Transportation Association of Canada

Urban Transportation Indicators

in Eight Canadian Urban Areas

June 1996

TAC mission: to promote the provision of safe, efficient, effective and environmentally sustainable transportation services in support of Canada's social and economic goals.

The Transportation Association of Canada (TAC) is the foremost, broad-based assembly of transportation stakeholders in Canada. It is a national non-profit, non-partisan association of some 500 public and private sector members. Its interest cover all modes of transportation. It acts as a neutral forum for the discussion of transportation issues and concerns, and as a technical focus in the roadway transportation area. It was founded in 1914 as the Canadian Good Roads Association, became RTAC in 1970 and TAC in 1990.

The mission of the TAC **Urban Transportation Council** is to provide a forum to address urban transportation issues within the Canadian transportation. community.

The research reported here was conducted as part of the Council's long term program to achieve TAC's ***New Vision for Urban Transportation***, first published in 1993.

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ISBN 1-55187-102-5

TAC REPORT DOCUMENTATION FORM

Project No.	Report No.	Report Date	IRRD No.
		April 1996	

Project Manager

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Title and Subtitle

Urban Transportation Indicators in Eight Canadian Urban Areas

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Abstract

In 1993 TAC's Urban Transportation Council published a generic vision of a more sustainable urban transportation future for Canadian cities entitled a *New Vision for Urban Transportation*. In it were outlined 13 principles to help achieve the Vision. Since that time, the Urban Council has been interested in creating a national database of urban development and urban transportation information which could be used to monitor progress in achieving the *New Vision*.

A preliminary pilot project was conducted in 1994, and in April 1995 , the Council decided to proceed with a second phase, a more focussed project, which resulted in this report. The main purpose of the work was to define and determine whether a preliminary set of urban transportation indicators could serve as a basis for the continuous monitoring of transportation development in Canadian municipalities.

Eight urban areas participated in the project (Edmonton, Hamilton, London, Montréal, Ottawa, Québec, Toronto and Vancouver). The questionnaire sent to the participants requested information under 5 major headings: Urban Structure, Transportation Supply, Transportation Demand, Transportation System Performance, and Transportation Costs and Finance. In all 20 indicators were gathered under these headings. A sixth heading, Environmental Impact, based on annual gasoline sales data, added another 4 indicators to the study. The data collected from the questionnaire is presented in this report.

The report concludes that the practicality of the Urban Transportation Indicators Survey Process has been successfully demonstrated. Data availability and consistency across cities are reasonable and can probably be improved based on experience gained in the pilot survey. It is further concluded that a continuing urban indicators program is practical and desirable.

Keywords (IRRD)

Urban Area 0313
Transport 1155
Planning 0133
Databank 8614
Interview 0107
Canada 8018

No. of Pages	No. of Figures	Language	Price
31 p		English	

Supplementary Information

FICHE DE RAPPORT DE L'ATC

Projet n°	Rapport n°	Date du rapport	DIRR n°
		Avril 96	

Gestionnaire du projet

John Hartman

Titre et sous-titre

Urban Transportation Indicators in Eight Canadian Urban Areas

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Résumé

Par l'entremise de son Conseil des transports urbains, l'Association des transports du Canada (ATC) a publié en 1993 une *Nouvelle vision des transports urbains* préconisant l'instauration de transports urbains plus durables au sein des villes canadiennes. Aux fins d'orienter les efforts en ce sens, 13 principes fondamentaux de concrétisation de la vision y étaient proposés. Cette dernière a depuis reçu l'aval de tous les paliers de gouvernement au Canada et bon nombre de municipalités, à la faveur de différentes initiatives, s'emploient à mettre en place des réseaux de transport et des collectivités plus durables en s'inspirant des positions et principes énoncés dans cette ***Nouvelle vision***.

Dans ce contexte, le Conseil des transports urbains a par ailleurs amorcé un projet-pilote visant à vérifier la faisabilité de constituer une base nationale d'information sur le développement et les transports urbains, base de données qui permettrait d'assurer le suivi de la concrétisation de la vision précitée et qui pourrait en outre être utilisée par les municipalités à l'appui de la planification ainsi que de la surveillance de la mise en oeuvre de leurs propres programmes en la matière.

Ayant terminé la phase 1 du projet-pilote en 1994, à sa réunion d'avril 1995, le Conseil des transports urbains a décidé de poursuivre celui-ci et d'en amorcer la phase 2. Plus ciblée, cette deuxième phase se fonde sur les objectifs ci-après.

1. Définir **une première série d'indicateurs des transports urbains** à titre d'outils de surveillance continue du développement des transports au sein des municipalités canadiennes.
2. Évaluer la **possibilité de constituer une base de données préliminaire sur les transports** par le biais d'une enquête auprès de huit villes choisies du Canada.
3. Élaborer **des recommandations quant à la future évolution** du projet de base de données sur les transports urbains.

Le présent rapport traite de la nature des travaux, des résultats et des conclusions de la phase 2 du projet-pilote. Huit villes canadiennes ont participé au projet-pilote, en l'occurrence : Edmonton, Hamilton, London, Montréal, Ottawa, Québec, Toronto et Vancouver. En soi, ce dernier questionnaire portait sur cinq principaux domaines, à savoir :

- **la structure de l'agglomération urbaine** (3 indicateurs mesurés),
- **l'offre de transport** (6 indicateurs mesurés),
- **la demande en transport** (6 indicateurs mesurés),
- **le rendement des réseaux de transport** (2 indicateurs mesurés),
- **les coûts et le financement des transports** (3 indicateurs mesurés).
- **les incidences environnementales** (4 indicateurs mesurés).

Comme principale conclusion, il est permis d'avancer que le bien-fondé du processus d'enquête sur les indicateurs de transports urbains a été démontré avec succès. En effet, l'accessibilité aux données et leur uniformité, d'une ville à l'autre, apparaissent raisonnables et pourraient probablement être améliorées à la lumière de l'expérience acquise au fil de cette enquête-pilote. On peut également ajouter que la mise en oeuvre d'un programme continu d'application d'indicateurs urbains apparaît aussi faisable que souhaitable et à cet égard, le rapport traite des prochaines étapes suggérées.

Mots-clés

Enquete 0107
Canada 8018
Banque de données 8614
Planification 0133
Transport 1155
Zone urbaine 0313

Nombre de pages	Nombre de figures	Langue	Prix
31 p		Anglais	

ACKNOWLEDGMENTS

This report was made possible with funding provided by the:

British Columbia Ministry of Transportation & Highways
City of Edmonton
London Transit Commission
Municipality of Metropolitan Toronto
Ontario Ministry of Transportation
Regional Municipality of Hamilton-Wentworth
Regional Municipality of Ottawa-Carleton.

Source data for the urban transportation indicators was provided through the voluntary efforts of staff members at the:

City of Edmonton
City of Montreal
Greater Vancouver Regional District
Hamilton Street Railway Company
London Transit Commission
Montreal Urban Community
Municipality of Metropolitan Toronto
Quebec Ministry of Transportation
Regional Municipality of Ottawa-Carleton.

The Transportation Association of Canada is grateful for all of this assistance.

This report was prepared by the IBI Group, who wish to express their sincere thanks and appreciation to the Project Steering Committee for their guidance, and to the Technical Sub-Committee and other staff from participating municipalities for their help in providing data.

The views, opinions, conclusions and recommendations in this report are those of the IBI Group and do not necessarily reflect the official positions or policies of the Transportation Association of Canada.

