Office of the Auditor General/Bureau du vérificateur général

AUDIT OF THE BRIDGE MAINTENANCE PROCESS

2009

VÉRIFICATION DU PROCESSUS D'ENTRETIEN DES PONTS

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EXECUTIVE SUMMARY

Introduction

The Office of the Auditor General (OAG) had originally identified an audit of the Bridge Maintenance Process in the 2008 Audit Plan that was presented to Council.

Provincial Requirements

Maintenance and inspection of municipal bridges and other similar structures are carried out in accordance with provincial legislation and regulations, and standards set by the Ministry of Transportation of Ontario (MTO) Provincial legislation regarding the inspection and maintenance of bridges comprise Public Transportation and Highway Improvement Act, R.S.O. 1990, c. P.50 and Standards for Bridges, Ontario Regulation 104/97. The Regulation specifically refers to standards set by MTO in publications on this subject, including the Ontario Structure Inspection Manual, the Structural Manual and Structure Rehabilitation Manual, and the Ontario Bridge Management System. In addition, the Province of Ontario adopted the Canadian Highway Bridge Design Code as the bridge design code, subject to modifications noted in the Structural Manual.

Ontario Regulation 104/97, as amended, requires that the design, evaluation, construction, inspection or rehabilitation of a bridge shall conform to the Canadian Highway Bridge Design Code and the standards set out in the MTO's manuals and standards. The structural integrity, safety, and condition of every bridge shall be determined through the performance of at least one inspection in every second calendar year under the direction of a professional engineer and in accordance with the Ontario Structure Inspection Manual. The Regulation indicates that the design, evaluation, construction, inspection, or rehabilitation of a bridge may vary from the MTO manuals and standards where the variation is not a marked departure from the MTO manuals and standards and the variation does not adversely affect the safety and mobility of people and goods.

Bridge Maintenance Responsibilities

The City's Infrastructure Services Branch (now the Infrastructure Services Department)[1] is responsible for the maintenance of bridges, culverts, retaining walls, and the structural components of transit stations. Architectural, electrical, mechanical components are maintained by the Real Property Asset Management Branch.

[1] The Infrastructure Services Branch is now the Infrastructure Services Department. The Infrastructure Management Division has been renamed Asset Management Branch. However, in this report we maintain the titles they had during the audit.

Bridge Maintenance includes all the systems and tasks that the City undertakes to prevent the development of defects or prevent the deterioration of a structure or its components. Repair is any modification, alteration, retrofitting or improvement to a component of the structure which is aimed at correcting existing defects or deficiencies. Rehabilitation is any modification, alteration, retrofitting or improvement to a structure sub-system or to the structure which is aimed at correcting existing defects or deficiencies. The entire system constitutes the Bridge Asset Management System.

The business units responsible for the Bridge Maintenance Process are the Infrastructure Management Division (IM) and the Construction Services Division of the Infrastructure Services Branch (ISB).

Bridge Maintenance Process

The Ministry of Transportation defines a structure as a bridge or culvert with a span of 3.0 m or greater. In addition, the Infrastructure Services Branch defines a bridge-culvert as a structure having more than 0.6 m of fill above the structure deck. The City owns approximately 750 bridges and bridge culverts; of these, approximately 527 are bridges.

The Infrastructure Services Branch defines bridge renewal as "Replacement, rehabilitation, or repairs resulting in the upgrading of the serviceability, durability or strength of a structure" in the Guidelines for Renewal Options Analysis, 2007. In addition, ISB classifies the structural renewal options into Minor and Major Rehabilitation and Replacement. Operational maintenance and repairs are performed by the Surface Operations Branch, based on operational needs and needs identified by their field staff, by 311 service requests, or in conjunction with staff in the Infrastructure Management Division.

The Infrastructure Services Branch indicated that it inspects the bridge and bridge culverts every two years or more frequently depending on the structure condition. This was confirmed during the audit.

As a component of the bridge asset management process, IM uses the Structure Information Management System (SIMS), a database prepared based on the former Municipal Bridge Assessment Data Entry System (MBADES). Currently the City is developing the Integrated Infrastructure Management System; one of the components of the system will be the Bridge Asset Management software upgrade.

Audit Objectives

Audit Objective #1: Examine and evaluate the studies, processes and methodologies pertaining to the Bridge Maintenance Procedures followed by the City.

Audit Objective #2: Determine whether the studies, processes and methodologies are consistent and compliant with all relevant policies, procedures, legislation and regulations**.**

Audit Objective #3: Examine representative reports, studies, and designs to determine if they are consistent with relevant policies, procedures, legislation, and regulations**.**

Audit Objective #4: Examine representative maintenance contracts to determine if the maintenance recommendations were fully implemented**.**

Audit Objective #5: Examine the implementation of the maintenance recommendations and the procedures used to record them in the structure database**.**

Audit Scope

The scope of the audit comprised the overall City processes used for the maintenance of the City's bridge and bridge culvert structures, including the bridge inspections, bridge database, methodology used for assigning maintenance priority, bridge rehabilitation processes, and bridge rehabilitation contract oversight and control. The audit examined both bridges and bridge-culverts as defined above.

The audit encompassed the following tasks:

- Review legislative framework;
- Review background data;
- Conduct interviews with individuals involved in the projects; and,
- Review project data for representative structures in the seven year cycle (2001 – 2007).

The file sample examined consisted of:

- Nine minor rehabilitations;
- Nine major rehabilitations (including the structure identified in the Fraud and Waste Hotline report);
- Five replacements; and,
- Eleven structures where the work consisted of operational maintenance or work done in conjunction with road maintenance (for instance, repaving of a section of road included repaving of a bridge deck).

Of the 34-structure sample, seven were bridge-culverts.

It is important to note that the audit did not include a physical inspection of the structures and the condition of the structures was not confirmed during the audit.

Summary of Key Findings

1. The Province of Ontario requires that all bridges be inspected at least every two calendar years, using the procedures in the Ontario Structure Inspection Manual (OSIM). This requirement is defined in the Public Transportation and Highway Improvement Act, R.S.O. 1990, c. P.50 under Standards for Bridges, Ontario Regulation 104/97. The Regulation allows use of procedures that depart from the OSIM procedures, where the procedures are not a marked departure from OSIM.
2. The inspections required every two calendar years are detailed visual inspections. Other inspections are carried out based on the results of the visual inspections and may include detailed condition assessments.
3. The Structure Information Management System was developed based on the former provincial database (Municipal Bridge Assessment Data Entry System or MBADES). SIMS was established for the City as part of the preparations for the Year 2000; the timing also was concurrent with the period during which the responsibility for the bridge inspections and database were transferred to the municipality.
4. SIMS follows the bridge appraisal system used in the MBADES database. Due to limitations in the database system, the data does not reflect the structure inspection system required by the current Ontario Structure Inspection Manual.
5. The City does not follow OSIM for the structure detailed visual inspections that are required at least once in every two calendar years. Instead, the City uses the methodology used for the MBADES system, comprising rankings of the various components of structures. Ranking ranges from 1 for a structure component in critical condition to 6 for a component in excellent condition. A ranking of 0 indicates that the specific item is not applicable.
6. The MBADES methodology provides inspection data and structure appraisal values that rely on subjective ranking assignments, rather than the more objective OSIM system, which provides evaluation of specific structural components, and any defects they may have.
7. The fact that the City does not follow the current OSIM for the bridge detailed visual inspections is allowed by the Regulation; however, the methodology used by the City, based on MBADES does not meet the requirements of the Regulation. Therefore, the system in use by the City does not meet Provincial legislative requirements.
8. We contacted the Ministry of Transportation's office in Kingston and St. Catharines. Discussions revealed that MTO does not consider that the old method of using Condition Ratings for the structure inspections is equivalent to the requirements of the OSIM and Ontario Regulation 104/97 as amended. The

MTO indicated that methods which would qualify as alternatives within Ontario Regulation 104/97 are methods that also use detailed visual inspections of structure elements and that give a quantitative indication of the percentage of each element that has defects. The Ministry of Transportation indicated that use of MBADES for structure inspections does not meet the requirements of OSIM and the Regulation.

9. The method used by the City for ranking of structures to set their priority for maintenance and renewal is based on data mining and analysis software external to SIMS.

10. The Senior Engineer responsible for maintenance of SIMS and for the ranking of the structures was the only person fully trained in the overall system. As the system requires professional judgement in the assignment of risk values, the fact that no other person was trained to manage SIMS and the attached processes constituted a concern.

11. During this audit, the Senior Engineer resigned; as a result, for a time thereafter it was necessary for two staff persons to maintain the database. These two staff persons were required to add the database maintenance duties to their regular duties. The Senior Engineer position was filled in late 2008 by promoting a Project Manager in Construction Services.

12. Application of the Guidelines for Renewal Options Analysis and the Project Management Manual have improved the uniformity of the filing and record-keeping methods used by different project managers. However, the City should improve the controls to ensure consistency between the project managers, as the quality of filing varies substantially.

13. Based on our sample, the studies, processes and methodologies used to manage the bridge assets are not always consistent and compliant with relevant policies, procedures and regulations, as noted below. The following table summarizes the results of our review:

Criteria	Number of Applicable Structures	Number of non-compliant Structures in relation to policies, procedures, and regulations	Percent Non-Compliant (Error Rate)
Inspections Interval	34	0	0.0%
Condition Survey	19	2	10.5%
Renewal Options Report	21	3	14.3%
Detail Design	30	4	13.3%
Contract Tendered	27	2	7.4%

Criteria	Number of Applicable Structures	Number of non-compliant Structures in relation to policies, procedures, and regulations	Percent Non-Compliant (Error Rate)
Construction Done	27	0	0.0%
Inspections done by City	26	3	11.5%
Inspections by outside firm	26	4	15.4%
Shop Drawings	23	3	13.0%
Quality Assurance	25	11	44.0%
Records of construction	25	5	20.0%
As-Built Drawing on File	30	9	30.0%
Renewal Info to Database	33	0	0.0%

14. Of the 34 structure files examined, only 3 files could be considered fully complete, in that all the information required to be filed was included in the file. All other files reviewed were missing one or more items that they were expected to contain. The complete files tend to be the most recent ones and those for more important projects (for example, the Laurier Avenue Bridge and the Green Creek bridge).

15. Some as-built record drawings have not been included in the network server, although the copy marked up with red pencil or ink (known as the red-lined copy) is available. A checklist or similar method may help in confirming to the program manager that all steps have been completed. In this regard, it is noted that the City already has procedures in the Project Manager Procedures Manual, but these are not being followed consistently.

16. Some records of quality assurance procedures have not been filed properly and could not be found. Consistent filing systems, as are now being implemented, should provide improvement of this issue.

17. Two structures had no information at all in their files. Information about the structures was included in the SIMS database, but there was no supporting data in the files. The structures had not had renewal work done since they were built circa 1975. Nevertheless, the City should have as a minimum a set of the original construction drawings on file. If none are available, the City should prepare the drawings from field information.

18. In two of the structures reviewed, the renewal work done in 2007 was resurfacing, completed as part of the road resurfacing contract. No condition

survey or renewal options work was done to confirm that resurfacing was the only work required. We noted that the latest inspection sheets indicated a rating of "Very Good" for one of the structures (Structure No. 056060), but some repairs were required for the other (Structure No. 016200). We found no confirmation that the repairs were completed.

19. IM indicated that, although the Structure Inspections do not follow OSIM, the Condition Survey included a detailed survey of the structure using OSIM forms and methodology. Our review of Detailed Condition Survey reports showed that generally this is the case, but we found three cases in which the OSIM forms were not used in the Condition Survey.

20. Replacement of culverts during road reconstruction contracts did not receive as strict review by IM as when the structures are examined independently of the road contract. Three bridge-culvert reconstruction or extension contracts in the sample were part of road reconstruction or widening contracts. We found that in those cases the investigation of renewal options was not done with the same level of detail as when structures are analysed independent of the road work. In addition, the construction inspection, the field inspection records, review of shop drawings, and quality assurance records were not kept as well in those three cases as for other bridges or bridge-culverts.

21. One of the bridge-culverts, the Castlefrank Road culvert in Glen Cairn, was designed as part of the flood control project. In reviewing the reports and options examined, we concluded that the range of options reviewed could have included alternatives that were not examined. Some of the construction difficulties encountered may have been avoided this way. In our opinion, IM should be involved in the assessment of replacement options in similar cases.

22. In the case of the Fortune Street culvert, the design of the culvert replacement was carried out by a firm which did not have the qualifications and experience to complete the work, as evidenced by the fact that they had to retain a specialist firm to undertake a review of their design.

23. In three cases the renewal options report was required by the Request for Quotations (or Request for Service) issued by the City, and was included as a task in the Offer of Services or Proposal by the consultant, but was not produced. In the three cases noted, when we noted that the renewal options reports were not in the files, the City indicated to us that the renewal options report were not required, when in fact it was. Subsequently, the City provided the required reports.

24. In two cases, the files were not provided for our review because they were held by the Legal Services Branch due to the existence of outstanding construction claims. We note that both files were managed by the same Project Manager. The two files noted above were provided for our review upon further request. It

was found that these two files are incomplete. Specifically, the files did not include records of quality assurance for concrete and asphalt; the inspector notes indicate that the information was received, but it is not in the files. The City subsequently clarified that only one file was held by Legal Services.

25. In one case (Structure 757210) we found no data at all in the file. The City indicated that this was the result of file retention policies. However, we noted that other two structures of approximately the same age did have part of their files available (these files also were not complete).

26. The City indicated that the File Retention Policies are based on the City's Records Management Policy, 2003. The Records Management Policy refers to the City's records retention and disposition schedule, which indicates that structure records must be kept inactive for 25 years. On this basis, the absence of records is appropriate. However, we note that records that are considered to have archival importance should not be destroyed. Since the structure (Structure 757210) was transferred in 2000, the structure records should have been available.

Recommendations and Management Responses

Recommendation 1

That the City ensure that the management of the database be fully documented in a manual and that training of the use of the database plus ranking of projects be provided to more than one person in the Infrastructure Management Division.

Management Response

Management agrees with the recommendation.

With the realignment that took place earlier this year in the Infrastructure Services Department (ISD), the former Infrastructure Management Division is now the Asset Management Branch (AMB). AMB has developed documentation on the management of the database. This documentation is expected to evolve as AMB migrates to a new structures management system in Q2 2011.

Within AMB, an intermediate level structural engineer reporting to the senior structural engineer has been created and staffed. This individual continues to be involved in the management of the database and on the prioritization of renewal projects.

Recommendation 2

That the City carry out bridge detailed visual inspections in accordance with current Ontario Structure Inspection Manual procedures to remove subjectivity of appraisals and to meet the requirement of current Provincial regulations.

Management Response

Management agrees with the recommendation.

AMB is working on modifications to its business processes and structures management system to align its visual inspections with the most recent Ontario Structures Inspection Manual (OSIM) requirements. AMB applies the OSIM requirements as part of detailed bridge condition assessments that take place prior to identifying specific renewal requirements.

The City is in the process of implementing a new Integrated Infrastructure Management System (IIMS). The structures management system is being implemented to align with the new IIMS. Funding for the new structure management system has been identified in the 2010 draft capital budget and the new system is expected to be completed by (Q2) 2011, subject to progress on the IIMS.

Recommendation 3

That the City ensure that the updated Structure Asset Management Database currently under development be provided with the capabilities required to remove the need for data mining and analysis using external software.

Management Response

Management agrees with the recommendation.

The new structures management system will have all the capabilities required for data management and analysis.

The City is in the process of implementing a new Integrated Infrastructure Management System (IIMS). The structures management system is being implemented to align with the new IIMS. Funding for the new structures management system has been identified in the 2010 draft capital budget and the new system is expected to be completed by (Q2) 2011, subject to progress on the IIMS.

Recommendation 4

That the City ensure that bridge-culvert projects undertaken as part of a road reconstruction project be reviewed in detail to confirm that the planning and design of the structure meets the requirements of the *Guidelines for Infrastructure Renewal Options Analysis.*

Management Response

Management agrees with the recommendation. This recommendation is consistent with Infrastructure Services' current procedure.

Recommendation 5

That the City implement a checklist or other management process to allow the program manager and the project manager to confirm that the inspection process has been completed, including the preparation of the As-Built drawings.

Management Response

Management agrees with the recommendation.

Infrastructure Services Department (ISD) has a Project Management Manual in place which defines project management requirements, communicates expectations and fosters consistency on all projects. The above-referenced requirements will be included in the manual by Q4 2010.

Recommendation 6

That the City ensure that the project files are set up, maintained, and complete in accordance with the City's policies and procedures and the Project Management Manual.

Management Response

Management agrees with the recommendation.

Infrastructure Services continues to improve adherence to proper project filing practices. While the audit concludes that only 3 of 34 structure files examined were complete in all aspects, it is noted that these structures span many decades and that filing practices have evolved over time. The four complete structure files represent projects undertaken since amalgamation and the adoption of the Project Management Manual in early 2006. The other 30 files contained over 85% of the required information.

Project filing requirements will be reviewed and reinforced in the Project Management Manual by Q4 2010.

Conclusion

The audit revealed that the Bridge Maintenance Process used by the City of Ottawa's Infrastructure Management Division is being used for the maintenance of the City bridges. However, the database management and structure ranking for setting of renewal priorities is cumbersome. Generally, we found that the City's overall bridge maintenance process has the necessary policies and procedures, but they are not being followed consistently. The variability in the application of the City's policies and procedures by different project managers results in a high error rate in the application of the policies and procedures and the Project Management Manual. We found only 3 of 34 structure files examined were complete in all aspects. The procedures used and the filing systems of the City require

improvements to ensure that the policies and procedures and the Project Management Manual of the City are followed by all project managers.

The bridge inspection process and records for the detailed visual inspections do not comply with Provincial regulations and the Ontario Structure Inspection Manual. The City must change this procedure as soon as possible to be compliant.

