each year, the Division des ponts et tunnels sets its priorities and submits them in its capital budget request. The allocated budgetary envelope helps set apart projects that are part of the coming year’s schedule. For example, the main projects programmed in 2010 are listed in Table 5.

Table 5—2010 Scheduling

Project	Response	2010 Budget (thousands of dollars)
Structures under city responsibility		
Jolicœur Bridge	Major reconstruction	2,775
Various contracts awarded before 2010	Various	1,557
Various structures	Minor repairs	1,253
Claude-Brunet Bridge (formerly de l'Asile Bridge)	Major reconstruction	775
Louis-H.-La Fontaine Overpass	Major reconstruction	525
Gouin Culvert	Major reconstruction	263
Rue Saint-Jacques/Chemin Upper-Lachine Underpass	Demolition	201
Subtotal		7,349
Structures with shared responsibility		
Curatteau Bridge over Highway 25 (MTQ)	Major reconstruction	2,500*
Querbes Ave./avenue du Parc Overpass (MTQ)	Major reconstruction	2,400*
Various structures – Côte-de-Liesse (MTQ)	Major reconstruction	2,157*
Saint-Jean-Baptiste Bridge over Highway 40 (MTQ)	Major reconstruction	400*
Viau Bridge (MTQ and Ville de Laval)	Major reconstruction	400*
Bridges over Highway 720 (MTQ)	Repairs	200*
Lachapelle Bridge (MTQ and Ville de Laval)	Repairs	130*
Subtotal		8,187
Computerized management system for structures	Implementation	550
Total		16,086

* Ville de Montréal's portion of projects carried out with the MTQ for structures with responsibility shared between the two administrations.

Source: Division des ponts et tunnels.

A substantial part of the budget is allocated for work on structures under shared jurisdiction with the MTQ. When work is needed on these structures, the MTQ supervises the project and invoices the city for its portion in accordance with a joint memorandum of understanding outlining each party's responsibilities and cost sharing. The Division des ponts et tunnels estimates \$10M needs to be invested on average each year to meet its commitments to the MTQ.

In 2010, \$8,187,000, i.e., 51% of the total TCWP budget of \$16,086,000, was earmarked for projects with the MTQ. According to budget monitoring made available to us in January 2011, only \$3,443,000 was spent out of the total available budget for 2010. This included \$3,031,000 for projects that were part of agreements with the MTQ. The Division des ponts et tunnels indicated, however, that this data required changes that were pending at the time of our report.

Without mentioning specific amounts, Division des ponts et tunnels representatives confirmed that the complete envelope was not spent and that expenses for the current year mainly involved work on structures shared with the MTQ.

3.6.1. PROJECT REPORTS

3.6.1.A. Background and Findings

Our audit identified several major projects involving structures under the city's jurisdiction planned for 2010 but deferred to the following year, for example:

- Rehabilitation projects on the Jolicoeur Bridge and Claude-Brunet Bridge (formerly de l'Asile Bridge) are only at the preparatory stage of drawings and estimates, setting this work back to a later year.
- The minor repair work program planned for various structures has not been implemented.
- Demolition of the Rue Saint-Jacques/Chemin Upper-Lachine Underpass was deferred.

The Division des ponts et tunnels had several explanations for rescheduling these priority projects. Several activities are under way to mitigate the consequences and improve the situation (see Table 6).

Table 6—Main Causes for Deferring Projects Identified as Priorities

Cause	Consequence	Current activity
Lack of staff	The Division des ponts et tunnels cannot fully complete its mission, especially planning activities.	<ul style="list-style-type: none"> • An internal analysis assessed the number of additional staff required. • A request for the creation of new staff positions was made to the transportation manager.
Late approval of the TCWP budget	<p>A revised 2010 budget was approved in May 2010 (an initial budget of approximately \$4M was approved in January 2010), which leaves little time to implement the program considering :</p> <ul style="list-style-type: none"> • The 3 months needed to award contracts • Restrictions due to winter conditions 	<ul style="list-style-type: none"> • In October 2010, the finance committees recommended moving TCWP approval to September of the previous year for a higher completion rate. In March 2011, this recommendation, like the other 29, was tabled before City Council and Urban Agglomeration Council, and there has yet to be a response from the Executive Committee.
Lack of coordination	<p>Some projects are part of an administration unit's program and funds are set aside for them but they are not a priority for other administration units whose involvement is required. For example:</p> <ul style="list-style-type: none"> • A rehabilitation project may be delayed for several years awaiting a planning decision because the different administration units do not give it the same priority. • A project that moves from the planning stage (Division des ponts et tunnels) to the construction stage (Direction des travaux publics) can be delayed due to the preparation of directives or role- and responsibility-sharing agreements. 	<ul style="list-style-type: none"> • The Direction générale established requirements for more efficient and effective planning, including improvements to work coordination methods. • A new business process at the Direction des travaux publics is intended to clarify the responsibility and accountability of stakeholders.