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EXECUTIVE SUMMARY

BACKGROUND

The Transportation Association of Canada (TAC), through its Urban Transportation Council, published in 1993 a New Vision for Urban Transportation which outlines a generic vision of a more sustainable urban transportation future for Canadian cities and describes 13 principles as a basis for action to help achieve the Vision. The approach has been endorsed by governments at all levels across Canada, and a significant number of municipalities are taking initiatives to achieve more sustainable transportation and communities, drawing as appropriate on the generic vision and principles in the New Vision document.

The Council has also been working to develop and test the feasibility of creating a national database of urban development and urban transportation information which could be used to monitor progress in achieving the Vision. It could also be used by individual municipalities to plan and monitor their own sustainability programs.

OBJECTIVES

Having conducted a preliminary Phase 1 pilot project during 1994 the Urban Transportation Council, at its April 1995 meeting, decided to proceed with a more focused Phase 2 pilot project, with the following objectives:

1. To define a **preliminary set of urban transportation indicators** which would serve as a basis for the continuous monitoring of transportation development in Canadian municipalities.

2. To assess the **feasibility of assembling the preliminary transportation data set** by conducting a survey of eight selected Canadian cities, and

3. To develop **recommendations for the further development** of the Urban Transportation Database Project.

The body of this report describes the work content, findings and conclusions of the Phase 2 Pilot Project. Chapter **1** of the report outlines earlier work and the Terms of Reference for the Phase 2 Pilot Study. Chapter 2 describes the questionnaire development, geographic areas and survey process and response, Chapter 3 describes and discusses the survey results, and Chapter 4 presents conclusions. This Executive Summary follows the same format.

DESCRIPTION OF THE PHASE 2 PILOT PROJECT

The eight urban areas which participated in the pilot project are Edmonton, Hamilton, London, Montreal, Ottawa, Quebec, Toronto and Vancouver. The urban areas, as defined for data assembly, generally include the metropolitan areas associated with each city, as defined more fully in the report.

Drawing on experience gained in the Phase 1 Pilot Study (in which the survey requested quantitative information on 61 indicators involving 212 individual data items), the Phase 2 questionnaire (Appendix

A) was more focused, requesting 20 indicators involving 82 data items. The questionnaire requested data under five major headings, as follows:

- **Urban Structure** (3 measured indicators)
- **Transportation Supply** (6 measured indicators)
- **Transportation Demand** (6 measured indicators)
- **Transportation System Performance** (2 measured indicators)
- **Transportation Costs and Finance** (3 measured indicators)

Each of the 20 indicators consisted of various data items depending on the geographic areas, time period, or mode for which the data were sought. The target year for data collection was 1991; most data received was for that year but some was obtained for slightly earlier or later years (in the range 1987-1995) depending on survey years and other data availability factors.

A sixth major heading, **Environmental Impact,** was also included based on annual gasoline sales data purchased for each relevant municipality from the Kent Marketing Company. Four derived indicators (dealing with energy consumption and carbon dioxide consumption per capita and per person trip, respectively) were based on this information. A broad indicator of traffic road utilization was also derived based on transportation supply and demand information provided by **the** questionnaire response.

Considerable attention was devoted in the Phase 2 survey to defining the four geographic areas within each urban area for which indicators were reported (see definitions and maps in Appendix B). while the geographic area definitions used by several of the urban areas might be reconsidered in light of the Phase 2 results, by and large the geographic areas as defined are reasonably consistent, and the comparability of the resulting indicators was considerably improved relative to that of the Phase 1 survey.

RESULTS OF THE PHASE 2 PILOT PROJECT

The response to the Phase 2 survey was very good, with over 70% of the data items reported for 18 of the 20 indicators and over 80% of the data items for 14 of the 20 indicators. A preliminary tabulation and graphing of the results was distributed to the eight cities with queries regarding some apparent anomalies which were evident from the graphical comparisons across cities; a number of data corrections were made as a result but there was insufficient time to carry this process further.

The results of the Phase 2 Pilot Project are presented graphically in histogram form (Exhibits 3.1 through 3.32) comparing various data items and indicators for the eight urban areas, plus tables and maps summarizing the geographic areas, survey response rates, significance of key indicators in helping to monitor progress towards more sustainable urban transportation, and showing the values of these key indicators for the eight cities. As shown in Exhibits 4.1 and 4.2, 33 key indicators are identified: 13 measured and 20 derived, with many of the latter expressing measured indicators on a per capita basis.

Of the 33 key indicators, 22 are considered to be of high relevance in measuring sustainability, six are considered to be of medium relevance, and five provide background information necessary to understand the size of the urban area and to express other indicators on a per capita or per employee basis.

CONCLUSIONS

The basic conclusion is that the practicality of the Urban Transportation Indicators Survey Process has been successfully demonstrated. Data availability and consistency across cities are reasonable and can probably be improved based on experience gained in the pilot survey. It is further concluded that a continuing urban indicators program is practical and desirable, and suggested next steps are discussed.

It is suggested that the urban transportation indicators surveys could be conducted every five years (timed to coincide with census years) and that sufficient time (e.g. six or seven months) be scheduled for the survey procedure to allow an iterative process (e.g. reporting initial survey results to all respondents and allowing time for changes/clarifications and development of additional responses). Based on the Phase 2 Pilot Project experience, this would be likely to increase the consistency and completeness of survey results.

It is suggested that a number of additional urban areas be included, particularly Calgary and Winnipeg, plus others such as Victoria, Regina, Saskatoon, Thunder Bay, Sudbury, Windsor, Kitchener-Waterloo, St. Catharines-Niagara, Chicoutimi-Jonquière, Halifax and possibly St. Johns and Saint John. In other words, some 15-25 urban areas might be included.

One option could be to expand the Phase 2 survey (i.e. 1991 data) to include the additional cities and, at the same time, allow the original eight cities to make any final adjustments to the geographic areas and data supplied in the Phase 2 survey, and possibly provide more complete data responses based on more recently processed survey information. This would build on the momentum of the Phase 2 survey work and would provide a very firm 1991 base year for the urban transportation indicators monitoring process. With or without this expansion of the 1991 base year survey, the next survey could be scheduled for 1998 or 1999, with 1996 as the base year and with subsequent surveys to follow at five year intervals. The base years for these surveys (e.g. 1996, 2001, 2006, etc.) would, by design, correspond with Census years to enhance the accuracy and usefulness of the results. These suggestions, and others relating to resources and funding sources, are offered for consideration by the Urban Transportation Council at its spring meeting scheduled for April 21, 1996.

SOMMAIRE

CONTEXTE

Par l'entremise de son Conseil des transports urbains, l'Association des transports du Canada (ATC) a publié en 1993 une ***Nouvelle vision des transports urbains*** préconisant l'instauration de transports urbains plus durables au sein des villes canadiennes. Aux fins d'orienter les efforts en ce sens, 13 principes fondamentaux de concrétisation de la vision y étaient proposés. Cette dernière a depuis reçu l'aval de tous les paliers de gouvernement au Canada et bon nombre de municipalités, à la faveur de différentes initiatives, s'emploient à mettre en place des réseaux de transport et des collectivités plus durables en s'inspirant des positions et principes énoncés dans cette ***Nouvelle vision***.