Acknowledgement

We wish to express our appreciation for the cooperation and assistance afforded the audit team by management and staff.

RÉSUMÉ

Introduction

Le Bureau du vérificateur général (BVG) avait inclus à l'origine une vérification du processus d'entretien des ponts dans le plan de vérification 2008 présenté au Conseil municipal.

Exigences provinciales

L'entretien et l'inspection des ponts municipaux et d'autres ouvrages similaires sont assurés conformément aux lois et règlements provinciaux et aux normes établies par la législation du ministère des Transports de l'Ontario (MTO) relativement à l'inspection et à l'entretien des ponts contenues dans la *Loi sur l'aménagement des voies publiques et des transports en commun*, L. R. O. 1990, ch. P.50 et du règlement de l'Ontario 104/97, *Standards for Bridges*. La réglementation fait directement référence aux normes précisées par le MTO dans les publications portant sur cette question, notamment dans l'*Ontario Structure Inspection Manual*, dans le *Structural Manual* et dans le *Structure Rehabilitation Manual*, de même que dans l'*Ontario Bridge Management System* (OBMS). De plus, le gouvernement de l'Ontario a adopté le *Code canadien sur le calcul des ponts routiers* à titre de code sur le calcul des ponts routiers, sous réserve des modifications inscrites dans le Manuel relatif aux éléments structuraux.

Le règlement de l'Ontario 104/97, tel que modifié, exige que la conception, l'évaluation, la construction, l'inspection ou la réhabilitation d'un pont soit conforme au *Code canadien sur le calcul des ponts routiers* et aux normes précisées dans les manuels et dans les normes du MTO. L'intégrité, la sécurité et la condition structurelles de chaque pont doivent être évaluées dans le cadre d'au moins une inspection toutes les deux années civiles réalisée sous la supervision d'un ingénieur professionnel et conformément à l'*Ontario Structure Inspection Manual*. Le règlement stipule qu'il peut y avoir des variations quant à la conception, l'évaluation, la construction, l'inspection ou la réhabilitation d'un pont par rapport aux normes et aux manuels du MTO si ces variations ne constituent pas un écart trop marqué par rapport à ces derniers et qu'elles n'ont pas d'effets négatifs sur la sécurité et sur la mobilité des biens et des personnes.

Responsabilités relatives à l'entretien des ponts

La Direction des services d'infrastructure de la Ville (qui porte maintenant le nom de Services d'infrastructure)[2] est responsable de l'entretien des ponts, ponceaux,

[2] La direction des services d'infrastructure porte maintenant le nom de Services d'infrastructure. Le nom de la Division de la gestion de l'infrastructure a été changé pour Direction de la gestion des biens. Nous avons toutefois gardé à chaque service le nom qu'il portait au moment de la vérification.

murs de soutènement et composants structurels des stations du couloir de transport en commun. L'entretien des composantes architecturales, électriques et mécaniques est assuré par la Direction de la gestion des biens immobiliers.

L'entretien des ponts regroupe tous les systèmes et les tâches entreprises par la Ville pour prévenir les défectuosités ou la détérioration d'un ouvrage et de ses composants. Par réparation, on entend toute modification, transformation, rénovation ou amélioration apportées à une composante d'un ouvrage et visant à corriger des défectuosités ou des anomalies existantes. La réhabilitation comprend toute modification, transformation, rénovation ou amélioration apportée au sous-système d'un ouvrage ou à l'ouvrage lui-même et visant à corriger des défectuosités ou des anomalies existantes. Ce système global constitue le Système de gestion des ponts.

Les unités opérationnelles responsables du processus d'entretien des ponts sont la Division de la gestion de l'infrastructure et la Division des services de construction de la Direction des services d'infrastructure (DSI).

Le processus d'entretien des ponts

Le ministère des Transports définit un ouvrage comme étant un pont ou un ponceau d'une envergure de 3 mètres ou plus. De plus, la Direction des services d'infrastructure définit un ponceau comme un ouvrage présentant une cavité de plus de 0,6 mètres au-dessus du tablier de sa structure. La Ville possède environ 750 ponts et ponceaux; de ce nombre, 527 sont des ponts.

Dans les lignes directrices pour l'analyse des possibilités de renouvellement (*Guidelines for Renewal Options Analysis*) de 2007, la Direction des services d'infrastructure définit le renouvellement d'un pont par le « remplacement, la réhabilitation ou la réparation entraînant une amélioration de la fonctionnalité, de la durabilité ou de la force de sa structure ». De plus, la DSI classe les options de renouvellement des ouvrages par catégories : réhabilitation mineure ou majeure, et remplacement. L'entretien général et les réparations sont effectués par la Direction des opérations de surface en fonction des besoins opérationnels et des besoins cernés par le personnel sur le terrain, des demandes générées par le 3-1-1 ou en collaboration avec le personnel de la Division de la gestion de l'infrastructure.

La Direction des services d'infrastructure a indiqué qu'elle inspecte les ponts et des ponceaux tous les deux ans et plus fréquemment selon l'état de leur structure. Cette information a été confirmée au cours de la vérification.

En tant que composante du processus de gestion des ponts, la Gestion de l'infrastructure (GI) a recours au système de gestion de l'information sur les ouvrages (*Structure Information Management System,* ou SIMS), une base de données préparée en s'inspirant de l'ancien MBADES – le système d'entrée de données sur l'évaluation des ponts municipaux (*Municipal Bridge Assessment Data Entry System*).

Présentement, la Ville travaille à l'élaboration d'un système intégré de gestion des infrastructures (*Integrated Infrastructure Management System*); l'une des composantes de ce système sera la mise à niveau du logiciel de gestion des ponts.

Objectifs de la vérification

Objectif 1 : Vérifier et évaluer les études, processus et méthodes relatifs aux procédures d'entretien des ponts utilisés par la Ville.

Objectif 2 : Déterminer si ces études, processus et méthodes sont compatibles avec toutes les politiques, procédures, législations et règlements pertinents et s'ils s'y conformes.

Objectif 3 : Vérifier les rapports et études représentatifs et les conceptions afin de déterminer s'ils sont compatibles avec les politiques, procédures, législations et règlements pertinents.

Objectif 4 : Vérifier les contrats d'entretien représentatifs afin de déterminer si les recommandations relatives à l'entretien ont été adéquatement mises en œuvre.

Objectif 5 : Vérifier la mise en œuvre des recommandations ayant trait à l'entretien et les procédures utilisées pour consigner le tout dans la base de données des ouvrages.

Portée de la vérification

La portée de la vérification englobait l'ensemble des processus utilisés par la Ville pour l'entretien des ouvrages des ponts et ponceaux de la Ville, dont les inspections des ponts, les bases de données les concernant, la méthodologie utilisée pour établir les priorités en matière d'entretien, les processus de réhabilitation des ponts de même que la surveillance et le contrôle des contrats de réhabilitation de ces ouvrages. La vérification a porté sur les ponts et sur les ponceaux tels que définis ci-dessus.

La vérification couvrait les tâches suivantes :

- examen du cadre législatif;
- revue des données documentaires;
- réalisation d'entrevues avec les personnes participant aux projets; et,
- examen des données de projets des ouvrages représentatifs, sur sept ans (2001 – 2007).

L'échantillon de dossiers vérifiés comprenait :

- neuf projets de réhabilitation mineurs;
- neuf projets de réhabilitation majeurs (incluant la Ligne directe de fraude et d'abus);

- cinq remplacements; et,
- onze structures pour lesquelles le travail consistait en des travaux d'entretien ou des travaux effectués conjointement avec des travaux d'entretien routiers (refaire le revêtement d'une section de la route et du même coup celui du tablier d'un pont, par exemple).

Des 34 ouvrages choisis comme échantillons pour la vérification, sept étaient des ponceaux.

Il est important de noter que la vérification n'incluait pas une inspection physique des ouvrages et que leur condition n'a pas été confirmée au cours de la vérification.

Sommaire des principales constatations

1. Le gouvernement de l'Ontario exige que tous les ponts soient inspectés au moins une fois tous les deux années civiles, selon la procédure prévue dans l'*Ontario Structure Inspection Manual* (OSIM). Cette exigence est précisée dans la *Loi sur l'aménagement des voies publiques et des transports en commun*, L. R. O. 1990, ch. P.50 et du règlement de l'Ontario 104/97 sous *Standards for Bridges*. Le règlement permet le recours à des procédures qui dérogent aux procédures de l'OSIM, pourvu qu'elles ne s'en éloignent pas trop.
2. Les inspections requises toutes les deux années civiles sont des inspections visuelles détaillées. D'autres inspections sont réalisées en fonction des résultats des inspections visuelles et peuvent inclure des évaluations plus détaillées de l'état des ouvrages.
3. Le SIMS a été créé à partir de l'ancienne base de données provinciales (la MBADES, ou *Municipal Bridge Assessment Data Entry System*, soit le système d'entrée de données sur l'évaluation des ponts municipaux). Le SIMS a été créé pour la Ville dans le cadre de sa préparation à l'an 2000; ces changements coïncidaient avec la période au cours de laquelle la responsabilité de la base de données et de l'inspection des ponts a été transférée à l'administration municipale.
4. Le SIMS fonctionne suivant le même mécanisme d'évaluation que celui utilisé pour la MBADES. En raison des limites du système de base de données, les données ne reflètent pas le système d'inspection des ouvrages exigé dans l'*Ontario Structure Inspection Manual*.
5. La Ville ne suit pas les directives de l'OSIM pour l'inspection visuelle détaillée des ouvrages exigée au moins une fois toutes les deux années civiles. Elle a plutôt recours à la méthodologie utilisée pour le système de la MBADES, laquelle comprend un système de cotes pour les diverses composantes des ouvrages. Ce classement va de 1 pour une composante détériorée de façon importante, à 6 pour une composante en excellente condition. Le zéro (0) indique que la composante en question ne s'applique pas.

6. La méthodologie de la MBADES fournit des données d'inspection et des valeurs d'évaluation de l'ouvrage qui reposent sur une attribution subjective de cotes au lieu de notes plus objectives comme c'est le cas avec l'OSIM, qui assure l'évaluation de composantes structurelles précises et de toute anomalie pouvant y être constatée.
7. La réglementation permet à la Ville de ne pas suivre les directives de l'OSIM pour l'inspection visuelle détaillée des ponts; toutefois, la méthodologie utilisée par la Ville, en fonction de la MBADES, ne satisfait pas aux exigences de la réglementation. Par conséquent, le système utilisé par la Ville ne répond pas non plus aux exigences législatives provinciales.
8. Nous avons communiqué avec les bureaux du ministère des Transports à Kingston et St. Catharines. Nos discussions ont révélé que le MTO ne considère pas que l'ancienne méthode consistant à attribuer des notes aux conditions des ouvrages lors de leur inspection est équivalente aux exigences de l'OSIM ou du règlement de l'Ontario 104/97 tel que modifié. Le MTO a indiqué que les autres méthodes qui seraient jugées admissibles en vertu du règlement de l'Ontario 104/97 sont celles où on effectue aussi une inspection visuelle détaillée des éléments de l'ouvrage, qui donne une indication quantitative du pourcentage de chaque élément de l'ouvrage présentant des anomalies. Le ministère des Transports a fait savoir que l'utilisation de la MBADES pour les inspections des ouvrages ne satisfait pas aux exigences de l'OSIM, ni de la réglementation.
9. La méthode utilisée par la Ville pour l'attribution de cotes aux ouvrages en vue de préciser les priorités en matière d'entretien et de renouvellement repose sur l'exploration de données et sur un logiciel d'analyse extérieur au SIMS.
10. L'ingénieur principal responsable de l'entretien du SIMS et du classement des ouvrages était la seule personne entièrement formée sur le système dans son ensemble. Puisque ce système exige un jugement professionnel pour l'attribution de valeurs de risque, le fait qu'aucune autre personne ne soit formée pour la gestion du SIMS et des processus qui s'y rattachent constitue un problème.
11. Au cours de la vérification, l'ingénieur principal a démissionné, ce qui a fait en sorte que pour quelque temps par la suite, deux membres du personnel étaient nécessaires pour assurer le maintien de la base de données. Ces deux personnes ont dû ajouter la gestion de la base de données à leurs tâches habituelles. Le poste d'ingénieur principal a été pourvu à la fin de 2008 par la promotion d'un gestionnaire de projet des Services de construction à ce poste.
12. L'application des Lignes directrices pour l'analyse des possibilités de renouvellement et du Manuel sur la gestion de projet (*Guidelines for Renewal Options Analysis and the Project Management Manual*) a amélioré l'uniformité des méthodes de classement et de tenue des dossiers utilisées par les divers

gestionnaires de projet. Toutefois, la Ville devrait améliorer les contrôles en vue d'assurer la cohérence entre les divers gestionnaires de projet, puisque la qualité des activités de classement varie grandement.

13. En fonction de notre échantillon, les études, procédés et méthodologies utilisées pour la gestion des ponts ne sont pas toujours uniformes et conformes aux politiques, aux procédures et à la réglementation existantes, comme on peut le voir ci-dessous. Le tableau ci-dessous résume les résultats de notre vérification :

Critère	Nombre d'ouvrages applicables	Nombre d'ouvrages non conformes en matière de politiques, procédures et réglementation	Pourcentage d'ouvrages non conformes (marge d'erreur)
Intervalle des inspections	34	0	0,0 %
Enquête sur l'état	19	2	10,5 %
Rapport sur les possibilités de renouvellement	21	3	14,3 %
Détails de la conception	30	4	13,3 %
Contrat soumissionné	27	2	7,4 %
Construction réalisée	27	0	0,0 %
Inspections réalisées par la Ville	26	3	11,5 %
Inspections réalisées par une firme externe	26	4	15,4 %
Dessins d'atelier	23	3	13,0 %
Assurance qualité	25	11	44,0 %
Dossiers de construction	25	5	20,0 %
Dessins d'ouvrage fini (« tels que construits ») en dossier	30	9	30,0 %
Renseignements sur le renouvellement dans la base de données	33	0	0,0 %

14. Des 34 dossiers d'ouvrages vérifiés, trois seulement pouvaient être considérés comme complets, c'est-à-dire que toute l'information nécessaire se trouvait dans le dossier. Dans tous les autres, il manquait au moins un élément que le dossier devait normalement contenir. Les dossiers complets étaient surtout des dossiers

récents ou concernant des ouvrages plus importants (le pont de l'avenue Laurier ou celui de Green Creek, par exemple).

15. Certains dessins d'ouvrages finis (« tels que construits ») n'avaient pas été inclus dans le serveur du réseau, même si la copie telle qu'annotée au stylo ou à l'encre rouge (« red-lined copy ») est disponible. Une liste de vérification ou une autre méthode du genre pourrait aider à confirmer au gestionnaire de programme que toutes les étapes ont été franchies. À cet égard, on souligne que la Ville dispose déjà de procédures dans le Manuel de procédures du gestionnaire de projet (*Project Manager Procedures Manual*), mais ces procédures ne sont pas suivies de façon uniforme.

16. Certaines données de procédures d'assurance qualité n'ont pas été classées correctement et ne peuvent être retracées. Des systèmes de classement uniformes, comme ceux qui sont présentement mis en place, devraient contribuer à améliorer la situation.

17. Les dossiers de deux des ouvrages ne contenaient aucune information. Des renseignements sur les ouvrages étaient inclus dans la base de données du SIMS, mais rien ne venait l'appuyer dans leur dossier. Ces ouvrages n'avaient subi aucune rénovation depuis leur construction, vers 1975. Néanmoins, la Ville devrait avoir, au minimum, un ensemble de dessins originaux de ces ouvrages en dossier. Si aucun n'est disponible, la Ville devrait faire préparer des dessins à partir de données recueillies sur place.

18. Pour deux des ouvrages vérifiés, les travaux de réfection réalisés en 2007 consistaient en un renouvellement de la couche de surface, réalisé dans le cadre de travaux similaires sur la route. Aucun relevé des conditions existantes ni travail relatif aux possibilités de renouvellement n'avait été effectué pour confirmer que le renouvellement de la couche de surface était le seul travail nécessaire. Nous avons constaté que sur les dernières fiches d'inspection, la cote très bon avait été attribuée à l'un des ouvrages (n° 056060), et que certains travaux de réparation étaient nécessaires pour l'autre ouvrage (n° 016200). Nous n'avons trouvé aucune confirmation que les travaux en question avaient été exécutés.

19. La GI a indiqué que même si l'inspection des ouvrages ne respecte pas l'OSIM, le relevé des conditions existantes incluait une inspection détaillée de l'ouvrage à l'aide de formulaires et de la méthodologie de l'OSIM. Notre vérification des relevés détaillés des conditions existantes révèle que c'est généralement le cas, mais nous avons relevé trois cas où les formulaires de l'OSIM n'avaient pas été utilisés pour le relevé des conditions existantes.

20. Les contrats de remplacement des ponceaux au cours des travaux de reconstruction des routes n'ont pas fait l'objet d'un examen rigoureux de la part de la GI comme lorsque les ouvrages sont examinés indépendamment du

contrat de travaux routiers. Trois reconstructions de ponts et ponceaux ou prolongations de contrats parmi les échantillons retenus faisaient partie de travaux de reconstruction ou d'élargissement d'une route. Nous avons constaté que dans ces cas, une investigation des options de renouvellement possible n'avait pas été réalisée avec la même rigueur que lorsque les ouvrages sont analysés indépendamment des travaux routiers. De plus, l'inspection de la construction, les données relatives à l'inspection sur le terrain, la vérification des dessins d'atelier et les données d'assurance qualité n'étaient pas consignées correctement dans ces trois cas, comme pour les autres ponts et ponceaux.

21. L'un des ponceaux, celui du chemin Castlefrank à Glen Cairn, avait été conçu dans le cadre d'un projet de contrôle des inondations. En examinant les rapports et les options envisagées, nous en sommes venus à la conclusion que l'éventail de possibilités examinées aurait pu inclure d'autres avenues qui n'ont pas été étudiées. Certaines des difficultés rencontrées au cours de la construction auraient ainsi pu être évitées. À notre avis, la GI devrait être engagée dans l'évaluation des diverses possibilités de remplacement dans des cas similaires.