In general, activities in progress are too recent for us to evaluate their results. In principle, they involve methods that are likely to bring about some improvement in the current situation.

Deferring these kinds of responses usually has major consequences, including:

- The need for monitoring to ensure user safety until the situation is rectified, which adds to costs
- Deterioration in the condition of the structures concerned, which may increase the cost of future responses
- Deterioration in the general state of the assets, which goes against 2008 Transportation Plan guidelines.

Mitigation measures intended to ensure the safety of users were implemented during the long deferral periods, generating additional costs. For example, 2007-2008 planning documents for a particular structure mentioned that a response *[TRANSLATION]* “is a priority because of the structure’s advanced deterioration [...] rehabilitation should be considered. [...] Work must begin as soon as possible.” Since then, the work has not been done, the structure has required regular inspections and concrete Jersey barriers have been installed to make the site safe. The total costs generated by deferring this project have not been compiled by the Division des ponts et tunnels.

In another case, road traffic on the affected structure has been restricted since 2007 because of deterioration and load bearing limitations. A reconstruction or rehabilitation project initially planned for 2008 was deferred and has yet to be completed. In the meantime, securing the structure has generated costs that could have been avoided if the project had been originally carried out when planned. Various measures had to be implemented until rehabilitation or demolition to ensure the safety of users, since 2007 for example:

- Continuous remote monitoring at an annual cost of \$32,000
- Seven inspections by the Division des ponts et tunnels or outside firms
- Twelve requests, including nine about falling fragments of concrete, that required response from the Division des ponts et tunnels or outside firms
- An estimated \$100,000 of work in the short term to prevent falling fragments
- Load bearing capacity tests estimated at \$80,000 needed in the short term to calibrate the remote monitoring instruments

FINDING

The assessment of costs incurred when a project is deferred is important management information. The Division des ponts et tunnels does not perform this analysis systematically, although the data would be useful for performance reporting on deferred projects identified as priorities. It would update the Direction générale on the impact of deferrals in the interests of informed decision-making.

3.6.1.B. Recommendations

We recommend that the Direction des transports account, in a structured way, for the consequences of deferrals and problems in completing work deemed to be a priority, regularly informing the Direction générale about the current situation of:

- specific projects not carried out during the year
- reasons for deferrals
- future costs incurred by deferrals
- temporary measures in place to ensure the safety of users

3.6.1.C. Action Plan of the Relevant Business Unit

[TRANSLATION] "Revise the accountability process to inform the Direction générale adequately. (Planned completion: July 2011)

Submit the updated process to the Direction générale for review. (Planned completion: July 2011)

Implement structured performance reporting that complies with the recommendation." (Planned completion: August 2011)

3.6.2. LEVEL OF SERVICE

3.6.2.A. Background and Findings

In recent years, some projects identified as priorities were not included in the annual planning process due to lack of available funds. The condition of the structures damaged over time as a result of this underfunding. We observed an inconsistency between the investment allotted and the service desired, which does not facilitate implementation of a comprehensive response strategy that is efficient and effective.

In its 2005 investment plan, the Direction des transports defined the desired state of the network (level of service), but authorities failed to vote on the plan and make it official. The Direction des transports wanted in particular to ensure that 80% of the structures were in good condition (including those in the “damaged” category) with a deterioration score between 0 and 25 and that no structure was in critical condition with a score above 80. This objective was comparable to the recommendation of the Commission of Inquiry into the collapse of the Concorde Overpass in its report to the Québec government in October 2007 to adopt a rehabilitation program over at least 10 years, at the end of which the proportion of bridges in good condition would rise to 80%.

Table 7 shows the desired state of all structures compared to their actual states in 2005 and 2008, based on data from the Direction des transports.

Table 7—Comparison Between Desired State and Actual State in 2005 and 2008

Condition	Deterioration score	Desired state	Actual state	
			2005*	2008**
Critical	≥ 80	0%	6%	4%
Defective	40-80	5%	10%	9%
Poor	25-40	15%	10%	12%
Damaged	8-25	10%	74%	22%
Good	0-8	70%		53%

* Investment plan prepared in 2005.

** Presentation of the Division des ponts et tunnels, [TRANSLATION] “Condition of structures,” in February 2010.
Source: Direction des transports.

The real condition of the structures improved slightly between 2005 and 2008 due to investments of \$43,000,000 and \$34,000,000 respectively.

In January 2008, the Direction des transports prepared a new investment plan for 2008 to 2015, based on the same desired condition. The plan recommended a gradual increase in investments from \$19,000,000 to \$70,000,000 over the targeted period to eliminate all structures in critical condition and bring those in defective condition down to 5%. One of the guidelines in the 2008 Transportation Plan took a similar approach, underscoring the city’s commitment [TRANSLATION] “to return the road network (arterial, local, structures and other components) to good condition and ensure its maintenance.”