Dans ce contexte, le Conseil des transports urbains a par ailleurs amorcé un projet-pilote visant à vérifier la faisabilité de constituer une base nationale d'information sur le développement et les transports urbains, base de données qui permettrait d'assurer le suivi de la concrétisation de la vision précitée et qui pourrait en outre être utilisée par les municipalités à l'appui de la planification ainsi que de la surveillance de la mise en oeuvre de leurs propres programmes en la matière.

OBJECTIFS

Ayant terminé la phase 1 du projet-pilote en 1994, à sa réunion d'avril 1995, le Conseil des transports urbains a décidé de poursuivre celui-ci et d'en amorcer la phase 2. Plus ciblée, cette deuxième phase se fonde sur les objectifs ci-après.

1. Définir **une première série d'indicateurs des transports urbains** à titre d'outils de surveillance continue du développement des transports au sein des municipalités canadiennes.

2. Évaluer la **possibilité de constituer une base de données préliminaire sur les transports** par le biais d'une enquête auprès de huit villes choisies du Canada.

3. Élaborer **des recommandations quant à la future évolution** du projet de base de données sur les transports urbains.

Le présent rapport traite de la nature des travaux, des résultats et des conclusions de la phase 2 du projet-pilote. Le chapitre 1 du document décrit les travaux exécutés antérieurement ainsi que le mandat de la phase 2 du projet. Le chapitre 2 porte pour sa part sur l'élaboration du questionnaire d'enquête, sur les zones géographiques visées ainsi que sur le processus d'enquête lui-même et le traitement des réponses obtenues. Le chapitre 3 est consacré à l'analyse des résultats d'enquête tandis que le chapitre 4 énonce les conclusions de l'exercice. Le présent sommaire traite des sujets précités dans le même ordre.

DESCRIPTION DE LA PHASE 2 DU PROJET-PILOTE

Huit villes canadiennes ont participé au projet-pilote, en l'occurrence : Edmonton, Hamilton, London, Montréal, Ottawa, Québec, Toronto et Vancouver. Aux termes des paramètres établis de collecte de l'information, les données fournies par ces villes englobaient généralement les zones urbaines adjacentes à chaque municipalité proprement dite, comme le précise d'ailleurs plus en détail le rapport.

A la lumière de l'expérience acquise au cours de la phase 1 du projet (le questionnaire d'enquête contenait 212 questions différentes devant servir à réunir des données quantitatives au regard de 61 indicateurs), le questionnaire d'enquête mis au point à l'appui de la phase 2 (voir annexe A) a été davantage ciblé et comportait 82 questions devant servir à circonscrire 20 indicateurs. En soi, ce dernier questionnaire portait sur cinq principaux domaines, à savoir :

- **la structure de l'agglomération urbaine** (3 indicateurs mesurés),
- **l'offre de transport** (6 indicateurs mesurés),
- **la demande en transport** (6 indicateurs mesurés),
- **le rendement des réseaux de transport** (2 indicateurs mesurés),
- **les coûts et le financement des transports** (3 indicateurs mesurés).

Chacun de ces 20 indicateurs a été établi à partir de différentes données d'ordre géographique ou temporel ou encore de renseignements sur un mode de transport donné. L'année cible de l'enquête était 1991. La majorité des données ainsi rassemblées se rapportaient à cette année, mais certaines concernaient néanmoins des années légèrement antérieures ou postérieures (la période de 1987 à 1995), tout dépendant des années d'enquête visées et aussi de certains autres facteurs liés à l'accessibilité à l'information demandée, voire l'existence de celle-ci.

Un sixième grand domaine, à savoir **les incidences environnementales**, a également été inclus dans le questionnaire. Sur ce sujet précis, le questionnaire visait à recueillir auprès de la Kent Marketing Company de l'information relative aux achats annuels d'essence de chaque municipalité. À partir des données ainsi réunies, quatre indicateurs ont été dérivés (consommation d'énergie et production de gaz carbonique, par habitant et par déplacement-personne, respectivement). Un indicateur général d'utilisation des routes a également été établi en se fondant sur les données concernant l'offre de transport/la demande en transport recueillies par le biais du questionnaire.

Dans le cadre de l'enquête de la phase 2, on a accordé une attention considérable à la définition des quatre zones géographiques constituant chaque agglomération urbaine et pour lesquelles des indicateurs étaient mesurés (voir définitions et cartes à l'annexe B). Ainsi, même si les définitions des zones géographiques utilisées par plusieurs agglomérations urbaines pourraient être révisées à la lumière des résultats de la phase 2, le fait demeure qu'en règle générale les définitions de ces zones sont raisonnablement uniformes de sorte que la comparabilité des indicateurs correspondants a été largement améliorée par rapport à la phase 1.

RÉSULTATS DE LA PHASE 2 DU PROJET-PILOTE

Le taux de réponse à l'enquête de la phase 2 a été très satisfaisant, se situant à plus de 70 % dans le cas des données relatives à 18 des 20 indicateurs et à plus de 80 % dans celui des données concernant 14 des 20 indicateurs. Une première série de totalisations et de représentations graphiques a été présentée aux huit villes répondantes, lesquelles ont été priées d'examiner certaines anomalies cernées lors de la comparaison générale des graphiques établis pour chacune d'elle. Un certain nombre de corrections ont été apportées aux données à la suite de cet exercice, lequel n'a cependant pu être approfondi davantage, faute de temps.

Les résultats de la phase 2 du projet-pilote sont présentés sous forme d'histogrammes (pièces 3.1 à 3.32 du rapport) de comparaison des différents éléments de donnée et des indicateurs pour les huit agglomérations urbaines visées. On trouve également des tableaux et des cartes précisant les points

suivants : les zones géographiques, les taux de réponse à l'enquête, la signification des indicateurs clés aux fins du suivi des progrès réalisés à l'appui de l'instauration de transports urbains plus durables ainsi que les valeurs de ces indicateurs clés pour les huit villes. Les pièces 4.1 et 4.2 portent sur 33 indicateurs clés, dont 13 ont été mesurés tandis que les 20 autres ont été dérivés. Nombre des indicateurs dérivés sont l'expression, par habitant, d'un indicateur mesuré.

De ces 33 indicateurs clés, 22 sont jugés hautement pertinents à la mesure de la durabilité, six autres sont considérés comme moyennement pertinents à cette fin tandis que les cinq derniers fournissent de l'information contextuelle nécessaire à la détermination de la taille de l'agglomération urbaine et à la conversion, par habitant ou par employé, d'autres indicateurs.

Comme principale conclusion, il est permis d'avancer que le bien-fondé du processus d'enquête sur les indicateurs de transports urbains a été démontré avec succès. En effet, l'accessibilité aux données et leur uniformité, d'une ville à l'autre, apparaissent raisonnables et pourraient probablement être améliorées à la lumière de l'expérience acquise au fil de cette enquête-pilote. On peut également ajouter que la mise en oeuvre d'un programme continu d'application d'indicateurs urbains apparaît aussi faisable que souhaitable et à cet égard, le rapport traite des prochaines étapes suggérées.

Le rapport propose également de procéder à des enquêtes sur les indicateurs de transports urbains tous les cinq ans (de manière à coïncider avec les années de recensement) tout en prévoyant chaque fois suffisamment de temps (de six à sept mois) pour procéder aux enquêtes mais aussi à une ronde de réexamen des résultats de cette dernière par les répondants (c'est-à-dire que les résultats initiaux d'enquête seraient soumis à tous les répondants et que du temps serait consenti à ces derniers pour apporter des modifications, des éclaircissements ou des précisions additionnelles à leurs réponses). L'expérience de la phase 2 du projet-pilote montre qu'une telle façon de procéder contribuerait vraisemblablement à accroître l'uniformité et la complétude des résultats d'enquête.