22. Dans le cas du ponceau de la rue Fortune, la conception pour son remplacement a été réalisée par une firme qui ne possédait ni les compétences ni l'expérience nécessaires pour mener à bien ce travail; le fait que cette entreprise a eu recours à une autre firme pour faire vérifier son travail de conception le confirme.

23. Dans trois cas, un rapport sur les options de renouvellement était exigé dans la demande de prix (ou la demande de service) émise par la Ville et faisait partie des tâches liées à l'offre de service ou à la proposition par le consultant, mais n'avait pas été produit. Dans les trois cas relevés, lorsque nous avons souligné le fait que les rapports sur les avenues possibles n'étaient pas dans le dossier, la Ville nous a dit que de tels rapports n'étaient pas nécessaires, alors qu'ils l'étaient. Plus tard, la Ville a fourni les rapports demandés.

24. Dans deux cas, les dossiers ne nous ont pas été remis pour vérification parce qu'ils étaient entre les mains de la Direction des services juridiques à la suite de réclamations en cours concernant la construction. Nous avons constaté que les deux dossiers étaient administrés par le même gestionnaire de projet. Ces deux dossiers nous ont été remis après une deuxième demande. Nous avons constaté qu'ils étaient incomplets. Plus précisément, ces dossiers n'incluaient pas les données relatives à l'assurance qualité pour le béton et l'asphalte; les notes de l'inspecteur indiquaient que ces renseignements avaient été obtenus, mais ils n'étaient pas dans le dossier. La Ville a ensuite précisé que seul un de ces dossiers était entre les mains des Services juridiques.

25. Dans un cas (ouvrage n^{o} 757210), nous n'avons trouvé aucune donnée dans le dossier. La Ville a expliqué le tout par des raisons de politiques de conservation des dossiers. Toutefois, nous avons noté qu'une partie des dossiers de deux

autres ouvrages ayant environ le même âge était disponible (mais ces deux dossiers n'étaient pas complets non plus).

26. La Ville a indiqué que les politiques de conservation des dossiers reposent sur la politique de gestion des dossiers de la Ville, qui date de 2003. Cette politique a trait au calendrier de conservation et de destruction des dossiers de la Ville, qui indique que les dossiers d'ouvrages doivent demeurer inactifs pour 25 ans. Si l'on tient compte de cette politique, l'absence de dossier est donc appropriée. Toutefois, nous soulignons que les dossiers considérés comme ayant une importance archivistique ne devraient pas être détruits. Puisque l'ouvrage en question (nº 757210) avait été transféré à la Ville en 2000, son dossier aurait dû être disponible.

Recommandations et réponses de la direction

Recommandation 1

Que la Ville s'assure que la gestion de la base de données est correctement documentée dans un manuel et que plus d'une personne au sein de la Division de la gestion de l'infrastructure bénéficie de la formation à l'utilisation de cette base de données et sache comment coter les projets.

Réponse de la direction

La direction accepte cette recommandation.

Avec les changements dans la composition du personnel qui a eu lieu plus tôt cette année aux Services d'infrastructure (SI), l'ancienne Division de la gestion de l'infrastructure est devenue la Direction de la gestion des biens (DGB). La DGB a préparé des documents sur la gestion de la base de données. On s'attend à ce que ces documents évoluent au fur et à mesure que la DGB migrera vers un système de gestion des nouveaux ouvrages, au cours du deuxième trimestre de 2011.

Au sein de la DGB, un poste d'ingénieur en structures intermédiaire, relevant de l'ingénieur en structures principal, a été créé et pourvu. Cette personne continue de participer à la gestion de la base de données et à la fixation de priorités dans les projets de renouvellement.

Recommandation 2

Que la Ville procède à une inspection visuelle détaillée des ponts, conformément aux procédures précisées dans l'*Ontario Structure Inspection Manual* (OSIM) afin de mettre un terme à la subjectivité des évaluations et de satisfaire aux exigences de la réglementation provinciale actuelle.

Réponse de la direction

La direction accepte cette recommandation.

La DGB travaille présentement à des modifications de ses processus administratifs et de son système de gestion des ouvrages en vue d'harmoniser les inspections visuelles aux exigences du plus récent *Ontario Structures Inspection Manual* (OSIM). La DBG applique les exigences de l'OSIM dans le cadre des évaluations détaillées de l'état des ponts qui a lieu avant que soient déterminées les exigences précises en matière de renouvellement.

La Ville procède actuellement à la mise en place d'un nouveau système intégré de gestion des infrastructures (*Integrated Infrastructure Management System*, ou IIMS). Le système de gestion des ouvrages est mis en place pour s'harmoniser au nouvel IIMS. Le financement pour ce nouveau système de gestion des ouvrages a été prévu dans le budget préliminaire d'immobilisations de 2010 et on s'attend à ce qu'il soit complété d'ici le deuxième trimestre de 2011, selon les progrès réalisés dans le déploiement de l'IIMS.

Recommandation 3

Que la Ville s'assure que la base de données de la gestion des ouvrages présentement en préparation est dotée des capacités requises afin qu'il ne soit plus nécessaire d'explorer et d'analyser les données à l'aide d'un logiciel externe.

Réponse de la direction

La direction accepte cette recommandation.

Le nouveau système de gestion des structures disposera de toutes les capacités nécessaires pour la gestion et l'analyse des données.

La Ville procède actuellement à la mise en place d'un nouveau système intégré de gestion des infrastructures (*Integrated Infrastructure Management System*, ou IIMS). Le système de gestion des ouvrages est mis en place pour s'harmoniser au nouvel IIMS. Le financement pour ce nouveau système de gestion des ouvrages a été prévu dans le budget préliminaire d'immobilisations de 2010 et on s'attend à ce qu'il soit complété d'ici le deuxième trimestre de 2011, selon les progrès réalisés dans le déploiement de l'IIMS.

Recommandation 4

Que la Ville s'assure que les projets de ponceaux entrepris dans le cadre d'un projet de reconstruction de route soient revus en détail afin de confirmer que la planification et la conception de l'ouvrage satisfont aux exigences des lignes directrices pour l'analyse des possibilités de renouvellement (*Guidelines for Renewal Options Analysis*).

Réponse de la direction

La direction accepte cette recommandation. Elle s'inscrit dans la procédure actuelle des Services d'infrastructure.

Recommandation 5

Que la Ville mette en place une liste de vérification ou un autre processus de gestion afin de permettre au gestionnaire de programme et au gestionnaire de projet de confirmer que le processus d'inspection a été achevé, y compris la préparation des dessins de l'ouvrage fini (« tel que construit »).

Réponse de la direction

La direction accepte cette recommandation.

Les Services d'infrastructure (SI) disposent d'un Manuel de gestion de projet qui précise les exigences liées à la gestion de projet, communique les attentes et favorise l'uniformité pour tous les projets. Les exigences mentionnées ci-dessus seront incluses dans le manuel d'ici le quatrième trimestre de 2010.

Recommandation 6

Que la Ville s'assure que les dossiers des projets sont créés, tenus à jour et complet conformément aux politiques et procédures de la Ville et au Manuel de gestion de projet.

Réponse de la direction

La direction accepte cette recommandation.

Le respect de pratiques adéquates pour la gestion des dossiers continue de s'accroître au sein des Services d'infrastructure. Si la vérification révèle que tous les aspects des dossiers n'étaient complets que dans 3 cas sur 34, on note toutefois que ces ouvrages s'étendent sur plusieurs décennies et que les pratiques en matière de gestion des dossiers ont évolué au fil du temps. Les quatre dossiers complets des ouvrages ont trait à des projets entrepris depuis la fusion et depuis l'adoption du Manuel de gestion de projet au début de 2006. Les 30 autres dossiers contenaient plus de 85 % des renseignements exigés.

Les exigences en matière de tenue de dossiers seront révisées et renforcées dans le Manuel de gestion de projet d'ici le quatrième trimestre de 2010.

Conclusion

La vérification a révélé que le processus d'entretien des ponts utilisé par la Division de la gestion de l'infrastructure de la Ville d'Ottawa est utilisé pour l'entretien des ponts de la Ville. Toutefois, la gestion de la base de données et l'attribution d'une cote aux ouvrages pour l'établissement des priorités de renouvellement sont lourdes. Nous avons constaté que généralement, le processus global d'entretien des ponts de la Ville dispose des politiques et procédures nécessaires, mais que celles-ci ne sont pas observées de manière uniforme. Les divergences dans la manière d'appliquer les politiques et procédures de la Ville chez les divers gestionnaires de projet font en sorte que le taux d'erreurs dans l'application de ces politiques et

procédures et du Manuel de gestion de projet est élevé. Des 34 dossiers que nous avons vérifiés, 3 seulement étaient complets sous tous les aspects. Les procédures utilisées et le système de classement de la Ville nécessitent des améliorations afin de s'assurer que les politiques et procédures et le Manuel de gestion de projet de la Ville sont suivis par tous les gestionnaires de projet.

Le processus et les dossiers d'inspection des ponts relatifs aux inspections visuelles détaillées ne sont pas conformes à la réglementation provinciale ni à l'*Ontario Structure Inspection Manual*. La Ville doit modifier ses façons de faire dès que possible en vue de parvenir à une conformité.

Remerciements

Nous souhaitons exprimer notre reconnaissance au personnel et à la direction pour leur collaboration et l'aide qu'ils ont apportée à notre équipe au cours de la réalisation de cette vérification.

1 BACKGROUND

1.1 Introduction

The Office of the Auditor General had originally identified an audit of the Bridge Maintenance Process in the 2008 Audit Plan that was presented to Council.

The Office of the Auditor General received information from the Fraud and Waste Hotline regarding concerns with the rehabilitation work for a bridge in the City, which deteriorated significantly after the rehabilitation work was completed in 2004. As a result of the rapid deterioration of the work completed in 2004, a second rehabilitation contract was issued in 2007 for essentially the same work as the 2004 contract. The audit of the bridge reported in the Fraud and Waste Hotline is presented in a separate and concurrent report.

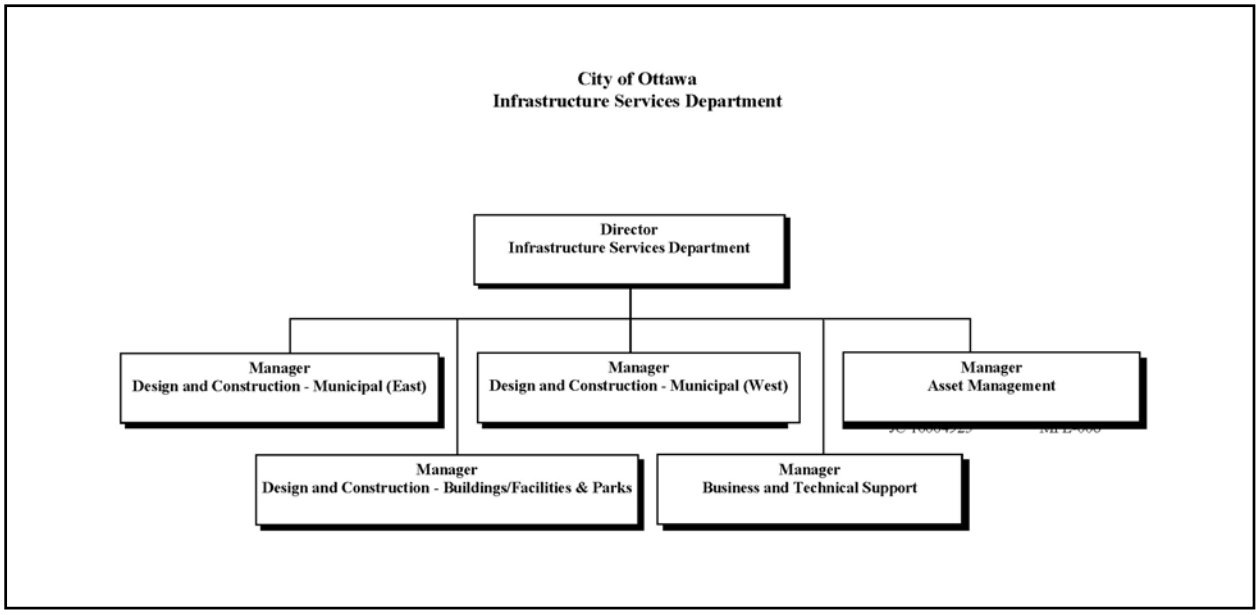
1.2 Responsible Business Unit

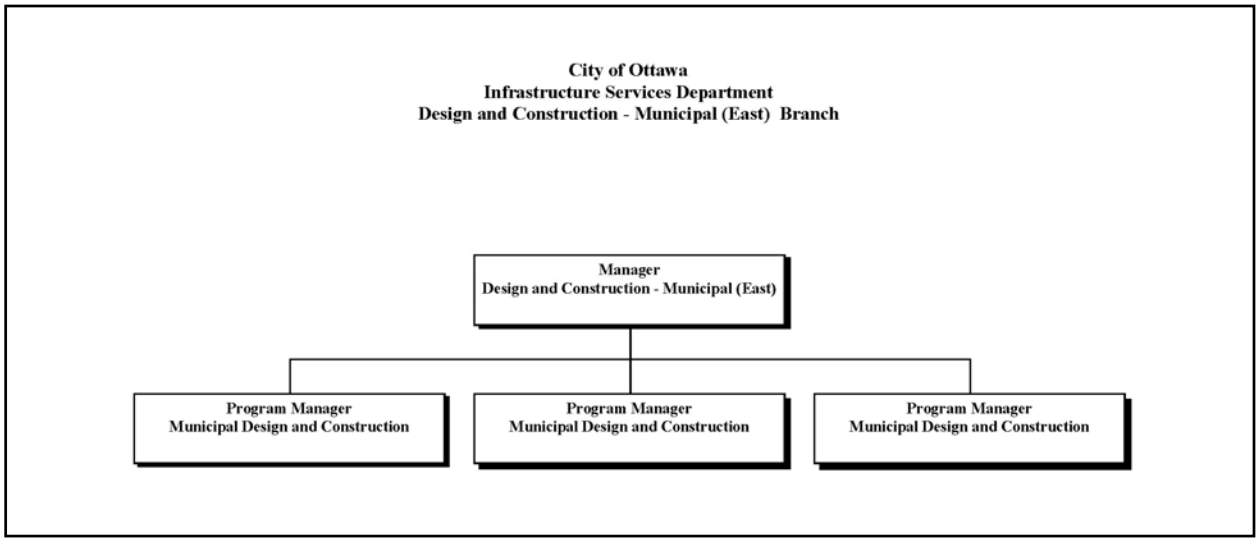
The City's Infrastructure Services Branch[3] is responsible for the maintenance of bridges, culverts, retaining walls, and the structural components of transit stations. Architectural, electrical, and mechanical components of the transit stations are maintained by the Real Property Asset Management Branch.

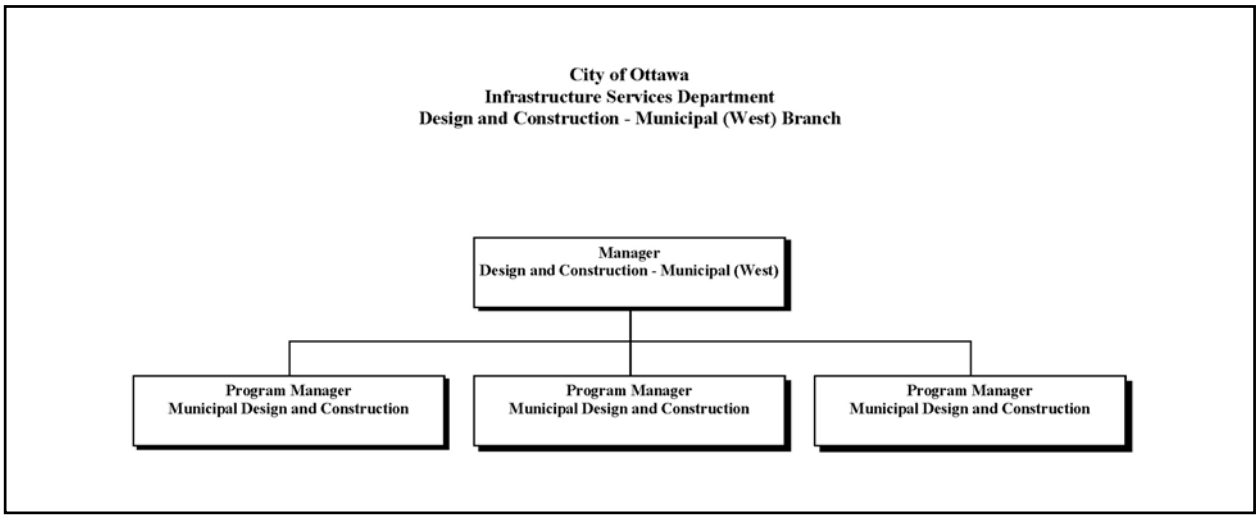
The business units responsible for the Bridge Maintenance Process are the Infrastructure Management Division (IM) and the Construction Services Division of the Infrastructure Services Branch (ISB).