In reality, the level of investment has been below the \$19,000,000 mark every year since 2008, which is clearly inadequate to meet priorities:

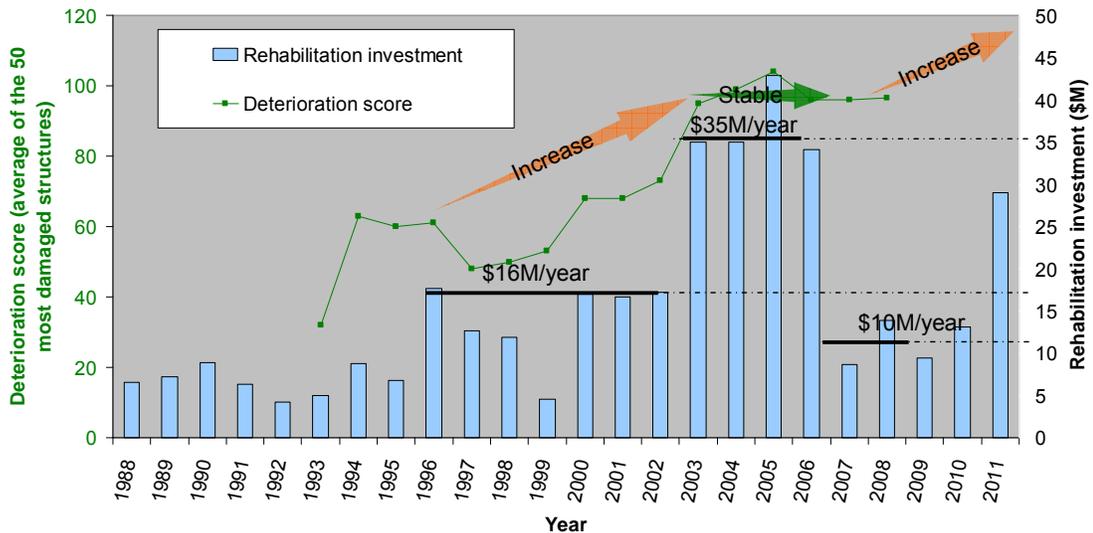
- \$14,000,000 in 2008

- \$10,000,000 in 2009
- \$16,000,000 in 2010

FINDING

Based on the estimates of the Direction des transports, underinvestment since 2008 has escalated structure deterioration, which is far from the commitment expressed in the 2008 Transportation Plan. If the situation is not rectified, the consequences will be serious as the number of structures in poor condition increases and future investment needs increase with the year. This is illustrated in Graph 1, which shows the evolution of structure condition in terms of investment.

Graph 1—Evolution of Structure Condition as a Function of Investment



Source: Direction des transports.

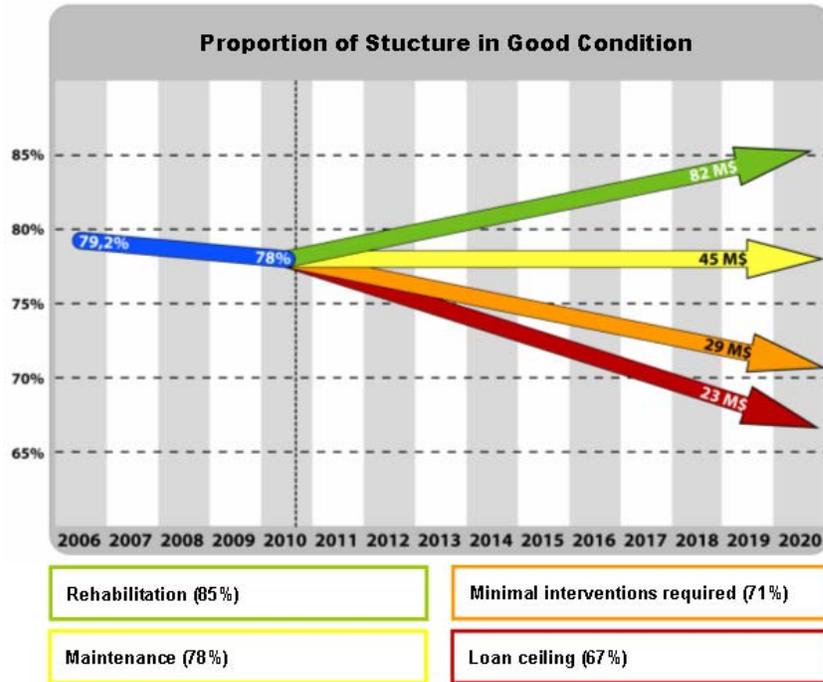
La Direction générale is aware of the problem and in 2010 created a project to produce a 10-year investment plan. This undertaking, which looked at all business units including the Division des ponts et tunnels, would produce a planning process allowing the city administration to:

- develop response plans needed to maintain and develop its assets over 10 years
- adopt investment management policies to ensure an optimal level of asset condition

Sectorial committees were formed to draw up investment plans. This resulted in the tabling of long-term investment planning reports to the finance committees in September 2010. The Direction des transports's report focused mainly on updating the amount required in the future to

meet various long-term objectives. Graph 2 shows the effects of various levels of investment on the percentage of structures in good condition over 10 years.