Il est également suggéré d'ajouter de 15 à 25 agglomérations urbaines au plan d'enquête, tout particulièrement celles de Calgary et Winnipeg, de même que celles de Victoria, Regina, Saskatoon, Thunder Bay, Sudbury, Windsor, Kitchener-Waterloo, St. Catharines-Niagara, Chicoutimi-Jonquière et Halifax ainsi qu'éventuellement, celles de St. John's (T.-N.) et de Saint John (N.-B.).

Dans ce contexte, l'une des possibilités qui s'offre pourrait être d'élargir le plan d'enquête (données de 1991) de la phase 2 de manière à englober d'autres villes et parallèlement à permettre aux huit villes répondantes originales d'apporter des précisions finales aux zones géographiques et aux données fournies dans le cadre de cette phase en même temps que de compléter éventuellement leurs réponses en regard des résultats d'enquête plus récents. Une telle démarche se fonderait sur les résultats d'enquête de la phase 2 et contribuerait à l'établissement d'une solide base de données pour l'année de référence 1991 en même temps qu'à l'amélioration du processus de suivi des indicateurs de transports urbains. Qu'il y ait ou non élargissement du plan d'enquête appliqué à l'année de base 1991, la prochaine enquête pourrait avoir lieu en 1998 ou 1999 et l'année 1996 servirait d'année de référence pour les enquêtes subséquentes, tous les cinq ans. Les années de référence de ces enquêtes (1996, 2001, 2006, etc.) coïncideraient volontairement avec les années de recensement dans le but d'accroître la précision et l'utilité des résultats. Ces suggestions et d'autres concernant l'affectation de ressources et les sources de financement des travaux visés ont été soumises à l'examen du Conseil des transports urbains, à sa réunion du 21 avril 1996.

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Phase 2 Pilot Project Report

1. BACKGROUND

1.1 CANADIAN SUSTAINABLE URBAN TRANSPORTATION INITIATIVES

The Transportation Association of Canada (TAC), through its Urban Transportation Council, published in 1993 a ***New Vision for Urban Transportation*** which outlines a generic vision of a more sustainable urban transportation future for Canadian cities and describes 13 principles as a basis for action to help achieve the Vision. The approach has been endorsed by governments at all levels across Canada, and a significant number of municipalities are taking initiatives to achieve more sustainable transportation and communities, drawing as appropriate on the generic vision and principles in the ***New Vision*** document.

The Council has also been working to develop and test the feasibility of creating a national database of urban development and urban transportation information which could be used to monitor progress in achieving TAC's ***New Vision for Urban Transportation.*** It could also be used by individual municipalities to plan and monitor their own sustainability programs.

It is becoming increasingly apparent, particularly to those living in large urban areas, that urban transportation in its current form is not sustainable in the long term, considering its environmental/ health impacts, incompatibility with urban amenities and "people places", and increasing consumption of non-renewable fossil fuels. Tightening financial constraints mean that urban transportation systems are also becoming steadily less affordable; declining expenditures are affecting system maintenance and delaying improvements, leading to reduced performance (in terms of capacity, service levels, safety, etc.) and growing road utilization. This, in turn, is having negative social, economic and environmental impacts.

In this context, municipal and provincial governments in Canada are taking a variety of initiatives aimed at achieving more sustainable urban transportation. The federal government, in cooperation with other national governments, has established emissions reduction targets, and supports technological improvements to reduce emissions per vehicle-km as mandated in the United Sates. The Transportation Association of Canada (TAC), through its Urban Transportation Council, has acted as a catalyst in stimulating and encouraging these moves towards greater sustainability [1, 2, 3]. One such action is the Urban Transportation Indicators Project initiated by the Council in 1994.

1.2 INITIAL PILOT STUDY

As described in the April, 1995 report by the Project Steering Committee [4], the Initial Pilot Study was approved by the Council at its October 20, 1994 meeting under the direction of a Project Steering Committee chaired by Ron Rice of McGill University. Other members of the Committee included:

John Hartman	Transportation Association of Canada
Jean Bertrand	Ville de Montréal
Bruce Duncan	City of Edmonton

John Gartner	Metropolitan Toronto
Paul Lee	Greater Vancouver Regional District
Nick Tunnacliffe	Regional Municipality of Ottawa-Carleton

The initial pilot study involved eight urban areas: Edmonton, Hamilton, London, Montreal, Ottawa, Quebec City, Toronto and Vancouver. A Technical Subcommittee, chaired by Dick Gordon of Metropolitan Toronto and including a representative from each of the participating urban areas, carried out the data assembly and preparation of the Initial Pilot Study report.

As documented in that report, quantitative information on 61 indicators was requested, involving 212 individual data items. In the limited time available, one of the eight urban areas (Montreal) was unable to respond to the questionnaire, and none of the others were able to provide all of the data items requested. Nevertheless, there was strong interest and a very positive response to the survey, indicating its potential value to the participants, and the report recommended that the pilot study be extended as a more focussed data collection request to the eight participating urban areas, building on the experience gained in the initial pilot study. In particular, it was proposed that fewer data items be requested and that more consideration be given to the definition of indicators and spatial units, small versus large city concerns, the use of modelled or forecasted data versus observed data, the possibility of a hierarchy of indicators, and the development of comparative measures.

1.3 PHASE 2 PILOT STUDY: TERMS OF REFERENCE

At its meeting on April 30, 1995, the Urban Transportation Council approved the above proposals and, in particular, instructed the Steering Committee to proceed with the Phase 2 Pilot Project, drawing on a more focussed survey of the eight urban areas *, with the following objectives:

1. To define a **preliminary set of urban transportation indicators** which would serve as a basis for the continuous monitoring of transportation development in Canadian municipalities.

* The eight urban areas, some of which are aggregations of many municipalities, are also referred to generically as "cities" in this report; the term "city" is used interchangeably with the term "urban area". The eight cities and the "region" defined for each are as follows:

- Edmonton, Census Metropolitan Area (CMA);
- Hamilton, CMA not including Burlington or Grimsby;
- London, new city boundary (post annexation);
- Montreal, service area for the three major public transit systems; somewhat larger than CMA;
- Ottawa, somewhat less than CMA and Regional Municipality of Ottawa-Carleton (RMOC) boundary;
- Quebec, considerably smaller than CMA, based on most densely urbanized municipalities;
- Toronto, the Greater Toronto Area (GTA) comprising the Regional Municipalities of Halton, Peel, York, Durham and Metropolitan Toronto;
- Vancouver, Greater Vancouver Regional District (GVRD).

See Appendix B for more detail.