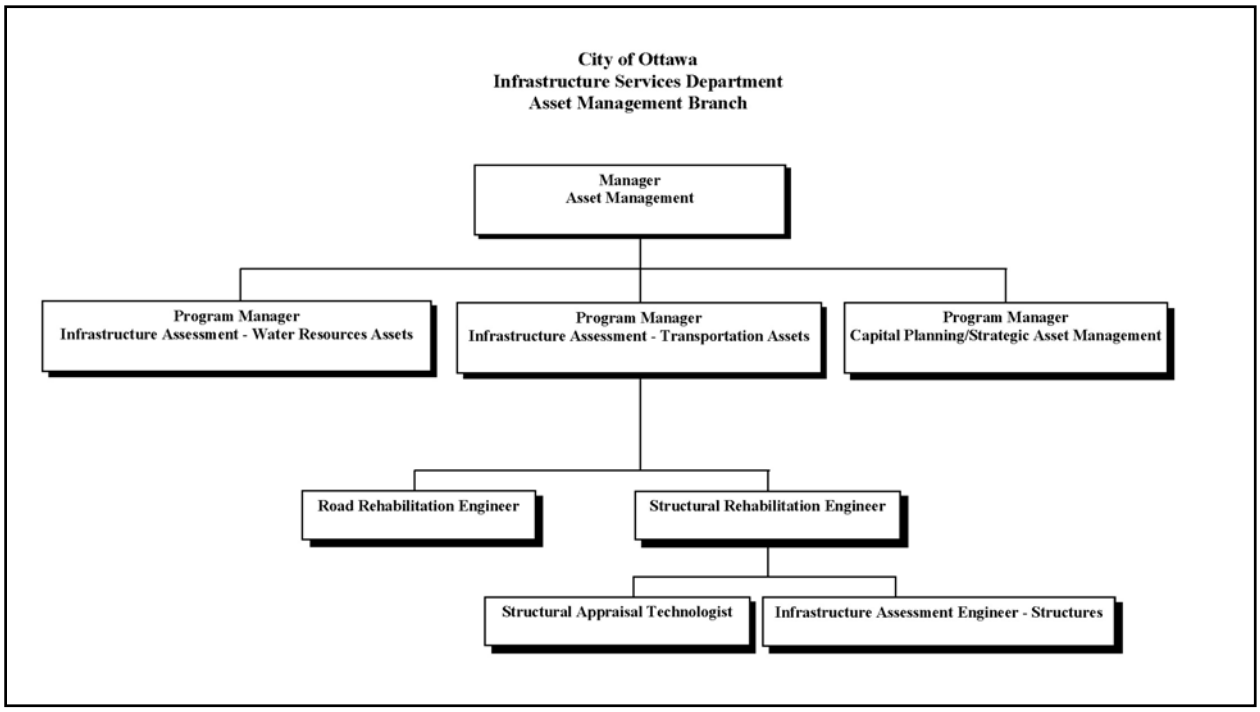
The organization charts for ISB and its divisions are provided in the following pages.

[3] The Infrastructure Services Branch is now the Infrastructure Services Department. The Infrastructure Management Division has been renamed Asset Management Branch. However, in this report we maintain the titles they had during the audit.


City of Ottawa
Infrastructure Services Department
Director
Infrastructure Services Department
Manager
Design and Construction - Municipal (East)
Manager
Design and Construction - Municipal (West)
Manager
Asset Management
Manager
Design and Construction - Buildings/Facilities & Parks
Manager
Business and Technical Support


City of Ottawa
Infrastructure Services Department
Design and Construction - Municipal (East) Branch
Manager
Design and Construction - Municipal (East)
Program Manager
Municipal Design and Construction
Program Manager
Municipal Design and Construction
Program Manager
Municipal Design and Construction





1.3 Bridge Maintenance Process

Bridge Maintenance includes all the systems and tasks that the City undertakes to prevent the development of defects or prevent the deterioration of a structure or its components. The overall system of bridge data, renewal management, and

evaluation of priorities for renewal constitutes the Bridge Maintenance Process or Bridge Asset Management System.

The Ministry of Transportation defines a structure as a bridge or culvert with a span of 3.0 m or greater. The Infrastructure Services Branch defines a bridge culvert as a structure having more than 0.6 m of fill above the structure deck.

The City owns approximately 750 bridges and bridge culverts; of these, approximately 527 are bridges.

The Infrastructure Services Branch defines bridge renewal as "Replacement, rehabilitation, or repairs resulting in the upgrading of the serviceability, durability or strength of a structure" in the Guidelines for Renewal Options Analysis, 2007. In addition, ISB classifies the structural renewal options into Minor and Major Rehabilitation and Replacement. Repair is any modification, alteration, retrofitting or improvement to a component of the structure, which is aimed at correcting existing defects or deficiencies. Rehabilitation is any modification, alteration, retrofitting or improvement to a structure sub-system or to the structure, which is aimed at correcting existing defects or deficiencies.

Operational maintenance and repairs are performed by the Surface Operations Branch, based on operational needs and needs identified by their field staff, by 311 service requests, or in conjunction with staff in the Infrastructure Management Division.

The Infrastructure Services Branch inspects the bridge and bridge culverts every two years or more frequently depending on the structure condition.

As a component of the bridge asset management process, IM uses the Structure Information Management System (SIMS), a legacy database prepared based on the former Municipal Bridge Assessment Data Entry System (MBADES). Currently the City is developing the Integrated Infrastructure Management System; one of the components of the system will be the Bridge Asset Management software upgrade.

1.4 Background Information

1.4.1 Infrastructure Management

The Infrastructure Services Branch comprises four divisions, namely Infrastructure Management, Construction Services – West, Construction Services – East, and Construction Services – Development.

The City's Infrastructure Management Division is in charge of asset management for all linear assets of the City, including roads, bridges, watermains, sanitary sewers and storm sewers.

The Bridge Maintenance Program is managed by the Infrastructure Management Division, assisted in the delivery of the required services by the Construction Services West and East divisions. Infrastructure Management works with

Construction Management East and West, divisions of Infrastructure Services Branch, for the implementation of the bridge maintenance process. Construction Management is responsible for management of the Detailed Condition Assessments, Renewal Options Evaluations, preliminary and detailed design, tendering, and construction inspection and contract administration.

1.4.2 Legislative Requirements

Maintenance and inspection of municipal bridges and other similar structures are carried out in accordance with provincial legislation and regulations, and standards set by the Ministry of Transportation of Ontario (MTO). Provincial legislation regarding the inspection and maintenance of bridges comprise Public Transportation and Highway Improvement Act, R.S.O. 1990, c. P.50 and Standards for Bridges, Ontario Regulation 104/97. The Regulation specifically refers to standards set by MTO in publications on this subject including the Ontario Structure Inspection Manual, the Structural Manual and Structure Rehabilitation Manual, and the Ontario Bridge Management System. In addition, the Province of Ontario adopted the Canadian Highway Bridge Design Code as the bridge design code, subject to modifications noted in the Structural Manual.

Ontario Regulation 104/97, as amended, requires that the design, evaluation, construction, inspection or rehabilitation of a bridge shall conform to the Canadian Highway Bridge Design Code and the standards set out in the Ministry's manuals and standards. The structural integrity, safety, and condition of every bridge shall be determined through the performance of at least one inspection in every second calendar year under the direction of a professional engineer and in accordance with the Ontario Structure Inspection Manual. The Regulation indicates that the design, evaluation, construction, inspection, or rehabilitation of a bridge may vary from the Ministry manuals and standards where the variation is not a marked departure from the Ministry manuals and standards and the variation does not adversely affect the safety and mobility of people and goods.

The Federal Government has no jurisdiction over maintenance of municipal bridges.

1.4.3 City of Ottawa's Bridge Maintenance Program

The City maintains the data for structures using an Oracle database called the Structure Information Management System, which was developed based on the former provincial database (Municipal Bridge Assessment Data Entry System or MBADES). SIMS was established for the City as part of the preparations for the Year 2000; the timing also was concurrent with the period during which the responsibility for the bridge inspections and database were transferred to the municipality.

SIMS follows the bridge appraisal system used in the MBADES database. Due to limitations in the database system, the data does not reflect the structure inspection system required by the current Ontario Structure Inspection Manual.

SIMS contains data for all structures owned by the City, including bridges, bridge culverts, drainage culverts and retaining walls, including those that are part of the Transitway.

Bridges are those structures with spans greater than 3.0 m, which are in turn subdivided into bridges and bridge-culverts (defined as structures that have more than 0.6 m of fill above the deck).

Inspections are carried out every two years, as a minimum, in accordance with Provincial legislation, and at more frequent intervals depending on the bridge rating. The bridge ratings are given based on Rating Codes, corresponding to the condition of the various bridge components.

Bridge Primary Components comprise the bridge superstructure (in turn classified as beam and slab, truss, or arch systems), abutments, piers and columns, approaches, hydraulics and general. The Rating Codes are:

6-Very Good	5–Good	4-Fair	3-Poor	2-Urgent	1-Critical	0-Not applicable

Detailed visual inspections are not being done using the current Ontario Structure Inspection Manual format, as the results cannot be inputted into SIMS. The City is currently upgrading the Bridge Asset Management software as part of the Integrated Infrastructure Management System; when the upgrade is complete, it will be capable of accepting the OSIM Inspection data.

Microsoft Excel™ is used for ranking of structure renewal needs and to arrive at budget priorities. Cognos™ software is used for data mining and long range financial planning. In order to produce a variety of asset management reports, data is exported to the Excel structure renewal prioritization modeller and the required results are created. Data for structure replacement cost is obtained by mining deck area, with MTO adjustments where required, and unit prices (per deck area) from the SIMS database, to arrive at comparative replacement cost estimates.

The bridge rating data is used to define regular visual inspection frequencies in order to track the structures condition ratings and to determine which ones should be subject to detailed condition assessments and/or structure or seismic evaluations.

Cost estimates produced by the Detailed Bridge Condition Assessment and Renewal Options Analysis study are entered into the Excel spreadsheet for budget

priority. Load posting recommendations from the Structure/Seismic Evaluation reports are processed through a Structure Maintenance Request to install the required signage.

Priority is assigned using a risk-based approach, based on weightings given due to the various drivers, namely,

- Structure condition;
- Performance;
- Functional needs;
- Operation and maintenance cost densities [$/m^2];
- Severity ratings (severity rating of light, medium, severe or very severe);
- Alternate routes;
- Functional needs; and,
- Component condition.

All drivers are ranked from 0-100 and aggregated without weightings applied. The aggregated ranking values are then normalized to the budget group population – they are ranked from 1 to the total number of needs within that budget group. Coordination with growth and the renewal needs of other disciplines is done and the ranking manually adjusted to achieve coordination. Structures with load postings are placed at the highest rankings, using only the risk rating to position them relative to each other.

With the information on budget available, IM uses the priority model to determine which bridges and other structures should be candidates for funding each year.

Bridges that do not make the cut are placed in backlog, until the ranking and funding place them above the cut-off-line matching the budget allocation provided by the City's Finance department.

IM keeps track of major/minor road bridges, drainage structures, and transit bridges using separately assigned budget groups/codes, but they all are inventoried in SIMS.

Projects that are included in a budget that is approved by Council, go to Design and Construction and become Structure Renewal Scoping Projects or Structure Renewal Projects. The scoping reports include the OSIM reports, drainage analysis, geotechnical investigation and design, structure/seismic evaluation, load postings as required, and renewal options analysis. The reports are captured into the SIMS database.

Once the structure is in the queue, the process of detailed bridge condition assessments, specialized tests, design of renewal options, etc., is followed. In general, structures enter the queue seven years ahead of the scheduled renewal.

Bridge Inspectors may recommend that structures be placed in the queue if they find deficiencies that cause concern. In that case, the structure is reviewed by senior engineers and technologists in the IM division to confirm that the deficiencies warrant that the structure be placed in the queue.

Once the structure is in the seven-year queue, the process is standard: detailed bridge inspection, condition surveys, renewal options study, preliminary and detailed design, tender, construction, and final inspection.

It is noted that the ranking of the structure is reviewed following the Structure Renewal Scoping Project. According to IM and interviews with project managers, in a few occasions the Renewal Scoping Project has resulted in upgrading of the structure rating, and consequently the priority for renewal has been lowered.

For Structure Renewal Projects, IM is involved again when the contract warranty period has six weeks remaining, at which time IM carries out an inspection to confirm that the structure can receive the highest rating. The as-built drawings are received by the Vault and SIMS database is updated to reflect the as-built renewed structure.

The renewed structure is given a rating of 5 and the process starts again in two years, when the structure is subject to a visual inspection.

1.4.4 Provincial Bridge Inspection Requirements

The existing provincial regulation (Ontario Regulation 104/97, amended by Ontario Regulation 278/06) requires that "the structural integrity, safety and condition of every bridge shall be determined through the performance of at least one inspection in every second calendar year under the direction of a professional engineer and in accordance with the Ontario Structure Inspection Manual, published by the Ministry [of Transportation of Ontario], as it may be amended from time to time."

The Ontario Structure Inspection Manual describes in detail the procedures to be followed in the inspection of structures in the Province. In summary, the structural inspections should involve a detailed visual inspection of the structure, consisting of a close-up visual inspection of material defects, performance deficiencies and maintenance needs of the structure, carried out element by element. In many cases, the inspection should be done at arms length of the element, and may need tapping with a hammer or removal of loose concrete or rust to permit inspection. If necessary, special equipment, such as bucket truck, ladders, mobile platforms (e.g., Bridgewalker™), etc., is used.

The OSIM also indicates that routine inspections by maintenance crews are essential and should be carried out regularly to determine sudden changes in the conditions of the bridge; however, the OSIM applies only to biennial detailed visual inspections. In the case of the City of Ottawa, these routine inspections are done by the Operations Division.

2 AUDIT OBJECTIVES AND CRITERIA

Following a review of the background information available from the City, the scope of the audit was synthesized in the Audit Objectives. The Criteria attached to each Audit Objective explain the scope of the review. The Audit Objectives and Criteria were presented in the Audit Plan, which was reviewed by Infrastructure Services Branch.

Audit Objective #1: Examine and evaluate the studies, processes and methodologies pertaining to the Bridge Maintenance Procedures followed by the City

Criteria:

- Status of bridge database;
- Methods used by City to maintain database;
- Monitoring system;
- Bridge condition rating;
- Ranking system;
- Bridge inspection reports;
- Additional studies and tests;
- Selection of rehabilitation measures;
- Design of rehabilitation measures;
- Implementation of rehabilitation measures; and,
- Budgeting process.

Audit Objective #2: Determine whether the studies, processes and methodologies are consistent and compliant with all relevant policies, procedures, legislation and regulations

Criteria:

- Public Transportation and Highway Improvement Act, R.S.O. 1990, c. P.50;
- Standards for Bridges, Ontario Regulation 104/97;
- Ontario Structure Inspection Manual;
- Canadian Highway Bridge Design Code;
- Structural Manual and Structure Rehabilitation Manual, MTO;
- Ontario Bridge Management System; and,
- Procedures used in other jurisdictions:
  - Ministry of Transportation;
  - Other municipalities in Ontario.

Audit Objective #3: Examine representative reports, studies, and designs to determine if they are consistent with relevant policies, procedures, legislation, and regulations

Criteria:

- Structure Information Management System;
- Bridge Inspection Reports;
- Detailed Bridge Condition Assessment and Renewal Options Analysis;
- Detailed Design Packages;
- Contract Packages;
- Contract Administration and Construction Supervision; and,
- As-Built Drawings.

Audit Objective #4: Examine representative maintenance contracts to determine if the maintenance recommendations were fully implemented

Criteria:

- Ranked structures vs. budget allocations;
- Contract Packages;
- Contract Administration and Construction Supervision;
- Inspection procedures;
- Quality assurance methods and processes;
- Recording of construction progress; and,
- Final inspections.

Audit Objective #5: Examine the implementation of the maintenance recommendations and the procedures used to record them in the structure database

Criteria:

- Structure Information Management System;
- Detailed Bridge Condition Assessment and Renewal Options Analysis;
- Detailed Design Packages; and,
- As-Built Drawings.

3 AUDIT SCOPE

The scope of the audit comprised the overall City processes used for the maintenance of the City's bridge and bridge culvert structures, including the bridge inspections, bridge database, methodology used for assigning maintenance priority, bridge rehabilitation processes, and bridge rehabilitation contract oversight and control. The audit examined both bridges and bridge culverts structures with spans of 3.0 m or greater.

The audit encompassed the following tasks:

- Review legislative framework;
- Review background data;
- Conduct interviews with individuals involved in the projects; and,
- Review project data for representative structures in the seven-year cycle (2001 – 2007).

The file sample examined consisted of:

- Nine minor rehabilitations;
- Nine major rehabilitations (including the structure specified in the Fraud and Waste Hotline report);
- Five replacements; and,
- Eleven structures where the work consisted of operational maintenance or work done in conjunction with road maintenance (for instance, repaving of a section of road included repaving of a bridge deck).

Of the 34 structure sample, seven were bridge-culverts.

It is important to note that the audit did not include a physical inspection of the structures and the condition of the structures was not confirmed during the audit. The audit began by reviewing the legislative framework for the project, to confirm the requirements that should have been followed. Collection and review of the background information were undertaken in light of the Audit Objectives and Criteria. The results of the review are an evaluation of the recommendations to determine whether the interests, including exposure to risk, of the City were adequately considered and protected.

3.1 Review Legislative Framework

This review is largely governed by the following legislation:

- Public Transportation And Highway Improvement Act, R.S.O. 1990, C. P.50
- Ontario Regulation 160/02 Made Under The Public Transportation And Highway Improvement Act Amending O. Reg. 104/97 (Standards For Bridges)

In addition, the Ontario Highway Bridge Design Code, the Canadian Highway Bridge Design Code, the Structural Manual, the Ontario Structure Inspection Manual, the Structure Rehabilitation Manual and the Drainage Design Manual were considered in this audit.

3.2 Interviews

Interviews were held with City staff involved in the various components of the Bridge Maintenance Process, including senior management, division managers, program managers and project managers.

3.3 Review Background Data

Background data available from the City was collected and reviewed. In general terms this included the structure inspection sheets, condition surveys, renewal options reports, preliminary and detailed design, tender documents, construction administration files, construction inspection data, quality assurance data, and as-built drawings.

Information on Bridge Management systems used by the Province of Ontario and the cities of Toronto and Mississauga was searched and reviewed.