Graph 2—Effect of Various Levels of Investment on the Percentage of Structures in Good Condition



Source: Direction des transports.

FINDING

In September 2010, the Direction des transports estimated that the annual investment required to maintain the inventory of structures in their 2010 condition would be around \$45,000,000 over the next 10 years. The budget allocated by the Division des ponts et tunnels in 2010 rose, in fact, to \$16 M and was used primarily to defray the costs of commitments stemming from agreements with the MTQ.

We were unable to assess the specific impact of underinvestment on the condition of structures since 2008. Data for January 2011 presented in Table 2 cannot be compared with the desired condition shown in Table 7, because changes were made to structure classification in 2010 that skews the comparison.

The budget for 2011 is \$29,000,000 (Chart 1) and is meant to cover minor responses required in the short term on infrastructures in critical condition. The Direction des transports estimates that

this level of investment is not enough to maintain the assets in their current condition. Instead it is likely to drive down the percentage of structures in good condition from 78% to approximately 70% over 10 years.

FINDING

To date, there remains a gap between the established levels of investment and the 2008 Transportation Plan guidelines, which focus on returning structures to good condition. No commitment has been made regarding the service level or desired condition for all structures and, consequently, the effect on the level of long-term investment that will be needed.

Several sources agree on the importance of settling these points:

- The *National Guide to Sustainable Municipal Infrastructure* stipulates that levels of service related to the condition of infrastructure must be established prior to determining and prioritizing needs. This activity must take into account a number of factors, such as the city's strategic directions, the condition of the network and available funds. The Guide specifies that City Council must approve service levels to give them legal status.
- In June 2010, the finance committees established 15 guidelines for city administration directions and Montréal's 2011 financial framework. Among these is the need for services and service levels to be clearly established.
- In its Equipment and Infrastructure Policy, which came into force on January 30, 2009, the Direction generale pointed to the need to set clear objectives for the condition in which the city's capital assets should be maintained.
- The Service des finances drafted a new financial policy for the 10-year investment plan setting funding objectives that would help determine a desired level of investment, to be approved by the Executive Committee at the end of August 2010.

FINDING

Ultimately, municipal decision makers failed to clearly and specifically approve the service level (desired state of the network) and long-term investment level, contrary to what leading expert sources suggest and what was proposed in a long-term investment planning process that took place in summer 2010. Without specific objectives, it is difficult to determine the needs to be met, predict appropriate network responses to prioritize over the long term and strike a balance with investments.

FINDING

The low investment rates, from 2007 to 2010 in particular, are not in line with Division des ponts et tunnels objectives and 2008 Transportation Plan guidelines for the desired condition of structures for which the city is responsible.

To reverse the trend and halt deterioration, authorities must approve a desired level of service and long-term investment levels so that those in charge can:

- plan priority responses in a timely manner within a comprehensive response strategy
- assess whether clear objectives have been achieved

3.6.2.B. Recommendations

To plan and implement priority responses in a timely manner and halt structure deterioration and the growth of a maintenance deficit, we recommend that the Direction générale:

- **translate the directives of the Transportation Plan into specific service objectives**
- **set a desired long-term investment level**
- **seek City Council approval for the service level and long-term investment level**
- **evaluate results annually**

3.6.2.C. Action Plan of the Relevant Business Unit

[TRANSLATION] “The Direction des transports will update the investment plan for bridges and tunnels for the ‘Development of a 10-year investment plan’ project. The update will take the Auditor General’s remarks into account and include, in particular, the appropriate cost-benefit analyses and an annual updating process.

City Council arbitrations, decisions and approvals will be part of current operating budget and TCWP processes. The ‘Development of a 10-year investment plan’ is part of that process and is a valuable information tool for elected officials.

In September 2010, various organizational performance initiatives were launched by the Direction générale. One of these dealt with the ‘Development of a 10-year investment plan.’ The aim of the city’s long-term investment planning process is to help city administrators prepare response plans to maintain and develop its assets, i.e., city infrastructure and equipment that it owns, for a period of up to 10 years.

This process will also allow the city administration to adopt investment management policies that will ensure an optimal condition level for its assets. This process covers all business units and all categories of assets and investments.” (Planned completion: February 2012)