2. To assess the **feasibility of assembling the preliminary transportation data set** by conducting a survey of eight selected Canadian cities, and

3. To develop **recommendations for the further development** of the Urban Transportation Database Project.

As a first step in launching the Phase 2 Pilot Project effort, a meeting was held on May 26 and 27, 1995 in Toronto involving members of the Steering Committee and Technical Subcommittee. This meeting reached agreement on a set of 33 measured indicators and 15 derived indicators, resolved a number of definitional issues, and defined a Phase 2 work program with specific steps to be carried out by members of the Technical Subcommittee and by a consultant to be retained to assist in assembling/compiling the data and to prepare the Pilot Project Final Report. The Technical Subcommittee members, and other individuals directly involved in the Phase 2 data assembly for each urban area were as follows:

Harvey Crone and Alan Brownlee: City of Edmonton
Bill O'Brien and Andrew Head: Hamilton Street Railway Co.
Greg Latham and John Ford: London Transit
Catherine Marchand, Communauté Urbaine de Montréal
Jean Bertrand and François Major, Ville de Montréal
Louis Shallal and Mark Campbell: Regional Municipality of Ottawa-Carleton
Robert Patry: Ministère de Transport du Québec
Dick Gordon, Rob Pringle and Dipak Dhrona, Metropolitan Toronto
Paul Lee, Karoly Krajczar and Clark Lim: Greater Vancouver Regional District

Following the May 26 and 27 meeting, a new draft questionnaire was developed by Planning Department staff of Metropolitan Toronto in consultation with other members of the Technical Subcommittee.

Based on responses to the Request for Proposal and Phase 2 Pilot Project Terms of Reference issued on August 16, 1995, Neal Irwin of IBI Group was retained to assist in finalizing the questionnaire, to work with representatives of the eight cities in helping them to respond to the questionnaire, and to prepare the Pilot Project Final Report, drawing on the survey results as compiled by staff of the Metropolitan Toronto Planning Department. Five tasks were defined to complete the Phase 2 Pilot Project, as follows:

Task 1: Redesign and Reissue Questionnaire

Task 2: Compile Database and Summarize Indicators

Task 3: Facilitate Municipal Responses

- 3.1 Refine Data Definitions in Light of Response Issues and Suggestions
- 3.2 Suggest Adjusted Definitions/Sources to Facilitate More Complete Response
- 3.3 Summarize Recommended Modifications and Outstanding Issues

Task 4: Summarize and Comment on Results

4.1 Update Database to Include Approved Modifications
4.2 Summarize and Comment on Key Indicators and Database
4.3 Evaluate Questionnaire and Recommend Modifications for Future Use

Task 5: Prepare Phase 2 Report

5.1 Draft Report
5.2 Final Report

Tasks 1 and 2 were conducted primarily by Metro Toronto Planning staff, while Tasks 3, 4 and 5 were carried out primarily by Mr. Irwin supported by Lee Sims and Brian Hollingworth of IBI Group.

The authors of this report wish to acknowledge with thanks the cooperation of the Technical Subcommittee members, without whose careful and comprehensive responses to the questionnaire and unfailing patience in dealing with phone and fax queries the Pilot Project could not have succeeded.

2. DESCRIPTION OF THE PHASE 2 PILOT PROJECT

2.1 QUESTIONNAIRE DEVELOPMENT

Based on detailed discussions during September, 1995, the draft questionnaire which had been part of the August 16 Terms of Reference was modified and refined in an attempt to clarify some of the questions. Additional derived indicators were also added (to be derived later from assembled data items) including annual carbon dioxide (CO_2) emissions per capita and a road utilization indicator. The Phase 2 Pilot Project questionnaire is presented in Appendix A.

The questionnaire requested data under five major headings, as follows:

- **Urban Structure** (3 measured indicators)
- **Transportation Supply** (6 measured indicators)
- **Transportation Demand** (6 measured indicators)
- **Transportation System Performance** (2 measured indicators)
- **Transportation Costs and Finance** (3 measured indicators)

A total of 20 measured indicators was therefore solicited by the questionnaire. Each of the 20 indicators consisted of various data items depending on the geographic areas, time period, or mode for which the data were sought. There were a total of 82 data items.

A sixth major heading **Environmental Impact**, was also included in the study. The measured indicator under this heading, Annual Fuel Consumption, was obtained separately by purchasing data on annual transportation fuel sales for each municipality from the Kent Marketing Company. Based on this, four derived indicators were produced:

- annual gasoline/energy consumption for transportation per capita (measured in litres and also in megajoules per capita);
- gasoline/energy consumption in litres per person trip (where person trips include all modes: auto, transit, walking, cycling);
- annual transportation emissions of carbon dioxide per capita, measured in tonnes; and
- carbon dioxide emissions in kilograms per person trip (trips by all modes, as noted above).

It should be noted that these indicators are based on gasoline sales only and do not include other transportation energy sources such as diesel fuel and electricity. The indicators tend to reflect private auto travel for this reason and to omit transit and truck energy use to a considerable extent.

Another derived indicator was also developed based on data provided in the survey, as follows:

- road utilization indicator, defined as the average trip distance to work multiplied by the number of a.m. peak period vehicle (auto) trips in the Existing Urbanized Area (EUA, see definitions in Section 2.2 below and in Appendix B) divided by arterial plus expressway lane-km in the EUA.

The latter provides a broad measure of auto vehicle-km in the a.m. peak period divided by lane-km on major roads, providing a measure of lane occupancy in vehicles per lane during the two hour peak period. Higher values of this indicator would suggest increasing levels of vehicular road utilization, but it is clearly a broad indicator only as it takes into account neither directional balance of flow volumes versus road capacity nor lane capacity differences by type of road.

The six major headings, similar to those used in the Initial Pilot Study, were selected, along with the measured and derived indicators under each, in order to monitor input factors which affect the efficiency and effectiveness of urban transportation and output factors which can best be used to monitor progress in achieving more sustainable urban transportation within each urban area over time and to provide comparison information across urban areas at a given time. A number of indicators requested in the Phase 1 Pilot Study questionnaire were not included in the Phase 2 questionnaire, either because they were found to be not readily available or because they were considered to be of secondary importance and expendable in the interest of a less onerous - and therefore more practical - data collection instrument.

A significant challenge in designing and responding to the questionnaire was the definition of geographic areas, as described in the following section.

2.2 DEFINITION OF GEOGRAPHIC AREAS

Adopting standard definitions is essential to provide results which are comparable, both from city to city and also over time based on future surveys. The Phase 2 survey questionnaire included definition and a detailed set of instructions for completing the questionnaire (See Appendix A).

Phase 2 of the pilot project identified four geographic areas for which data was requested. These were: the Region, the Existing Urbanized Area (EUA), the Central Area (CA) and the Central Business District (CBD). A detailed description of each of the four areas was provided in the "Preamble to the Questionnaire". In addition, an example showing how each of the four areas had been demarcated in Toronto was included with the questionnaire.

In the context of the Phase 2 questionnaire, the Region is defined as the area which is planned or projected to be urbanized over the planning horizon; typically about 20 years. The EUA refers to the area which is currently urbanized and which covers most of the peak period commutershed. Unlike the region, the EUA was not to be constrained to jurisdictional boundaries. In the absence of a consistent definition of the EUA for which all data was available, it was suggested that the Census Metropolitan Area or transit service area could be used as a substitute. The Central Area is the area within the region and the EUA which acts as the major activity centre. The CBD comprises the least land area of the four geographically defined areas and is defined as that area within the Central Area which has a markedly higher density of office retail, and other commercial uses than the surrounding area.

Maps for each city showing the boundaries corresponding to each of the four geographic areas are provided in Appendix B along with Exhibit B.1 which shows the basis on which the geographic areas were defined in each city. Exhibit 2.1 provides a summary definition of each area and the size of each, in square kilometres (km^2) for each urban area.

In addition to geographic area definitions, several other clarifications were included in the instructions for the Phase 2 pilot survey. These included definitions of peak periods, clarification of internal trips and when they are counted, modal definitions (e.g. transit includes commuter rail and paratransit trips or trip segments), and the preferred comparison year which was 1991 or the nearest year to 1991 for which data were available.