3.4 Correspondence Reviewed

The correspondence files for the projects maintained by the City were reviewed in detail.

3.5 Documents Examined

The audit included a review of the documents listed in Sections 3.3 and 3.4, together with the review notes and related correspondence.

The audit reviewed project data for representative structures in the seven-year cycle (2001 – 2007), with a total sample of 34 structures, including the structure identified in the Fraud and Waste Hotline report. The sample of 34 structures was selected to include approximately equal numbers of projects involving minor rehabilitations, major rehabilitations, and replacements.

Other documents prepared by the City, collected and reviewed as part of this audit included:

- Guidelines for Infrastructure Renewal Options Analysis, December 2007
- Project Manager's Procedures Manual, 2006
- Inspection Manual for City's Construction Contracts, May 2003

4 FINDINGS

4.1 Items Examined

To meet the audit objectives, the audit examined the following items of the bridge or bridge-culvert files:

Item	Description
Inspection interval	Confirmation that the inspection interval conforms to the requirements of Ont. Reg. 104/97 as amended, that is every two years.
Condition survey	Confirmation of preparation of the required condition survey, per IM's procedures.

Item	Description
Renewal options report	Confirmation of preparation of the required report, per IM's procedures.
Detail design	Determination that the project was designed for construction.
Contract tendered	Determination that the project construction was subject to tender.
Construction done	Confirmation that the renewal works recommended by the Renewal Options Report were carried out.
Inspections done by City	Determination of what inspections were done by City staff.
Inspections by outside firm	Determination of which inspections were done by outside consultants.
Shop drawings	Confirmation that shop drawings and other submissions required by the contract documents were submitted and reviewed prior to fabrication or manufacture.
Quality assurance	Determination of the quality assurance methods used to control the quality of construction; for instance, concrete cylinders, granular compaction, etc.
Records of construction	Determination of construction inspection records.
As-built drawings on file	Confirmation that as-built drawings were prepared and are included in the project file.
Renewal information to database	Confirmation that the latest renewal information was submitted to IM and that database was updated.
Design costs	Examination of design costs per the proposal vs. actual.
Construction costs	Examination of the construction cost estimate vs. actual.

The audit did not include a physical inspection of the structures and the condition of the structures was not confirmed during the audit.

4.2 Structures Examined

The final sample consisted of nine minor rehabilitations, nine major rehabilitations (including the structure identified in the Fraud and Waste Hotline report) and five replacements, plus 11 structures where the work consisted of operational maintenance or work done in conjunction with road maintenance (for instance, repaving of a section of road included repaving of a bridge deck). Of the 34 structures in the sample, seven were bridge-culverts. The following table summarizes the structures files examined in this audit and presents a summary of the findings. The results of the examination are summarized in the spreadsheet in Appendix A.

Sample No.	Structure Name	Type	OAG Review
1	Laurier Av Bridge	Bridge	This is a very large bridge, which received very close attention during the evaluation of renewal options, detailed design, and construction. The files for this bridge are complete. Database spreadsheet states bridge constructed in 1901, but it was replaced in 2004.
2	Porters Island Pedestrian Bridge	Bridge	Structure Inspection Sheet - 2007/06/04 - Bridge closed at time of inspection. Same for 2004 inspection. This bridge is closed to the public. The City continues to inspect it biennially.
3	O-Train/NS LRT Underpass at W Transitway W. Transitway CPR Overpass at 0.3 km W of Bayview Road	Bridge	Structure Inspection Sheet - 2003/05/27 & 2004/03/03 - Prior to renewal. Structure Inspection Sheet - 2005/09/30 - after renewal - Note that original design assignment was for bearing replacement. There were problems with installation of bearing replacements, and the expansion joints. Files were complete for this structure.
4	NS LRT Underpass at Gladstone Av	Bridge	Part M of Contract ISB07-5003. Inspection of bridge work done by IM staff. Inspection forms in the Condition Report do not conform to OSIM. Condition Report was not in the file, but was provided upon request.
5	W Transitway Overpass at Bayview Rd	Bridge	Only 2002 repairs in file. Files were not complete for these repairs. The latest work on this bridge was repaving in 2007, as part of overlay contract. However, there was no documentation in the files regarding the work.
6	Lemieux Island Bridge	Bridge	Note re organization of files. No reports in file. Note Eradiquake isolation bearing calculations based on CSA S6, CHBDC. Note construction calculations and handwritten notes not organized, no dates, no initials, no title. Condition Survey and Renewal Options Report not in file. Provided upon request. No quality assurance data in file.
7	SE Transitway Overpass at Riverside Dr	Bridge	File provided contains a maintenance request 2000. Inspection sheets up to 2000. The latest work on this bridge was repaving in 2007, as part of overlay contract. However, there was no documentation in the files regarding the work.

Sample No.	Structure Name	Type	OAG Review
8	Confederation Heights Bridge [Airport Pkwy Overpass at Heron Rd/O-Train]	Bridge	Inspection Sheets for the inspection done in 2000 seem to indicate that there were significant problems after the work done in 1999.
9	Richmond Rd Overpass at Bayshore Dr	Bridge	Last renewal for this structure was done in 1997. The structure is being inspected on schedule every two years.
10	Blair Rd Overpass at Hwy 174	Bridge	File was incomplete. Some additional information provided upon request.
11	Greens Creek Bridge St Joseph Blvd Overpass at Greens Creek	Bridge	Dec. 2002 - Preliminary Design Study - Contents similar to Detailed Renewal Options Report - notes that bridge rehabilitated in 1981 and 1991. Many items included in 1991 rehabilitation were replaced in 1981. Detailed inspection work met requirements of OSIM. Note very detailed supervision by Project Manager. Note that this bridge was rehabilitated based on 2002/2003 reports and Class EA. This file was complete. It should be used as an example of file setup and completeness.
12	Albion Rd Overpass at Sawmill Creek	Bridge	No information. Drawings only. The City indicated that it probably was repaired as part of Albion Road improvements in 2001 by Gloucester
13	Townline Bridge Con IX Lot 1 [Fitzroy]	Bridge	File was not complete. No inspectors diary or record of construction inspection in file, but was provided upon request. Quality assurance data incomplete; no indication of follow-up on QA.
14	Old Almonte Rd Overpass at Creek 0.50 km W of David Manchester Rd	Bridge	This was a culvert replacement. However, there is no record of evaluation of alternatives. (Schedule A project). In addition, City stated that Renewal Options report not required, but it was required by RFP and proposal. Preliminary report with renewal options was subsequently provided by the City.
15	March Rd Overpass at Cody Creek	Bridge	File incomplete. Renewal options report should have been required. No data on construction inspections in file, but subsequently provided by City. No as-built drawings.

Sample No.	Structure Name	Type	OAG Review
16	Jock Trail Bridge, Jock Trail Rd Overpass at Creek	Bridge	File provided contains 2004 contract. It appears that work was done due to very poor condition of bridge. Correspondence file Aug. 2004 to Dec. 2004 - bridge was rehabilitated in 1994. Timber deck failed in Aug. 2004, required emergency repairs. Preliminary design examined five options. IM requested lifecycle cost analysis, but it is not included in file. Contract based on Request for Quotations, awarded to 2nd lowest bidder due to lowest bidder not meeting bonding requirements. Condition inspection upon failure of deck. Renewal options report prepared. Records of construction and as-built drawings provided upon request. Design of original repairs was done without adequate survey.
17	Castlefrank Rd Overpass at Glen Cairn Twin Box Culvert	Bridge	This structure was replaced as part of the Flood Control Project for Glen Cairn. Note comments in Structure Inspection Sheets regarding the construction of the culverts, particularly misalignment of the concrete boxes. Culvert was designed for cast-in-place construction, but was changed after the tender to precast boxes. Very limited number of options reviewed. This culvert was designed as part of the Glen Cairn Flood Control Project. The renewal options were examined within the flood control project study. However, we did not find indication that the structure replacement options were examined by the IM division or its equivalent at the time.
18	Fortune St Bridge 0.30 km North of Royal York St	Bridge	CSP culvert replaced during Fortune Street reconstruction with precast concrete box culvert. Note shop drawings for precast concrete boxes uses OHBDC 1991, but should have used CHBDC 2000. Note that the consultant was hired because they were the former Twp. of Goulbourn engineering consultants. There does not seem to have been a proposal. Also note that the files for this project are very disorganized and very hard to follow. There is no design information. General Arrangement and detail drawings were included. No examination of renewal options.

Sample No.	Structure Name	Type	OAG Review
19	Kars Bridge Roger Stevens Dr Overpass at Rideau River	Bridge	At the time of the audit, we were advised that bridge renewal was done in 2008. However, IM advises that construction is being done in 2009. Noted that structural evaluation done in-house. This be part of Renewal Options Report. The latest work on this structure was done by RMOC in 1990.
20	Rideau Valley Dr S Overpass at Steven Creek	Bridge	This project was included in contract with Mud Creek 877830 and Malakoff Road culvert SN 868310. Some of the files and information on this project was not available. Upon receipt of the files from Legal Services, it was noted that the files are incomplete.
21	Stevens Creek Bridge Second Line Rd	Bridge	Condition Inspection/Evaluation Report dated February 2002 provided by City. The report does not contain OSIM forms for detailed visual inspection. The condition survey does not meet the requirements of MTO's Structure Rehabilitation Manual. Cost estimate breakdowns not included.
22	Stevens Creek Bridge Fourth Line Rd Overpass at Stevens Creek	Bridge	Rehabilitation of existing bridge. Some of the files and information on this project was not available due to an outstanding claim. Upon receipt of the files from Legal Services, it was noted that the files are incomplete.
23	First Line Rd Overpass at Mud Creek	Bridge	No shop drawing, no quality assurance data in the file.
24	Fourth Line Rd Con III/IV Lot 34	Bridge	1999 Inspection noted bulging of CSP soffit under shoulder, but this was not noted in 2007 inspection. However, the file shows no note of repairs. No design or other information at all on file. IM indicated that the road was transferred to RMOC in 1985.
25	Kenmore Bridge Yorks Corner Rd Overpass at S Castor River	Bridge	The file on this project was complete. At the time of review, the project was under construction. Field inspection and other data was provided upon request.

Sample No.	Structure Name	Type	OAG Review
26	Reside Bridge Grey's Creek Rd Con 5/6 Lot 22	Bridge	Original timber deck on structural steel girders on concrete abutments bridge was replaced with a corrugated steel culvert. No Renewal Options Report in file, although RFQ required it and proposal offered it. City provided a copy of the report upon request. No tender in file. No records of construction. No record of quality assurance.
27	Aubrey Bridge Ninth Line Rd Overpass at Castor River	Bridge	This project included two culverts - noted Project Turnover Document, Project Scoping from IM, Project Definition Statement by project manager. Condition Survey data collected in accordance with OSIM. Proposed to do half-cell testing when deck exposed during construction. Renewal Options Report not in file, although City says it was completed.
28	Becketts Creek Bridge Con I Lot 5/6	Bridge	Only file provided comprises Structure appraisal sheets from 1971 to 1974. Note rating then as 3. Rating in 2004 and 2006 Inspection Sheets is 4 to 5. Also noted 2004 inspection showed structure rock wingwalls lost pieces; hole behind rock wingwall. 2006 report notes scour, and very large area of deterioration of NE abutment wall. There is no indication that these deficiencies were corrected. Data that is available is contained in SIMS. No financial information is available
29	Walkley Rd Sawmill Crk B-Culvert 1.80 km E of Riverside Dr	Bridge-Culvert	Inspector's Files provided. No renewal options report. City indicated it was not required. No shop drawings, no quality assurance data, no records of construction in file.
30	Black Rapids Creek Br CR15 Con I Lot 23	Bridge-Culvert	Culvert extensions done as part of road reconstruction as part of Woodruff Avenue Widening project. Note that the pedestrian bridges may affect the hydraulics of the culvert; however, no hydraulic evaluation included in the reports or design. Condition survey done as technical memorandum. Renewal options included in memorandum. No contract drawings in file, but provided upon request. Contract documents provided upon request. As-built drawings in network.

Sample No.	Structure Name	Type	OAG Review
31	Ninth Line Rd Culvert Con 8/9 Lot 4 OF	Bridge-Culvert	This culvert was constructed in 1975 (information in database). Construction date is 1978, based on file data There is no information or drawings available.
32	Beaudoin Bridge Renaud Rd Overpass at Mud Creek	Bridge-Culvert	Included Project Scoping per IM. This file was complete.
33	Poole Creek Bridge Carp Rd Con XI Lot 23	Bridge-Culvert	Note that 2005 inspection shows a large delamination area on the soffit of the concrete deck. Recommendation was to monitor. The overall deck was given a rating of 5. Last work done in 1991. City says file retention expires after 10 years, but there are other structures where files have been saved, e.g., Structure No. 058200 or 116110. No as-built drawings in file or network storage.
34	Frank Kenny Rd [Old] Cardinal Creek Bridge-Culvert Con 7/8 Lot 1	Bridge-Culvert	No work proposed. Note comment from Senior Inspector that road has low traffic. Structure appears to have been constructed in 1978. This culvert was constructed in 1975 (information in database). There is no information or drawings available.

Based on our sample, the studies, processes and methodologies used to manage the bridge assets are not always consistent and compliant with relevant policies, procedures and regulations, as noted below. The following table summarizes the results of our review:

Criteria	Number of Applicable Structures	Number of non-compliant Structures	Percent Non-Compliant (Error Rate)
Inspections Interval	34	0	0.0%
Condition Survey	19	2	10.5%
Renewal Options Report	21	3	14.3%
Detail Design	30	4	13.3%
Contract Tendered	27	2	7.4%
Construction Done	27	0	0.0%
Inspections done by City	26	3	11.5%

Criteria	Number of Applicable Structures	Number of non-compliant Structures	Percent Non-Compliant (Error Rate)
Inspections by outside firm	26	4	15.4%
Shop Drawings	23	3	13.0%
Quality Assurance	25	11	44.0%
Records of construction	25	5	20.0%
As-Built Drawings on File	30	9	30.0%
Renewal Info to Database	33	0	0.0%

From the review of the files and the results noted above, it is possible to conclude as follows:

1. Of the 34 structure files examined, only 3 files could be considered fully complete, in that all the information required to be filed was included in the file. All other files reviewed were missing one or more items that they were expected to contain. The complete files tend to be the most recent ones and those for more important projects (for example, the Laurier Avenue Bridge and the Green Creek bridge).
2. Some as-built record drawings have not been included in the network server, although the copy marked up with red pencil or ink (known as the red-lined copy) is available. A checklist or similar method may help in confirming to the program manager that all steps have been completed. In this regard, it is noted that the City already has procedures in the Project Manager Procedures Manual, but these are not being followed consistently.
3. Some records of quality assurance procedures have not been filed properly and could not be found. Consistent filing systems, as are now being implemented, should provide improvement of this issue.
4. Two structures had no information at all in their files. Information about the structures was included in the SIMS database, but there was no supporting data in the files. The structures had not had renewal work done since they were built circa 1975. Nevertheless, the City should have as a minimum a set of the original construction drawings on file. If none are available, the City should prepare the drawings from field information.
5. In two of the structures reviewed, the renewal work done in 2007 was resurfacing, completed as part of the road resurfacing contract. No condition survey or renewal options work was done to confirm that resurfacing was the only work required. We noted that the latest inspection sheets indicated a rating of "Very Good" for one of the structures (Structure No. 056060), but some

repairs were required for the other (Structure No. 016200). We found no confirmation that the repairs were completed.

6. IM indicated that, although the Structure Inspections do not follow OSIM, the Condition Survey included a detailed survey of the structure using OSIM forms and methodology. Our review of Detailed Condition Survey reports showed that generally this is the case, but we found three cases in which the OSIM forms were not used in the Condition Survey.

7. Replacement of culverts during road reconstruction contracts do not receive as strict review by IM as when the structures are examined independently of the road contract. Three bridge-culvert reconstruction or extension contracts in the sample were part of road reconstruction or widening contract. We found that in those cases the investigation of renewal options was not done with the same level of detail as when structures are analysed independent of the road work. In addition, the construction inspection, the field inspection records, review of shop drawings, and quality assurance records were not kept as well in those three cases as for other bridges or bridge-culverts.

8. One of the bridge-culverts, the Castlefrank Road culvert in Glen Cairn, was designed as part of the flood control project. In reviewing the reports and options examined, we concluded that the range of options reviewed could have included alternatives that were not examined. For example, the soil conditions could have warranted considering a bridge on piled foundation rather than a box culvert. Some of the construction difficulties encountered may have been avoided this way. In our opinion, IM should be involved in the assessment of replacement options in similar cases.

9. In the case of the Fortune Street culvert, the design of the culvert replacement was carried out by a firm which did not have the qualifications and experience to complete the work, as evidenced by the fact that they had to retain a specialist firm to undertake a review of their design.

10. In three cases the renewal options report was required by the Request for Quotations (or Request for Service) issued by the City, and was included as a task in the Offer of Services or Proposal by the consultant, but was not produced. In the three cases noted, when we noted that the renewal options reports were not in the files, the City indicated to us that the renewal options report were not required, when in fact it was. Subsequently, the City provided the required reports.

11. In two cases, the files were not provided for our review because they were held by the Legal Services Branch due to the existence of outstanding construction claims. We note that both files were managed by the same Project Manager. The two files noted above were provided for our review upon further request. It was found that these two files are incomplete. Specifically, the files did not

include records of quality assurance for concrete and asphalt; the inspector notes indicate that the information was received, but it is not in the files. The City subsequently clarified that only one file was held by Legal Services.

12. In one case (Structure 757210) we found no data at all in the file. The City indicated that this was the result of file retention policies. However, we noted that other two structures of approximately the same age did have part of their files available (albeit these files also were not complete).