2.3 SURVEY PROCESS AND RESPONSE

The questionnaire as presented in Appendix A was issued to the eight urban areas on October 2, 1995. During the following two weeks, Neal Irwin was in telephone contact with the Technical Subcommittee representative(s) from each of the eight urban areas to discuss the questionnaire and respond to questions and suggestions received; he issued a memo to representatives of the eight areas on October 27, 1995 clarifying a number of the questions and desired responses in light of the telephone discussions. Further telephone contacts with the survey respondents continued through the months of November, December and, in one or two cases, into January, 1996 in order to assist and expedite the survey response process. The database of survey responses is shown in Appendix C.

Responses from six of the urban areas were received during 1995 and the responses from the remaining two areas were received in January and February, 1996. As described more fully in Section 3 below, a number of the urban areas were not able to provide all of the requested information, although the response rate was significantly higher than that achieved in the Initial Pilot Study, reflecting the more focussed questionnaire, the slightly longer response time available,

and the time which was devoted to the survey process as a result of retaining a consultant for this work.

Exhibit 2.2 presents an overview of the response rates to the Phase 2 Questionnaire. Overall, the response rates were very encouraging. All eight cities responded to the questionnaire with varying degrees of completeness, as shown more fully in Exhibit 2.3. In some cases the non-response to questions was due to the fact that certain data items were simply not available in the form requested, and in other cases the data items were available, but could not be provided within the time allotted for the pilot project survey.

Under the Urban Structure heading, population and employment data were generally available for all four geographic areas with one or two exceptions, in London and Quebec. Data on Transportation Supply were available for most categories, with the exception of the number of off-street parking spaces which was partially or totally omitted for three out of eight cities. In the area of Transportation Demand, the City of London was not able to report mode shares for the CBD due to the fact that data for trips to and from a defined CBD area were not readily available. Other missing data problems occurred with questions pertaining to arterial and expressway vehicle-kilometres. Questions relating to Transportation System Performance and Transportation Costs and Finance were well reported.

3. RESULTS OF THE PHASE 2 PILOT PROJECT

Given the objectives of this pilot project, comparisons across the eight urban areas are provided primarily to assess the overall quality and completeness of the data and identify any inconsistencies or problems with the definitions, in order to help provide a base on which future surveys can proceed. Where appropriate, these aspects of the survey results are discussed in the following sections.

3.1 URBAN STRUCTURE

In the Phase 2 questionnaire, urban structure included three measured indicators: land area, residential population, and total employment. Each of these was requested separately for the four geographic areas. Individually, these statistics provide little indication of the urban structure as it pertains to transportation and land use. Collectively however, and in combination with other data, these statistics form the basis for developing and comparing transportation indicators across cities. Exhibits 3.1, 3.2, and 3.3 display the base land area, residential population, and employment for each of the eight cities.

In terms of land area, the data provided for each city appear reasonable given the individual definitions of the four geographic areas. However, when comparing the land area for each geographic area across cities, and more specifically the proportions of each of the four areas, it is apparent that the definitions of Region, EUA, Central Area, and CBD vary between cities. For example, the sizes of the EUA for Montreal, Toronto, and Vancouver are significantly different, with Vancouver's EUA being approximately 1.8 times larger than Toronto's and 2.7 times larger than Montreal's. This indicates that the basis for defining the EUA varies noticeably among the urban areas. For example, Montreal defines the EUA as an aggregation of the three main transit

service areas and Vancouver uses the Census Metropolitan Area (CMA) while Edmonton, London, and Hamilton follow more traditional municipal boundaries. Toronto and Quebec define the EUA in terms of the actual urbanized areas. The definition of Central Area and CBD also varies somewhat among cities; for example the Central Areas as defined for Montreal, Ottawa, Quebec, Toronto and Vancouver include significant park, water and/or greenbelt areas, while those for Edmonton, Hamilton and London are more fully built up. The definition of CBD is unique for each city and may be influenced by historical circumstances as well as the location of the existing commercial core.

While each city has slightly different interpretations of the each of the four geographic areas which must be considered when making comparisons across cities, it is important to note that each city was internally consistent when providing different data for each area. In developing transportation indicators, some of the differences in area definitions can be minimized by normalizing data across the appropriate urban structure variables; e.g. trips per capita, average trip distance, etc. It should be noted that, for purposes of the pilot project, the Ottawa area does not include data for Hull and Outouais on the Quebec side of the Ottawa River; in a future urban transportation indicators survey it would be desirable to include the entire urban region, on both sides of the river.

Population for the Region and EUA are more indicative of the "size" of each city than the land area statistics. Employment for each city was also collected for each of the four areas, including both full and part-time employment.

Urban structure can be further represented by combining land area, population and employment. Exhibits 3.4 and 3.5 display the population and employment density for each city. Most of the peculiarities which were apparent in the graphs of population and employment are less apparent when each is presented as a function of land area. Urban structure may also be described in terms of activity rates (employment to population ratio) and also by the percentage of employment in the Central Area relative to that in the EUA, though the latter percentage is somewhat dependent on how the two areas are defined. Exhibits 3.6 and 3.7 display these additional combinations of population and employment statistics.

3.2 TRANSPORTATION SUPPLY

Transportation supply is described by a total of six measured indicators dealing with the auto, transit and bicycle modes as well as park-and-ride and off-street parking. Exhibit 3.8 shows the number of arterial and expressway lane-kilometres in the EUA, expressed on a per capita basis. The numbers of HOV and bike lane-kilometres are shown in Exhibits 3.9 and 3.10 respectively. With respect to HOV lane-km per capita, Quebec's response is notably high. The number of automobiles per capita was calculated and is shown in Exhibit 3.11. This value is fairly consistent for each city with Quebec being slightly higher than the average and Montreal and Ottawa being slightly lower than the others. It is not clear whether the differences are due to the actual differences in auto ownership or are more to do with the definition of EUA. Exhibit 3.12 shows the number of transit seat-km per capita provided in the EUA. While it may or may not have significant impacts, it is important to observe that the area for which the number of seat-km was

reported may not correspond to any of the four geographic regions in some cases since it is dependent on the transit service area itself.

Exhibit 3.13 shows the number of park-and-ride spaces per capita and Exhibit 3.14 shows the number of off-street parking spaces per employee in the CBD. Some of the differences among cities are due to the definition of parking categories: public, private, and not available to the public. It is noteworthy that in Vancouver off-street parking is 100 percent publicly owned as indicated by the survey results.

3.3 TRANSPORTATION DEMAND

Indicators of transportation demand include modal splits, numbers of person trips, annual transit riders, and peak period arterial and expressway vehicle-km. Exhibits 3.15 - 3.17 show the modal splits for trips to and from the CBD for the a.m. peak, p.m. peak, and 24 hour periods. In each case, the internal trips within the CBD are not included. Mode shares for the EUA are shown in Exhibits 3.18 - 3.20. In Toronto, the walk/cycle/other mode share for both the CBD and EUA is lower than that reported for most other cities; this is due to the fact that walk trips included only trips to work and to school, based on available survey information, while cycle trips included all trip purposes.

Exhibit 3.21 displays the person trips (for all modes) per capita for three time periods, while Exhibit 3.22 shows the annual transit rides per capita. As shown in Exhibit 3.22, the number of transit trips per capita in the Montreal EUA is fairly high. This could be due in part to the modal definitions used in the 1993 origin-destination survey and to the existence of three different transit properties in the EUA, which may have led to some double counting of transit trips in Montreal.