13. The City indicated that the File Retention Policies are based on the City's Records Management Policy, 2003. The Records Management Policy refers to the City's records retention and disposition schedule, which indicates that structure records must be kept inactive for 25 years. On this basis, the absence of records is appropriate. However, we note that records that are considered to have archival importance should not be destroyed. Since the structure (Structure 757210) was transferred in 2000, the structure records should have been available.

14. The results of the analysis and the findings of the audit are presented in the following sub-sections following the Audit Objectives. For ease of reference, the Audit Objectives and the Criteria used are repeated here and the findings are discussed in relation to the criteria.

4.3 Audit Objective No. 1

Examine and evaluate the studies, processes and methodologies pertaining to the Bridge Maintenance Procedures followed by the City

Criteria

- Status of bridge database;
- Methods used by City to maintain database;
- Monitoring system;
- Bridge condition rating;
- Ranking system;
- Bridge inspection reports;
- Additional studies and tests;
- Selection of rehabilitation measures;
- Design of rehabilitation measures;
- Implementation of rehabilitation measures; and,
- Budgeting process.

4.3.1 Status of bridge database

Based on our review of the database output provided by the City and the review of the 34 structure files the database was generally up to date.

However, it did not contain any data on financial information, such as the estimated and actual cost of design and construction. When we requested this data, expecting that it would be extracted from the database, IM staff had to go back to the project files to extract that data. In addition, for older projects this information was not available.

4.3.2 Methods used by City to maintain database

The City maintains the database manually based on input from the structure inspections, the condition surveys, and the structure renewal work. When the audit started, the database was maintained by the Senior Engineer in charge of Needs & Programming – Structures in the Infrastructure Management Division.

The Senior Engineer is responsible for updating and managing the database, and it appears to be done competently. In reviewing the procedures, we noted that this process was done exclusively by the Senior Engineer. Other staff in the Division should be trained to be able to undertake this work. As well, the procedures and criteria used by the Senior Engineer should be set in a manual.

Since this audit started the Senior Engineer - Needs & Programming – Structures in the Infrastructure Management Division left the City. As a result, the database was managed and maintained by two persons, who were doing this in addition to their normal responsibilities. The City replaced the Senior Engineer from within with a Senior Project Manager. Since then, the new Senior Engineer has implemented a program of training others on the database.

4.3.3 Monitoring system

The City indicated that they inspect the bridges and bridge-culverts at least every two years, and that the inspections are done more often if the structure condition starts to deteriorate rapidly. It is noted that the purpose of structural inspections in general terms is to be able to determine if the condition of the structure has changed significantly from one inspection to the next. Because the monitoring system is based on the bridge condition rating that was used prior to the 2000 OSIM, the monitoring system is a qualitative system.

We contacted the Ministry of Transportation's office in Kingston and St. Catharines. Discussions revealed that MTO does not consider that the old method of using Condition Ratings for the structure inspections is equivalent to the requirements of the OSIM and Ontario Regulation 104/97 as amended. The MTO indicated that methods which would qualify as alternatives within Ontario Regulation 104/97 are methods that also use detailed visual inspections of structure elements and that give a quantitative indication of the percentage of each element that has defects.

The City should use the 2000 OSIM, as it provides a quasi-quantitative system that permits more ready comparison of the bridge condition with the condition two years early. It is noted that the current version of OSIM is already being used for detailed conditions assessments, but not for the detailed visual inspections.

4.3.4 Bridge Condition Rating

The comments given above with respect to the Monitoring system apply to the Bridge Condition Rating. The current methodology used by the City is based on the rating provided by the inspector, which is subjective and based on experience. As noted above, the bridge condition rating does not meet the intent of Ontario Regulation 104/97 as amended.

The current OSIM methodology provides a more rational method for the rating of the structures, as it requires that the areas and severity of deterioration be recorded in the Bridge Inspection Sheets.

4.3.5 Ranking system

The ranking system used by the City for setting of priorities for renewal is rational, based on a risk assessment procedure. Based on a review of the methodologies used in other jurisdictions, it appears that the Ottawa risk-based ranking method is rather unique for bridges. In a search of similar information systems in Ontario, other municipalities, and other provinces we did not find another jurisdiction using risk as a component of their structure priority ranking method.

The risk ranking method used by the City provides a rational method for evaluating the effect on priority of the structure condition, performance, function, and operation and maintenance costs.

We consider that the ranking system can be improved by ensuring that the procedures and criteria used to assign the risk are fully documented. In addition, the Infrastructure Management Division should ensure that the updated Asset Management System currently in development provides sufficient capabilities to remove the need for the Senior Engineer of using Cognos and Excel for data mining and analysis.

4.3.6 Bridge inspection reports

Bridge inspection reports are prepared by City staff at regular intervals, as noted previously. The reports are prepared using the methods that were used when MBADES was in use. The methodology used for the inspection reports is based on visual inspections which assign ratings to the various bridge components, as discussed in Section 1.4.

4.3.7 Additional studies and tests

Once the structure has been placed in the rehabilitation queue, the City has a fairly well established system for the process, documented in the Guidelines for Infrastructure Renewal Options Analysis, issued in December 2007. The review of the files indicates that the structures rehabilitated in the last four years have been subject to the processes required by the Guidelines. However, review of files by different project managers shows that the execution of the processes requires some additional controls to achieve uniformity of the standards applied, as not all project managers apply the requirements uniformly.

4.3.8 Selection of rehabilitation measures

The Guidelines for Infrastructure Renewal Options Analysis provide a reasoned approach to the selection of the rehabilitation measures, including the option of structure replacement, with a new structure, rather than renewal of components, where warranted. The Guidelines require that the alternatives be evaluated using a life-cycle cost analysis, which examines the economics of the alternatives over the expected useful life of the structure.

The guideline process requires spot checks to confirm that the project managers are applying them consistently. However, we found no evidence of these spot checks in the files.

4.3.9 Design of rehabilitation measures

The design of the rehabilitation measures used by the City follows the Canadian Highway Bridge Design Code, the Structural Manual, and the Structure Rehabilitation Manual. We found that the design meets the current design standards, with the exception of one bridge and one culvert replaced as part of a road reconstruction contract.

In the first instance, the design of the renewal measures did not meet the requirements of the Canadian Highway Bridge Design Code and the Structural Manual. The second example was designed on the basis of the Ontario Highway Bridge Design Code, 1991, which had been superseded by the Canadian Highway Bridge Design Code in 2000.

In both cases, we consider that the work of the consultant did not receive proper review when the work was reviewed by the City.

4.3.10 Implementation of rehabilitation measures

In general terms the implementation of the rehabilitation measures follows standard procedures. The City uses a tendering process for major projects, provides construction inspection and supervision, and quality assurance during construction.

The City uses currently three internal procedures and policies documents, namely the Guidelines for Infrastructure Renewal Options Analysis, December 2007, Project Manager's Procedures Manual, 2006, and the Inspection Manual for City's Construction Contracts, May 2003. In general the various project managers are using these documents in their projects; however, we noted that not all project managers apply the documents with the same rigor.

4.3.11 Budgeting process

The budgeting process used by the Infrastructure Management Division consists of two stages: Initially the budget for the expected rehabilitation work is set based on dollars per square meter of deck area, based on values for similar work; and, the budget is adjusted once the Detailed Condition and the Renewal Options Reports have been completed. The methodology provides results that are realistic with allowance for contingencies.

Our review of the estimated costs for design and subsequently for construction revealed that in no case was the engineering cost exceeded and in only two cases were the construction cost estimates exceeded.

Recommendation 1

That the City ensure that the management of the database be fully documented in a manual and that training on the use of the database plus ranking of projects be provided to more than one person in the Infrastructure Management Division.

Management Response

Management agrees with the recommendation.

With the realignment that took place earlier this year in the Infrastructure Services Department (ISD), the former Infrastructure Management Division is now the Asset Management Branch (AMB). AMB has developed documentation on the management of the database. This documentation is expected to evolve as AMB migrates to a new structures management system in Q2 2011.

Within AMB, an intermediate level structural engineer reporting to the senior structural engineer has been created and staffed. This individual continues to be involved in the management of the database and on the prioritization of renewal projects.

Recommendation 2

That the City carry out bridge detailed visual inspections in accordance with current Ontario Structure Inspection Manual procedures to remove subjectivity of appraisals and to meet the requirement of current Provincial regulations.

Management Response

Management agrees with the recommendation.

AMB is working on modifications to its business processes and structures management system to align its visual inspections with the most recent Ontario Structures Inspection Manual (OSIM) requirements. AMB applies the OSIM requirements as part of detailed bridge condition assessments that take place prior to identifying specific renewal requirements.

The City is in the process of implementing a new Integrated Infrastructure Management System (IIMS). The structures management system is being implemented to align with the new IIMS. Funding for the new structure management system has been identified in the 2010 draft capital budget and the new system is expected to be completed by (Q2) 2011, subject to progress on the IIMS.

Recommendation 3

That the City ensure that the updated Structure Asset Management Database currently under development be provided with the capabilities required to remove the need for data mining and analysis using external software.

Management Response

Management agrees with the recommendation.

The new structures management system will have all the capabilities required for data management and analysis.

The City is in the process of implementing a new Integrated Infrastructure Management System (IIMS). The structures management system is being implemented to align with the new IIMS. Funding for the new structures management system has been identified in the 2010 draft capital budget and the new system is expected to be completed by (Q2) 2011, subject to progress on the IIMS.

4.4 Audit Objective No. 2

Determine whether the studies, processes and methodologies are consistent and compliant with all relevant policies, procedures, legislation and regulations

Criteria

- Public Transportation and Highway Improvement Act, R.S.O. 1990, c. P.50;
- Standards for Bridges, Ontario Regulation 104/97;
- Ontario Structure Inspection Manual;
- Canadian Highway Bridge Design Code;
- Structural Manual and Structure Rehabilitation Manual, MTO;
- Ontario Bridge Management System;
- Procedures used in other jurisdictions;

- Ministry of Transportation; and,
- Other municipalities in Ontario (Toronto, Mississauga).

4.4.1 Public Transportation and Highway Improvement Act, R.S.O. 1990, c. P.50

This Act is the statute that governs the inspection and rehabilitation of bridges in Ontario. The Act is the enabling legislation for the Regulations that govern the inspection process in Ontario.

4.4.2 Standards for Bridges, Ontario Regulation 104/97

This Regulation applies directly to the Bridge Maintenance Process. The following is the text of the Regulation, highlighted to emphasize the application:

> **1**. In this Regulation,
>
> "Canadian Highway Bridge Design Code" means the "Canadian Highway Bridge Design Code" designated as CAN/CSA-S6-00 published by the Canadian Standards Association and the "Commentary on CAN/CSA-s6-00, Canadian Highway Bridge Design Code" published by the Canadian Standards Association, as they may be amended from time to time;
>
> "evaluation" has the meaning set out in the General Technical Definitions of the Canadian Highway Bridge Design Code;
>
> "Ministry manuals and standards" means the *Structural Manual*, the *Structure Rehabilitation Manual*, the *Drainage Management Manual*, the *Roadside Safety Manual*, the *Geometric Design Standards for Ontario Highways*, the *Ontario Structure Inspection Manual* and the *Ontario Provincial Standards for Roads and Municipal Services*, published by the Ministry, as they may be amended from time to time;
>
> "professional engineer" means a person who holds a licence or a temporary licence issued under the *Professional Engineers Act* to engage in the practice of professional engineering, but does not include a person who holds a limited licence issued under that Act;
>
> "rehabilitation" has the meaning set out in the General Technical Definitions of the Canadian Highway Bridge Design Code. O. Reg. 104/97, s. 1; O. Reg. 160/02, s. 1; O. Reg. 278/06, s. 1.
>
> **2.** (1) Subject to subsection (2), where any person undertakes or causes to be undertaken the design, evaluation, construction, inspection or rehabilitation of a bridge, the design, evaluation, construction, inspection or rehabilitation shall conform to,
>
> (a) the standards set out in the Canadian Highway Bridge Design Code; and
>
> (b) the standards set out in the Ministry manuals and standards.

(2) Despite clause (1) (b) and subsection (3), the design, evaluation, construction, inspection or rehabilitation of a bridge may vary from the Ministry manuals and standards where,

(a) the variation is not a marked departure from the Ministry manuals and standards; and

(b) the variation does not adversely affect the safety and mobility of people and goods.

(3) The structural integrity, safety and condition of every bridge shall be determined through the performance of at least one inspection in every second calendar year under the direction of a professional engineer and in accordance with the *Ontario Structure Inspection Manual*, published by the Ministry, as it may be amended from time to time.

(3.1) For greater certainty, the inspection referred to in subsection (3) may be performed at any time in the calendar year, regardless of when in a prior calendar year the previous inspection was performed.

(4) In the event of a conflict or inconsistency between a standard in the Canadian Highway Bridge Design Code and a standard in the section of the *Structural Manual*, published by the Ministry, as it may be amended from time to time, entitled "Exceptions to the Canadian Highway Bridge Design Code", the standard set out in the *Structural Manual* prevails.

3. Every bridge shall be kept safe and in good repair.

Based on this Regulation, the process used by the City for the inspections does not meet the regulation requirements, as the process used is based on the previous version of the Ontario Structure Inspection Manual, which was designed to operate with the MBADES method of bridge appraisal and rating, which the Ministry has phased out.

The fact that the detailed visual inspection process does not meet the current regulations means that the City is not using the best practices in this regard.

4.4.3 Ontario Structure Inspection Manual

At present the City carries the detailed visual bridge inspections using a format that fits the City's Structure Information Management System (SIMS), but which does not conform with the current requirements of the Ontario Regulations. As noted above, the process used is based on the previous version of the Ontario Structure Inspection Manual, which was designed to operate with the MBADES method of bridge appraisal and rating.

The City plans to switch to the 2000 OSIM format when the SIMS is updated. Based on the information provided during the interviews, it is expected that the switch over will commence in 2009. It is recommended that the City uses the 2000 OSIM

methodology and format, as it provides a quantitative assessment of the structure condition, as opposed to the qualitative assessment method in the previous version.

4.4.4 Canadian Highway Bridge Design Code

The Canadian Highway Bridge Design Code (CHBDC) is used in the City's design projects as required by the legislation. However, we found in one instance, when the CHBDC came into force, that the consultant used the Ontario Highway Bridge Design Code. As far as we could ascertain, this was an isolated incident, that has not been repeated.

4.4.5 Structural Manual and Structure Rehabilitation Manual, MTO

Based on the review of the files, it was concluded that the City uses the Structural Manual and the Structure Rehabilitation Manual in the design of the bridge rehabilitation projects, as required by regulation.

4.4.6 Ontario Bridge Management System

The Ontario Bridge Management System is the system developed by the Province for the provincial highways. As opposed to previous bridge management databases, the Province does not require municipalities to maintain a specific database. Consequently, the City developed its own system, SIMS, at the time that the database was upgraded due to the Y2K revisions.

The OBMS was developed in 1998, and includes many of the components that SIMS contains, such as a Bridge Cost Model, Deterioration Model, and estimates of rehabilitation work based on current unit prices.

In retrospect, it would have been convenient for the City to apply the Ontario Bridge Management System rather than the one being used presently (Structure Information Management System).

4.4.7 Ministry of Transportation

The Ministry of Transportation assigned the responsibility for bridge management and inspections to the municipalities. Consequently, the MTO publishes the Ontario Highway Bridge Design Code, Structural Manual, Structure Rehabilitation Manual, and Structure Inspection Manual, but does not have a centralized database of bridge condition or biennial inspections.

4.4.8 Other municipalities in Ontario

The City of Toronto is currently revising their bridge management system. Their inspections, based on conversations with their bridge management staff, follow OSIM.

The Regional Municipality of Durham uses OSIM for their bridge inspections, but use MBADES as their database for bridge data entry.

4.5 Audit Objective No. 3

Examine representative reports, studies, and designs to determine if they are consistent with relevant policies, procedures, legislation, and regulations

Criteria

- Structure Information Management System;
- Bridge Inspection Reports;
- Detailed Bridge Condition Assessment and Renewal Options Analysis;
- Detailed Design Packages;
- Contract Packages;
- Contract Administration and Construction Supervision; and,
- As-Built Drawings.

4.5.1 Structure Information Management System

The City's Structure Information Management System is being used by the City to keep track of the bridges' condition and to set priorities for the maintenance of the bridges. The City is currently upgrading SIMS to permit the use of the current version of OSIM.

Based on a review of SIMS and comparison with the requirements of a bridge management system, it can be concluded that the overall system as applied in conjunction with the Cognos™ data mining software and Microsoft Excel spreadsheet contains all the requirements of a bridge management system. The main concern at present is the time and effort required to manipulate the database data into the Microsoft Excel spreadsheet. On the other hand, the need for a person to extract and review the file is useful as long as the process is done by or under the direct supervision of an experienced engineer.

The work currently proceeding to integrate SIMS into a single database will improve the process substantially, as it will reduce the time and effort required to maintain the database.

4.5.2 Bridge Inspection Reports

As noted previously, the methodology used for the bridge inspections and the corresponding reports does not meet the current OSIM. It is important that the City uses the current OSIM methodology to remove the subjectivity of the bridge appraisal methods presently in use.

The main difficulty with the method currently used by the City is that it is subjective. This is one of the reasons why the Ministry moved to the current system, which is more time consuming in the field but provides better record and comparison of the condition of the structure from year to year.

A more serious concern with the practice of undertaking the inspection of structures using a methodology that does not conform with the requirements of OSIM is that it could place the City at a disadvantage if there is a problem, as an adversary could argue that the City did not meet statutory requirements in the inspection process.

4.5.3 Detailed Bridge Condition Assessment and Renewal Options Analysis

The Detailed Bridge Condition Assessment carried out by the City meets the requirements of the Structural Rehabilitation Manual. At the time of the structure inspection, the City requires that the consultant or the City project manager, as the case may be, carries out a detailed visual inspection of the structure, using the OSIM methods and forms. We found that, with one exception, this is generally the case in the sample that we examined.

The Renewal Options Analysis is comprehensive and in accordance with the Guidelines prepared by the City. Life cycle costing of the renewal options is beneficial to the City and meets the requirements of the Ministry. The Guidelines prepared by the City allow variation in the level of complexity used in the life cycle cost analyses; this is useful in matching the level of complexity to the importance of the structure and the seriousness of the renewal options required. The Guidelines require examination of the option of complete replacement of the structure, but only when it is a viable option.

Review of the sample files disclosed that the most recent projects are following the City standards in this regard.

As noted in Sub-section 4.1, in three of the files examined it was found that the request for quotation required and the proposal offered preparation of the detailed condition assessment and the renewal options evaluation, but the documents were not available in the file or upon request. In those cases, the City indicated that the condition assessment and the renewal options evaluation were not required. This was incorrect. The City should have an appropriate method to confirm that the required deliverables are in fact delivered before the project is considered fully paid.

In addition, we found that the process used for the renewal options assessment in the case of bridge-culverts that are replaced as part of an overall road reconstruction project did not conform to the required process. In those cases, the investigation of options was not as thorough as for bridges or bridge-culverts that are renewed independently of the road reconstruction project. In this regard, we believe that the condition survey and the assessment of renewal options should be done under the direct supervision of IM, using the same methodologies.

Recommendation 4

That the City ensure that bridge-culvert projects undertaken as part of a road reconstruction project be reviewed in detail to confirm that the planning and design of the structure meets the requirements of the *Guidelines for Infrastructure Renewal Options Analysis.*

Management Response

Management agrees with the recommendation. This recommendation is consistent with Infrastructure Services' current procedure.

4.5.4 Detailed Design Packages

Where required, the detailed design drawings reviewed were found to be completed in accordance with professional standards.

4.5.5 Contract Packages

In general the methodology was established by RMOC. No concerns with respect to these were found.

4.5.6 Contract Administration and Construction Supervision

Depending on the size and complexity of the project, contract administration and construction supervision is done part-time or full-time.

Part-time inspection of smaller projects is a standard procedure in public and private projects in Ontario. Depending on the contractor and his capabilities, part-time inspection presents the potential for important aspects of construction not being observed by the inspector. It is recommended that the inspection timing be arranged such that the project manager and the construction inspector can vary the schedule as required to ensure that critical aspects of the project are inspected.

4.5.7 As-Built Drawings

In general terms the as-built drawings are based on drawings prepared and maintained by City's Inspector during construction, by marking in red ink those parts of the project that may have differed from the design data (for example, elevations of footings, location of pipes or services, etc.). The red-line information is used to prepare the file 'as-built' drawings when the project is completed.

All projects investigated had as-built drawings in file or in the network server.

Recommendation 5

That the City implement a checklist or other management process to allow the program manager and the project manager to confirm that the inspection process has been completed, including the preparation of the As-Built drawings.

Management Response

Management agrees with the recommendation.

Infrastructure Services Department (ISD) has a Project Management Manual in place which defines project management requirements, communicates expectations and fosters consistency on all projects. The above-referenced requirements will be included in the manual by Q4 2010.

4.6 Audit Objective No. 4

Examine representative maintenance contracts to determine if the maintenance recommendations were fully implemented

Criteria

- Ranked structures vs. budget allocations;
- Contract Packages;
- Contract Administration and Construction Supervision;
- Inspection procedures;
- Quality assurance methods and processes;
- Recording of construction progress; and,
- Final inspections.

4.6.1 Ranked structures vs. budget allocations

As in any other public or private enterprise, the budget allocations do not cover the entire range of projects that need renewal. The system used by the City for setting the priorities of structures includes large, medium and small structures, to ensure that the budget is not concentrated in one type of structure. The risk-based method of setting priorities for structure renewal also assists in ensuring that those structures with the most pressing need for renewal are given sufficient importance in setting the budget.

The priority setting method used by Infrastructure Management also assists in providing budget for relatively minor maintenance and renewal works, to maintain the structures at a serviceable level and reducing the rate of deterioration of the structures.

Further controls on the implementation of the renewal projects is provided by the process in the Project Management Manual, in the project scoping process required at the initiation of the project.

4.6.2 Contract Packages

Contract packages are prepared based on the conclusions of the Detailed Condition Assessment and Renewal Options Report. Depending on the size of the project, a Preliminary Design Report may be completed in addition to the Detailed Condition

Assessment and Renewal Options Report. Complicated structures, such as the Lemieux Island Bridge also include a detailed seismic evaluation. These depend on the requirements of the Canadian Highway Bridge Design Code.

In the structures examined we found that the recommended renewal options were fully implemented. However, as discussed in sub-section 4.1, in a number of cases the consultant did not prepare a Renewal Options Report, although it was a requirement of the Request for Quotations and the consultant offered the work as part of the proposal. Of note in this regard is that all the projects involved were assigned to the same City Project Manager. This implies that the City procedures and requirements may be appropriate but are not being implemented properly by the noted Project Manager.

The Project Management Manual issued in 2006 contains a variety of requirements for project control and reporting. Appropriate use of the Project Management Manual and careful implementation of its requirements should assist in ensuring that the consultants deliver the required items (deliverables). However, it is noted that the same result can be accomplished if the project manager involved applies the required standard of care to ensure that the services contracted and paid by the City are delivered. A simple check-list would suffice in many cases.

4.6.3 Contract Administration and Construction Supervision

In general terms the procedures for contract administration and construction supervision were found to be consistent with standard professional requirements. Once the contract documents are prepared and the tender awarded, the work required was found to be completed adequately.

We found two instances in which files were not available for review because they were in the Legal Services section, due to a construction claim. The subject projects were under the responsibility of the same project manager, who also was responsible for the three projects were the consultants did not submit the required deliverables and who reported to our request for the missing documents that the particular projects did not require the Renewal Options Reports.

4.6.4 Inspection Procedures

As noted earlier, inspection is carried out on a part-time or full-time basis depending on the size of the contract and the complexity of the structure and the required renewal work. This methodology is standard in Ontario. In general, we found that the documentation of the inspections was adequate. We would encourage the City to implement standard filing procedures (as far as practical) to ensure that the files for a project are all kept together and that all the information that is supposed to be in the file is kept there (unless it is in use, of course).

Part-time inspection is standard operating procedure for small, simple projects. However, it requires that the inspector be on site during the key steps in the project.

Accordingly, the inspector must have sufficient flexibility in scheduling inspections to confirm that the work is done properly.

4.6.5 Quality assurance methods and processes

In general terms, quality assurance testing, methods and processes followed standard practice used in construction supervision. We found that the records maintained in the files were not always complete, and the filing system varied with the project manager. We recommend that the City ensures that the systems are consistent.

4.6.6 Recording of construction progress

Recording of construction progress is made in the Field Inspectors Book by the construction inspector. In general terms we found that the City's inspectors kept complete and organized written record of their observations.

The construction inspectors also are responsible for maintaining the copy of the construction drawings, for preparation of the 'as-built' drawings. In general terms, the inspectors carried out this responsibility in a competent manner.

4.6.7 Final inspections

The Project Mmanager and construction inspector carry out the final inspections prior to the issuance of the Certificate of substantial completion.

A Senior Inspector with the Infrastructure Management Division inspects the completed work about six weeks prior to the expiration of the Warranty Period and communicates the results of the inspection to the Project Manager, who instructs the Contractor to undertake any required work. The IM Senior Inspector then informs the Senior Engineer responsible for SIMS to update the database, showing the bridge as being renewed. This is the final opportunity to ensure that the bridge has been renewed in accordance with the Renewal Options report.

4.7 Audit Objective No. 5

Examine the implementation of the maintenance recommendations and the procedures used to record them in the structure database

Criteria

- Structure Information Management System
- Detailed Bridge Condition Assessment and Renewal Options Analysis
- Detailed Design Packages
- As-Built Drawings

4.7.1 Structure Information Management System

Previous sections of this audit report discussing other Audit Objectives have presented our findings with respect to the maintenance of the data in SIMS. The database is designed to summarize the data collected in the Bridge Appraisal sheets prepared during the bridge inspections. Once the inspection conducted six weeks prior to the expiry of the contract warranty period is complete, the bridge appraisal sheet corresponding to that inspection is incorporated into the database, and the structure rating is upgraded to the maximum (5).

4.7.2 Detailed Bridge Condition Assessment and Renewal Options Analysis

Examination of the files for the sampled structures shows the progress achieved by the City in the process of condition assessments and renewal options analyses. The procedures in the current Guidelines and Project Management Manual are being followed in the most recent projects.

4.7.3 Detailed Design Packages

The following excerpt from the City's Project Management Manual summarizes the procedures for implementation:

> *Upon completion of the Project Analysis, Budgeting and Scoping phase by the Infrastructure Management Division (IMD) or the Planning and Growth Management Department (PGM) and council approval, projects are assigned to PWS or other departments as appropriate for implementation.*
>
> *At the start of the Project Initiation Phase, for those projects transferred to the Infrastructure Services Branch (ISB), the Director and ISB Division Managers review the project requirements such as project technical area, scheduling, project costs and the scope of the project. Based upon the assessments made in these discussions, the Director delegates the authority for the project to an appropriate ISB Division Manager (in many cases this determination will have already occurred as a result of work conducted in the Project Scoping, Budgeting and Approval Phase and these previous decisions are verified at this point).*
>
> *Based upon workload, scope and available resources the ISB Division Manager and/or the Division Program Manager and Project Manager will determine whether the project will be managed internally or contracted out. For the most part, these projects are funded from the PWS and the PGM portions of the City's annual capital budget.*

The project scope and needs are reviewed with the Infrastructure Management Division for all projects that are initiated by IM. We found that IM will provide a Project Scoping memorandum to Construction Services at the time that the project is initiated. This procedure was implemented recently (2005±). We believe the

Project Scoping memorandum is a significant quality assurance document that helps to ensure that the renewal contract work will encompass the required renewal of the bridge.

Infrastructure Management does warranty inspections. Once this is complete, the bridge is placed in the database as being renewed, and the corresponding condition rating is raised to 5, the maximum value.

4.7.4 As-Built Drawings

As-built drawings are completed for all structures by the Construction Inspector and the drawings are updated and placed in the network server.

We found that this procedure is followed generally, but we found a few exceptions in the sample examined, as noted previously.

Recommendation 6

That the City ensure that the project files are set up, maintained, and complete in accordance with the City's policies and procedures and the Project Management Manual.

Management Response

Management agrees with the recommendation.

Infrastructure Services continues to improve adherence to proper project filing practices. While the audit concludes that only 3 of 34 structure files examined were complete in all aspects, it is noted that these structures span many decades and that filing practices have evolved over time. The four complete structure files represent projects undertaken since amalgamation and the adoption of the Project Management Manual in early 2006. The other 30 files contained over 85% of the required information.

Project filing requirements will be reviewed and reinforced in the Project Management Manual by Q4 2010.

5 CONCLUSION

The audit revealed that the Bridge Maintenance Process used by the City of Ottawa's Infrastructure Management Division is being used for the maintenance of the City bridges. However, the database management and structure ranking for setting of renewal priorities is cumbersome. Generally, we found that the City's overall bridge maintenance process has the necessary policies and procedures, but they are not being followed consistently. The variability in the application of the City's policies and procedures by different project managers results in a high error rate in the application of the policies and procedures and the Project Management Manual. We found only 4 of 34 structure files examined were complete in all aspects. The procedures used and the filing systems of the City require

improvements to ensure that the policies and procedures and the Project Management Manual of the City are followed by all project managers.

The bridge inspection process and records for the detailed visual inspections do not comply with Provincial regulations and the Ontario Structure Inspection Manual. The City must change this procedure as soon as possible to be compliant.

6 ACKNOWLEDGEMENT

We wish to express our appreciation for the cooperation and assistance afforded the audit team by management and staff.

APPENDIX A – Summary of Structure Files Examined

APPENDIX A – Summary of Structure Files Examined

City of Ottawa
Audit of Bridge Maintenance Process

Summary of Structure Files Reviewed

Sample No.	Structure Number	Selected for Audit	Name	Category	Year Built	Yr Last Rnew	Inspections Reports	Inspections done	Condition Survey	Renewal Options Report	Detail Design	Contract Tendered	Construction Done	Inspections done by City	Inspections by outside firm	Shop Drawings
1	012160	A	Laurier Av Bridge	Bridge	1901	2004	2005, 2007	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
2	013260	A	Porters Island Pedestrian Bridge	Bridge	1894	1998	2003, 2007	Yes	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable
3	015040	A	O-Train/NS LRT U/P W Transitway W. Transitway CPR O/P 0.3km W of Bayview Road	Bridge	1983	2004	2004, 2005	Yes	Visual inspection + detailed deck condition survey	Detailed bridge rehabilitation study	Yes	Yes	Yes	Yes	Specialist engineering services during construction	Yes
4	015880	A	NS LRT U/P Gladstone Av	Bridge	1966	2007	2004, 2005, 2007 by consultant	Yes	Yes Inspection forms do not conform to OSIM	Yes, but not with file; report was provided separately upon request	Yes	Yes	Yes	Yes	Yes	Yes
5	016200	A	W Transitway O/P Bayview Rd	Bridge	1984	2007	2005, 2007	Yes	Not applicable	No renewal options analysis done. The work completed in 2007 was to repave the surface.	No	Yes	Yes	No data	No data	No data
6	017170	A	Lemieux Island Bridge	Bridge	1989	2007	2004, 2005	Yes	Not in file Info provided	Yes, but not in file Note that Sept. 2005 Structural and Seismic Evaluation Report and Nov. 2006 Preliminary Design Report in file Info provided upon request	Yes	Yes	Yes	Yes	Yes	Yes
7	056060	A	SE Transitway O/P Riverside Dr	Bridge	1989	2007	2004, 2006	Yes	Not applicable	No renewal options analysis done. The work completed in 2007 was to repave the surface.	No	Yes	Yes	No data	No data	Not required
8	056610	A	Confederation Heights Bridge [A	Bridge	1970	1998	2005, 2007	Yes	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable

APPENDIX A – Summary of Structure Files Examined

City of Ottawa
Audit of Bridge Maintenance Process

Summary of Structure Files Reviewed

Sample No.	Structure Number	Selected for Audit	Name	Category	Year Built	Yr Last Rnew	Inspections Reports	Inspections done	Condition Survey	Renewal Options Report	Detail Design	Contract Tendered	Construction Done	Inspections done by City	Inspections by outside firm	Shop Drawings
9	116110	A	Richmond Rd O/P Bayshore Dr	Bridge	1973	1994 1997 according to files	2005, 2006	Yes	Not applicable	No Was not required for this project	Yes	Yes	Yes	Not in file Info available has been provided.	Not in file Info available has been provided.	Not in file Info available has been provided.
10	224840	A	Blair Rd O/P Hwy 174	Bridge	1968	2000	1999, 2001,2005,2006, 2007	Yes	Not in file	Not in file Was not required for this project	Yes	Not in file Info provided	Yes	Yes	Yes	Yes
11	227120	A	Greens Creek Bridge St Joseph I	Bridge	1950	2008	2005, 2007	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes, shop drawing review Fisheries Act compliance Some problems with failure of sed. control system,	Yes
12	227480	A	Albion Rd O/P Sawmill Creek	Bridge	1963	2001	2005, 2008	Yes	Not in file	Information not available. Completed by former Gloucester prior to amalgamation. Likely completed as part of Albion Road improvements.	No data	No data	No data	No data	No data	No data
13	433080	A	Townline Bridge Con IX Lot 1 [Fi	Bridge	2003	2004	2001, 2003, 2005, 2007	Yes	2001 Report date August 2001	Preliminary Engineering Report, Jan 2003 presents EA (Schedule B) results, plus prelim. eng. design of structure. Examined 4 alternatives. Note report is not stamped by prof. eng.	Yes	Yes	Yes	No Inspectors Diary in file	Yes, shop drawings	Yes
14	543250	A	Old Almonte Rd O/P Creek 0.50	Bridge	2003	2003	2001, 2004, 2006	Yes	Not in file Was not required for this project Note that this is a major structure, should have had a condition survey	Not in file Preliminary Report with Renewal Options provided upon request	Yes	Yes	Yes	Yes	No	Yes

APPENDIX A – Summary of Structure Files Examined

City of Ottawa
Audit of Bridge Maintenance Process

Summary of Structure Files Reviewed

Sample No.	Structure Number	Selected for Audit	Name	Category	Year Built	Yr Last Rnew	Inspections Reports	Inspections done	Condition Survey	Renewal Options Report	Detail Design	Contract Tendered	Construction Done	Inspections done by City	Inspections by outside firm	Shop Drawings
15	547530	A	March Rd O/P Cody Creek	Bridge	1980	2007	2005, 2007	Yes	Yes, note that hydrologic calculations are based on old Drainage Manual, and there are no hydraulic calculations No OSIM inspection sheets	Not in file Was not required for this project No options examined at all	Yes	Yes, but tender documents not in file	Yes	No Data provided upon request	Consultant for contract administration Design consultant for specialist services	For road protection
16	753090	A	Jock Trail Bridge Jock Trail Rd O	Bridge	1947	2007	2005	Yes	Not in file Info provided on 28 June 2008	Not in file Info provided on 28 June 2008	Yes	Yes, RFQ	Yes	Yes	Yes	Yes
17	757401	A	Castlefrank Rd O/P Glen CairnTv	Bridge	2003	2003	2005, 2007	Yes	No, structure replaced as part of Flood Mitigation Study	No, covered under Flood Mitigation Options report No options examined	Yes	Yes	Yes	Not in file Provided upon request	Yes	Yes
18	757960	A	Fortune St Bridge 0.30 km North	Bridge	2003	2003	2004, 2006	Yes	Not in file Was not required. Done as part of a road contract	Not in file Was not required. Done as part of a road contract	Yes	Yes	Yes	Yes	Not in file	Not in file
19	872130	A	Kars Bridge Roger Stevens Dr O	Bridge	1958	1990	2006, 2007	Yes	Yes	Yes, but not found in file Info provided	This structure was in queue for renewal.	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable
20	873010	A	Rideau Valley Dr S O/P Steven Creek NOT IN ORIGINAL REQUEST, BUT DATA PROVIDED REPLACED 113100 IN AUDIT	Bridge	1967	2006	2003, 2006, 2007	Yes	Yes, draft	Yes, draft	Yes	Yes	Yes	Yes	Not in file	Shop drawings not required. File contains data submitted by Contractor for materials