Exhibit 3.23 shows the arterial vehicle-km per capita in the EUA for the four cities where data was available. Unfortunately, the number of expressway vehicle-km per capita was available for only three of the eight cities and is therefore not shown. The percent commercial vehicles in the traffic flow was also requested for both types of roads but was only partially reported by four cities.

3.4 TRANSPORTATION SYSTEM PERFORMANCE

Two measured indicators were collected to develop transportation system indicators: average home to work trip distance (for the EUA); and annual injuries and fatalities. Exhibit 3.24 displays the average trip distance for each city in the EUA. Some of these are based on "over the road" distances and in other cities (e.g. Toronto) they are "crow's flight" distances. Future surveys should be designed to achieve a consistent distance measure. The number of annual injuries and fatalities per capita is shown in Exhibit 3.25. When normalized by population, the number of injuries and fatalities per capita is fairly consistent across cities with the exception of Vancouver which is considerably higher than the average.

3.5 TRANSPORTATION COSTS AND FINANCE

In the Phase 2 questionnaire, transportation costs were measured for both roads and transit and were requested in terms of actual expenditures in 1991 at the Region level. The total roads and transit operating costs are shown in Exhibit 3.26. Where available, the operating and maintenance costs are also shown. An additional measured transportation cost and finance indicator was transit farebox revenue. This is shown in Exhibit 3.27 as a percent of the transit operating and maintenance budget.

3.6 ADDITIONAL PERFORMANCE INDICATORS

In addition to the above mentioned transportation measures and indicators, several other indicators were derived. As described earlier, the road utilization indicator is the average trip distance multiplied by the number of vehicle trips divided by the number of arterial and expressway lane-km. The results are shown in Exhibit 3.28. Essentially this provides a road utilization index expressed in veh-km per lane-km. Unfortunately, due to the number of variables involved, only five cities had the required data for this indicator.

3.7 ENVIRONMENTAL IMPACT

As indicated earlier, there are four derived indicators under this heading. Exhibit 3.29 shows annual gasoline/energy consumption per capita based on the transportation gasoline consumption data obtained from the Kent Marketing Company for the EUA in each urban area. Exhibit 3.30 shows average gasoline consumption (from the same source) per person trip. The first of these is a broad measure of fuel consumption per person (primarily for private auto use as noted in Section 2.1), while the second takes into account the importance of person trips as a measure of mobility, and shows whether these are being accomplished with greater fuel efficiency; that is, transportation energy consumed per unit of mobility rather than per capita. A similar distinction is made in the last two indicators: annual transportation emissions of carbon dioxide (gasoline-based) per capita, shown in Exhibit 3.31 and carbon dioxide emissions per person trip, shown in Exhibit 3.32, using the same definition of person trips as in the indicator shown in Exhibit 3.30. The four derived indicators under this heading are all useful "bottom line" indicators of progress (or otherwise) in achieving more sustainable transportation from the environmental standpoint.

As shown in Exhibits 3.30 and 3.32, when expressed on a per trip basis, the average gasoline consumption and CO_2 emissions for Hamilton are significantly higher than other cities. No reasonable explanation or source of error was found to explain this anomaly except the possible impact of long commuting trips from Hamilton to Toronto.

4. CONCLUSIONS

This section provides comments and conclusions regarding the availability and suitability of the various indicators as measures of sustainable urban transportation, the practicability of a continuing urban transportation indicators program in light of the pilot project experience, and suggested next steps.

4.1 AVAILABILITY OF DATA

As discussed earlier in Section 2.3 and summarized in Exhibits 2.2 and 2.3, the response rate to the questionnaire was generally high. Of the 20 indicators requested, five were fully available from all eight cities, 94-97% of requested items were available for another four indicators, 83-88% of requested items were available for a further six indicators, and 75-79% of the items were available for an additional three indicators; that is, 75% or more of the requested data items were available for 18 of the 20 indicators and 83% or more of the items were provided for 15 of the 20 indicators. The two indicators with a lower response rate were peak period and 24 hour arterial vehicle-km (auto) (35% of items requested; five cities with incomplete data), and peak period and 24 hour expressway vehicle-km (auto) (23% of requested items reported; eight cities with incomplete data).

Based on these results, it might be argued that the two indicators relating to auto vehicle-km should be eliminated from the questionnaire if an ongoing urban transportation indicators program is established. If this were done, it would be possible to replace these two indicators with an estimate of annual vehicle-km in the Region or the EUA (for gasoline-powered vehicles) based on annual gasoline sales for transportation divided by the average fleet fuel efficiency in litres per km. Fleet fuel efficiency is available from Natural Resources Canada and other sources. This derived indicator would be a broader measure of annual vehicle-km than indicators 14 and 15 which it would replace, but it would be a useful measure and possibly less error-prone owing to its reliance on gasoline sales. It is suggested that auto vehicle-km be retained, but as an indicator derived from gasoline sales rather than a measured indicator requested in the survey.

The indicator with the next lowest response rate (79%), off-street parking, should be retained in the questionnaire, it is suggested, because it is an important measure of parking supply in the CBD, a variable which can be influenced by public policy to help achieve sustainability objectives. The suggestion here is that, if an ongoing indicators program involves a relatively small number (e.g. 10-20) of Canada's larger urban areas, an attempt be made to retain this variable, which was reported on (at least partially) by seven of the eight cities in the Phase 2 Pilot Project.

4.2 DATA CONSISTENCY ACROSS CITIES

A number of possible anomalies in the reported data are discussed briefly in Section 3. A memo was issued to representatives of the eight urban areas on February 6, 1996 with the initial survey tabulation and graphical results attached, pointing out a number of possible anomalies and requesting comments and possible changes and additional data in this context. Written replies were received from four of the urban areas, augmented by verbal replies from all eight areas. This helped to improve the consistency and completeness of the results, as reported here. In the time available, it was not possible to follow up on other possible anomalies or to consider possible changes to the geographic areas adopted by one or two cities in light of the comparisons presented.

There are larger differences in defining the Region for each urban area than in defining the other geographic areas, but this has relatively little impact on the numerical values of the indicators. Consistency in defining the Existing Urbanized Area (EUA) is more important since indicators on

a per capita basis are generally reported for this area. Non built-up areas should be excluded from the EUA if possible, and more attention will be required in this regard to obtain greater consistency in future surveys.

Having said this, the survey results as summarized in the 30 exhibits of Section 3 appear to be reasonably consistent across the eight urban areas and it seems fair to say that they present a reasonable "snapshot" of the various indicators as of the early 1990's. As such, the survey results represent a useful base against which to measure future progress in moving to more sustainable transportation.

Based on Phase 2 survey results for the eight cities, it is possible to generalize somewhat about the implications of city size for the various indicators, but care is required reflecting the preliminary nature of the results. For example, as would be expected, the two largest centres, Toronto and Montreal, show the highest population and employment densities for the EUA. This indicator is considerably lower, however, for Vancouver, reflecting the inclusion of considerable non built-up area in the EUA as defined for Vancouver. Similar comments apply for non-auto modal shares to, from and within the EUA (e.g. Exhibit 3.18) and annual transit rides per capita in the EUA (Exhibit 3.22). However, medium and smaller cities in some cases have results quite similar to the larger cities and, for example, the transportation cost indicators (Exhibits 3.26 and 3.27) show no discernable pattern by city size. Data for a larger number of cities and for more than one survey year would be desirable, along with further improvement in the consistency of data and area definitions, as a basis for firmer conclusions regarding the impacts of city size on urban transportation indicators.