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Sample No.	Structure Number	Selected for Audit	Name	Category	Year Built	Yr Last Rnew	Inspections Reports	Inspections done	Condition Survey	Renewal Options Report	Detail Design	Contract Tendered	Construction Done	Inspections done by City	Inspections by outside firm	Shop Drawings
21	873030	A	Stevens Creek Bridge Second Line Rd	Bridge	1937	2003	2004, 2006	Yes	Not in file Provided upon request. No OSIM data in Detailed Visual Inspection	Not in file Provided upon request	Yes	Yes	Yes	Yes	Yes	Not in file - Was not required
22	873090	A	Stevens Creek Bridge Fourth Lin	Bridge	1967	2007	2005, 2006	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
23	877830	A	First Line Rd O/P Mud Creek	Bridge	1940	2006	2005, 2007	Yes	Not in file	Draft marked up report, incomplete Refer to contract for structure 873010	Yes	Yes	Yes	Yes	Not in file	Not in file
24	877930	A	Fourth Line Rd Con III/V Lot 34	Bridge	1984	1984	2005, 2007	Yes	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable
25	882120	A	Kenmore Bridge Yorks Corner R	Bridge	1971	2008	2003, 2004	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
26	882340	A	Reside Bridge Grey's Creek Rd (	Bridge	2003	2003	2001, 2002, 2004, 2006	Yes	Not in file Provided upon request. No OSIM data in Detailed Visual Inspection	Not in file Provided upon request	Yes	Yes Note no tender doc in file	Yes	Not in file - Info provided	Not in file	Yes
27	882540	A	Aubrey Bridge Ninth Line Rd O/F	Bridge	1960	2007	2003, 2005	Yes	Yes	Not provided	Yes	Yes	Yes	Yes	Yes	Yes

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28	897140	A	Becketts Creek Bridge Con I Lot	Bridge	1965	1965	2004, 2006	Yes	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable
29	058200	A	Walkley Rd Sawmill Crk B-Culve	Bridge-Culvert	1972	1997	2005, 2007	Yes	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable
30	117670	A	Black Rapids Creek Br CR15 Con I Lot 23	Bridge-Culvert	1960	2004	2003, 2008	Yes	Yes, technical memorandum Acceptable since this is a culvert extension No reference drawings provided	Not in file Was not required for this project Memorandum reviewed by Senior Bridge Engineer.	Dwgs. not in file Only Preliminary General Arrangement drawing	Yes Contract documents in file	Yes	Yes	Yes	No
31	223200	A	Ninth Line Rd Culvert Con 8/9 Lo	Bridge-Culvert	1975	1975	2006, 2007	Yes	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable
32	227040	A	Beaudoin Bridge Renaud Rd O/P	Bridge-Culvert	1965	2006	2005, 2007, 2008	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No
33	757210	A	Poole Creek Bridge Carp Rd Cor	Bridge-Culvert	1955	1991	2005, 2007	Yes	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable
34	897260	A	Frank Kenny Rd [Old] Cardinal C	Bridge-Culvert	1975	1975	2004, 2006	Yes	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable

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1	012160	A	Laurier Av Bridge	Yes concrete cylinders piling data	Yes	Yes	Yes	$1,893,873 (plus contingency)	$2,515,480	$18,013,445 (plus contingency)	$18,675,502	This is a very large bridge, which received very close attention during the evaluation of renewal options, detailed design, and construction. The files for this bridge are complete. Database spreadsheet states bridge constructed in 1901, but it was replaced in 2004.
2	013260	A	Porters Island Pedestrian Bridge	Not applicable	Not applicable	Yes	Yes	7,500.00	7,500.00	22,470.00	26,119.90	Structure Inspection Sheet - 2007/06/04 - Bridge closed at time of inspection. Same for 2004 inspection. This bridge is closed to the public. The City continues to inspect it biennially.
3	015040	A	O-Train/NS LRT U/P W Transitway W. Transitway CPR O/P 0.3km W of Bayview Road	Yes, by City QA Section Concrete tests by City's QA Testing Laboratory	Yes	Yes	Yes	73,439	72,492	343,170	244,970	Structure Inspection Sheet - 2003/05/27 & 2004/03/03 - Prior to renewal. Structure Inspection Sheet - 2005/09/30 - after renewal - Note that original design assignment was for bearing replacement. There were problems with installation of bearing replacements, and the expansion joints. Files were complete for this structure.
4	015880	A	NS LRT U/P Gladstone Av	Yes	Yes	No - In process of being completed	Yes	not available	17,383.01	215,595.00	200,250.00	Part M of Contract ISB07-5003 Inspection of bridge work done by IM Staff Inspection forms in the Condition Report do not conform to OSIM. Condition Report was not in the file, but was provided upon request.
5	016200	A	W Transitway O/P Bayview Rd	No data	No data	No data	Yes	0.00	0.00	3,925.00	3,925.00	Only 2002 repairs in file. Files were not complete for these repairs. The latest work on this bridge was repaving in 2007, as part of overlay contract. However, there was no documentation in the files regarding the work.
6	017170	A	Lemieux Island Bridge	Not in file	Yes	Yes	Yes	not available	not available $200,873 incl. taxes	869,550.00	759,969.00	Note re organization of files No reports in file Note Eradiquake isolation bearing calculations based on CSA S6, CHBDC. Note construction calculations and handwritten notes not organized, no dates, no initials, n title. Condition Survey and Renewal Options Report not in file. Provided upon request. No quality assurance data in file.
7	056060	A	SE Transitway O/P Riverside Dr	No data	No data	No	Yes	0.00	0.00	14,444.00	14,444.00	File provided contains a maintenance request 2000, Inspection sheets up to 2000. The latest work on this bridge was repaving in 2007, as part of overlay contract. However, there was no documentation in the files regarding the work.
8	056610	A	Confederation Heights Bridge [A	Not applicable	Not applicable	Yes	Yes	279,000 approved budget. (includes other work on top of the structure)	264,997.00	2,134,870 (includes other work on top of the structure)	2,300,144.41 (includes other work on top of the structure)	Inspection Sheet for 2000 indicates that there were significant problems after the work done in 1999. There is no indication this was corrected.

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9	116110	A	Richmond Rd O/P Bayshore Dr	Not in file Info available has been provided.	Not in file Info available has been provided.	Not in file - Available on "I" Drive	Yes	95,000.00	141,005.00	394,570.00	404,078.00	Last renewal for this structure was done in 1997. The structure is being inspected on schedule every two years.
10	224840	A	Blair Rd O/P Hwy 174	Not in file	Yes	Yes	Yes	55,555.00	78,655.00	705,759.00	697,992.00	File was incomplete. Some additional information provided upon request.
11	227120	A	Greens Creek Bridge St Joseph	Yes, by City QA Section Concrete tests by City's QA Testing Laboratory	On-going	Not applicable at time of audit	Not applicable at time of audit	HP 206,332.75 Delcan 73,031.50 Packman 51,823.60	HP 178,435.95 Delcan 73,384.13 GA Packman - 0.00	2,135,589.50	2,099,820.51	Dec. 2002 - Preliminary Design Study - Contents similar to Detailed Renewal Options Report - notes that bridge rehabilitated in 1981 and 1991. Many items included in 1991 rehabilitation were replaced in 1981. Detailed inspection work met requirements of OSIM.
12	227480	A	Albion Rd O/P Sawmill Creek	No data	No data	No data	Yes	not applicable	not applicable	not applicable	not applicable	No information. Drawings only. The City indicated that it probably was repaired as part of Albion Road improvements in 2001 by Gloucester
13	433080	A	Townline Bridge Con IX Lot 1 [Fi	Not in file Some concrete cylinder test results in file. No granulars. Precast concrete girder QC data on file	No Inspectors Diary in file Info provided	Not in file Info provided	Yes	154,400.00	148,252.02	1,166,346.83	1,109,235.06	File was not complete. No inspectors diary or record of construction inspection in file, but was provided upon request. Quality assurance data incomplete; no indication of follow-up on QA.
14	543250	A	Old Almonte Rd O/P Creek 0.50	Yes	Yes	Yes	Yes	33,000.00	32,987.00	231,312.40	238,160.34	This was a culvert replacement. However, there is no record of evaluation of alternatives. (Schedule A project). In addition, City stated that Renewal Options report not required, but it was required by RFP and proposal.

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15	547530	A	March Rd O/P Cody Creek	Not in file Provided upon request	Yes	Not in file	Yes	50,715.00	50,713.00	103,944.00	95,954.00	File incomplete Renewal options report should have been required No data on construction inspections. No as-built drawings
16	753090	A	Jock Trail Bridge Jock Trail Rd O	Yes	Not in file Info provided	Not in file Info provided	Yes	$23,700 (2004 contract) $13,860 (2007 contract)	$24,882.93 (2004 contract) $12,600 (2007 contract)	$82,023.50 (2004 contract) $97,282.50 (2007 contract)	$90,225 (2004 contract) $84,970 (2007 contract)	File provided contains 2004 contract. It appears that work was done due to very poor condition of bridge Correspondence file Aug. 2004 to Dec. 2004 - bridge was rehabilitated in 1994. Timber deck failed in Aug. 2004, required emergency repairs. Preliminary design examined five options. IM requested lifecycle cost analysis, but it is not included in file. Contract based on Request for Quotations, awarded to 2nd lowest bidder due to lowest bidder not meeting bonding requirements. Condition inspection upon failure of deck. Renewal options report prepared. Records of construction and as-built drawings provided upon request. Design of original repairs was done without adequate survey.
17	757401	A	Castlefrank Rd O/P Glen CairnTv	Not in file Info provided upon request	Not in file Info provided upon request	Not in file Info provided upon request	Yes	245,599.78 tax included. This value also includes road work and storm sewer	314,228.51 tax included	920,159.23 This value also includes road work and storm sewer	859,961 contract BID included the structure and road work and storm sewer	This structure was replaced as part of the Flood Control Project for Glen Cairn Note comments in Structure Inspection Sheets regarding the construction of the culverts, particularly misalignment of the concrete boxes. Culvert was designed for cast-in-place construction, but was changed after the tender to precast boxes. Very limited number of options reviewed. This culvert was designed as part of the Glen Cairn Flood Control Project. The renewal options were examined within the flood control project study. However, we did not find indication that the structure replacement options were examined by the IM division.
18	757960	A	Fortune St Bridge 0.30 km North	Not in file	Not in file Information provided upon request	Yes	Yes	Phase I : $74,905 Phase II: 43,308	Phase I = $96,215 Phase II = $43,549	1,685,000.00	1,720,219.65	CSP culvert replaced during Fortune Street reconstruction with precast concrete box culvert. Note shop drawings for precast concrete boxes uses OHBDC 1991. Note that Consultants were hired to do this work because they were the former twp of Goulbourn engineering consultants. There does not seem to have been a proposal. Also note that the file for this project is very disorganized. Very hard to follow. There is no design information regarding the culvert size, etc. GA and detail drawings were included. No examination of renewal options
19	872130	A	Kars Bridge Roger Stevens Dr O	Not applicable	Not applicable	Not applicable	Yes	192,000.00	163,727.00	1,183,598.16	999,578.00	Bridge renewal was done in 2008. Noted that structural evaluation done in-house. This be part of Renewal options report The latest work on this structure was done by RMOC in 1990. The file does not contain any information on construction inspections, quality assurance or as-built drawings.
20	873010	A	Rideau Valley Dr S O/P Steven Creek NOT IN ORIGINAL REQUEST, BUT DATA PROVIDED REPLACED 113100 IN AUDIT	Not in file With Legal Services due to outstanding claim resolution. Submission by Concrete Chemicals	Not in file - Was not required Information provided	Not in file - Available on I: Drive	Not in file - Info provided	70,580.00	70,580.00	155,261.00	112,986.00	This project was included in contract with Mud Creek 877830 and Malakoff Road culvert SN 868310 Some of the files and information on this project was not available due to an outstanding claim. Upon receipt of the files from Legal Services, it was noted that the files are incomplete.

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21	873030	A	Stevens Creek Bridge Second Line Rd	Not in file	Yes	Yes	Yes	23,149.00	23,111.00	112,557.00	112,492.00	Condition survey and Renewal Options not done, although RFQ required them and Proposal offered them as part of scope of work.
22	873090	A	Stevens Creek Bridge Fourth Lin	Not in file With Legal Services. Provided upon request, but no QA data for asphalt.	Not in file With Legal Services. Provided upon request.	Not in file - Construction drawing available on I: Drive	Yes	60,177.00	59,302.00	429,930.00	231,430.00	Rehabilitation of existing bridge Some of the files and information on this project was not available due to an outstanding claim. Upon receipt of the files from Legal Services, it was noted that the files are incomplete.
23	877830	A	First Line Rd O/P Mud Creek	Not in file	Yes	Not in file - Available on I: Drive	Yes	incl with SN873010	incl with SN873010	112,815.00	106,469.00	No shop drawings, no quality assurance data,
24	877930	A	Fourth Line Rd Con III/V Lot 34	Not applicable	Not applicable	No	Yes	not applicable	not applicable	not applicable	not applicable	1999 Inspection noted bulging of CSP soffit under shoulder, but this was not noted in 2007 inspection. However, the file shows no note of repairs. No design or other information at all on file. IM indicated that the road was transferred to RMOC in 1985.
25	882120	A	Kenmore Bridge Yorks Corner R	Yes	Not in file Info provided upon request, as project under construction	Not finished Under construction	Not applicable at time of audit	122,949.35	116,888.78	702,070.00	684,743.00	The file on this project was complete. At the time of review, the project was under construction. Field inspection and other data was provided upon request.
26	882340	A	Reside Bridge Grey's Creek Rd (	Not in file	Not in file	Not in file - Available on I: Drive	Yes	23,149.00	23,111.00	112,557.00	112,492.00	Original timber deck on structural steel girders on concrete abutments bridge was replaced with a corrugated steel culvert. Note that there was no report Note deliverables noted in proposal for design not in file; there is no indication that they were delivered. No Renewal Options Report, although RFQ required it and proposal offered it. No tender in file No records of construction No record of quality assurance
27	882540	A	Aubrey Bridge Ninth Line Rd O/F	Yes, by consultant and City	Yes	Project construction not complete	Yes	115,604.53	108,405.35	607,994.78	553,148.36	This project included two culverts - noted Project Turnover Document, Project Scoping from IM, Project Definition Statement by project mananger. Condition Survey data collected in accordance with OSIM Proposed to do half-cell testing when deck exposed during construction. Renewal Options report not in file, although City says it was completed.

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28	897140	A	Becketts Creek Bridge Con I Lot	Not applicable	Not applicable	Not applicable	Yes	not appilcable	not applicable	not applicable	not applicable	Only file provided comprises Structure appraisal sheets from 1971 to 1974. Note rating then as 3. Rating in 2004 and 2006 Inspection Sheets is 4 to 5. Also noted 2004 inspection showed structure rock wingwalls lost pieces; hole behind rock wingwall. 2006 report notes scour, and very large area of deterioration of NE abutment wall. There is no indication that these deficiencies were corrected. Data that is available is contained in SIMS. No financial information is available
29	058200	A	Walkley Rd Sawmill Crk B-Culve	Not applicable	Not applicable	Yes	Yes	$0.00 (done in-house)	$0.00 (done in-house)	189,475.00	File not available	Inspector's Files provided No renewal options report. City indicated it was not required. No shop drawings, no quality assurance data, no records of construction in file.
30	117670	A	Black Rapids Creek Br CR15 Con I Lot 23	Granulars, concrete cylinders by consultant. Note that compaction tests show various Fail results. No record of correction. No record in the Inspection Diary.	Yes	Not in file - Construction drawing available on I: Drive Should be included in file	Yes	not available	not available	307,607.00	279,438.33	Culvert extensions done as part of road reconstruction as part of Woodruff Avenue Widening project. Note that the pedestrian bridges may affect the hydraulics of the culvert; however, no hydraulic evaluation included in the reports or design. Condition survey done as technical memorandum. Renewal options included in memorandum. No contract drawings in file, but provided upon request. Contract documents provided upon request. As-built drawings in network.
31	223200	A	Ninth Line Rd Culvert Con 8/9 Lo	Not applicable	Not applicable	No	Yes	not applicable	not applicable	not applicable	not applicable	This culvert was constructed in 1975 (information in database). Construction date is 1978, based on file data There is no information or drawings available.
32	227040	A	Beaudoin Bridge Renaud Rd O/P	Yes	Yes	Yes	Yes	56,151.74	56,160.74	426,761.50	355,027.92	Included Project Scoping per IM This file was complete.
33	757210	A	Poole Creek Bridge Carp Rd Cor	Not applicable	Not applicable	Yes	Yes	not applicable	not applicable	not applicable	not applicable	Note that 2005 inspection shows a large delamination area on the soffit of the concrete deck. Recommendation was to monitor. The overall deck was given a rating of 5. Last work done in 1991. City says File retention expires after 10 years, but there are other structures where files have been saved, e.g. Structure No. 058200 or 116110. No As-built drawings in file or network storage.
34	897260	A	Frank Kenny Rd [Old] Cardinal C	Not applicable	Not applicable	No drawings available	Yes	not applicable	not applicable	not applicable	not applicable	No work proposed Note comment from Senior Inspector that road has low traffic. Structure appears to have been constructed in 1978 This culvert was constructed in 1975 (information in database). There is no information or drawings available.