4.3 DATA CONSISTENCY OVER TIME

It is important that the indicators reported by each urban area have a high degree of consistency over time. That is, if a survey of the same indicators were carried out for the year 2001, the definition of data items, geographic areas and methods used to develop the indicators should be as consistent as possible with those used in the current survey for 1991.

One problem is that, while 1991 was the desired base year for the Phase 2 survey, some of the reported data was for other years (in the range 1987-1995; see Appendix C) owing to the dates of travel surveys and other available data. This should be considered when interpreting the survey results. Most of the data reported are for the years 1991-1994; relatively static conditions or slow growth during this period tends to reduce the significance of these differences. If a regular program of Urban Transportation Indicator surveys is instituted (e.g. every five years) it is possible and likely that the cities involved would tend to time travel surveys and other relevant data collection to coincide with the survey years, in future. This problem would therefore tend to become less significant over time.

It is recognized that growth and development will continue and, for example, the boundaries of the existing urban area (EUA) in each city will change in order to encompass newly urbanized areas; this should not be a problem, however, since the various transportation indicators for trips to, from and within the EUA can still be normalized on a per capita or other appropriate basis and other measures such as modal splits will still be consistent for EUA trips.

An important relevant point to be considered in laying out an urban transportation indicators program for the future is the desirability of conducting surveys frequently enough that staff turnover in the interval between surveys is likely to be reasonably low. This is perhaps the best way of trying to ensure that the methods and assumptions remain reasonably consistent from one survey to the next. On the other hand, conducting surveys every year would be difficult to justify in terms of the effort required versus the additional information provided. The most appropriate interval between surveys will require careful consideration by the Steering Committee and technical representatives of the various urban areas. On balance, every five years would probably be frequent enough to maintain a high degree of consistency, drawing on the survey questionnaires, clarifying memoranda and reports produced during the previous survey exercise.

Institutional arrangements are equally important in helping to achieve data consistency across cities and over time. A single coordinating agency - such as TAC (possibly in conjunction with Statistics Canada) - is required to ensure that a consistent approach is maintained from survey to survey and while drawing data from different sources.

4.4 RANKING OF INDICATORS AS SUSTAINABILITY MEASURES

One way of ranking the various indicators in terms of their usefulness for monitoring progress towards more sustainable transportation is simply the availability and reliability of the indicators, as discussed above in Section 4.1. Another way of assessing the indicators is to consider the extent to which each contributes to an understanding of the nature of each urban area (e.g. its structure and land use characteristics including density and mix of population) and its transportation characteristics in terms of supply, demand, performance, costs/revenues, and environmental impact.

Exhibit 4.1 summarizes these aspects of the indicators and rates them as having **High** importance or **Medium** importance as a sustainable transportation indicator or whether they basically provide **Background** information. As shown, most of the listed indicators are considered to be of **High** importance.

Exhibit 4.2 lists the key urban transportation indicators considered by the authors of this report to be important to include in an ongoing program; it includes all indicators listed in Exhibit 4.1, since even the Background indicators are necessary to describe the urban structure of each urban area. It is recognized that there are gaps in the availability of some of these indicators, as shown in Exhibits 2.3 and 4.2 and Appendix C; the gaps apply mainly for Vancouver and London, although all eight urban areas, including Vancouver and London, were able to provide most of the indicators.

It is proposed that, if an ongoing urban transportation indicators program is established, every effort be made to include all of the key indicators shown in Exhibit 4.2.

4.5 PRACTICALITY OF A CONTINUING URBAN TRANSPORTATION INDICATORS PROGRAM

Based on the Phase 2 Pilot Project results as reported above, we conclude that a continuing urban transportation indicators program would be practical and desirable, particularly for Canada's larger urban areas. For example, if surveys were conducted every five years (timed to coincide with census years) and if sufficient time (e.g. two additional months) were allowed during the survey procedure to allow an iterative process (e.g. reporting initial survey results to all respondents and allowing time for changes/clarifications and development of additional responses) it is likely that the consistency and completeness of survey results could be materially improved relative to those reported here.

It is suggested that a number of additional urban areas be included, particularly Calgary and Winnipeg, plus others such as Victoria, Regina, Saskatoon, Thunder Bay, Sudbury, Windsor, Kitchener-Waterloo, St. Catharines-Niagara, Chicoutimi-Jonquière, Halifax and possibly St. Johns and Saint John. In other words, some 15-20 urban areas might be included, possibly as many as 22.

In designing future surveys an important consideration is the most appropriate municipal staff to whom the questionnaire should be addressed. Based on experience in the Phase 2 pilot survey, and reflecting the extreme importance of consistent area definitions, the most appropriate general approach would appear to be to the Planning Department in each urban area, at the regional level where appropriate. This agency may be the best positioned to coordinate the collection or compilation of the necessary data, drawing on input from other departments (e.g. transportation, public works, transit) and municipal jurisdictions as necessary in each urban area.

Given the foundation that now exists in terms of survey design/methodology and expertise in the pilot project cities, it seems likely that the cost of conducting and publishing the next urban transportation indicators survey would be less on a per city basis than that experienced in the pilot project. A cost in this order of magnitude every five years would seem reasonable in light of the added precision it would bring to understanding and monitoring transportation sustainability progress in Canada's larger and mid-size urban areas. A report of this nature, possibly conducted and/or produced as part of the census process or in cooperation with it, could be extremely influential in achieving a wider public understanding of sustainability concepts and of initiatives to achieve more sustainable urban transportation.

4.6 SUGGESTED NEXT STEPS

Reflecting the above conclusions, a number of additional steps are suggested, as follows:

1. Distribution of the Phase 2 Pilot Project report to members of the Urban Transportation Council well in advance of its next meeting, scheduled for April 21, 1996.

2. Consideration of the report at that meeting and a decision by the Council on whether or not to proceed with such a program.

3. If such a program is contemplated, a decision would also be required on the number of urban areas to be invited to participate. It is suggested that the urban areas listed above in Section 4.5 be approached and, if feasible, the number of participating urban areas be increased to 15-25, in order to include all of the larger Canadian cities and a sample of medium-sized centres.

4. If it is decided to proceed, one option could be to conduct the first urban transportation indicators survey (beyond the pilot project) in 1998 or 1999, drawing on 1996 data, in order to coincide with a census year and establish a firm basis for the program which would involve repeating the survey every five years coincident with census years. Under this program, the base year would be 1996, the next survey would be in 2001, the following survey in 2006, etc.

5. Another option could be to expand the Phase 2 survey (i.e. 1991 data) to include the additional cities and, at the same time, allow the original eight cities to make any final adjustments to the geographic areas and data supplied in the Phase 2 survey, and possibly provide more complete data responses based on more recently processed survey information. This would build on the momentum of the Phase 2 survey work and would provide a very firm 1991 base year for the urban transportation indicators monitoring process. The base year under this option would be 1991 with subsequent surveys at five year intervals.

6. In designing and carrying out future surveys it is particularly important that additional attention be devoted to more consistent definitions of the geographic areas used for data collection. In particular, the definition of Vancouver's EUA should perhaps be reviewed along with the Central Areas in a number of cities that include significant parks or water areas. For the eight surveyed cities it would appear to be relatively easy to adjust the definitions for greater consistency, although the impact on data assembly would have to be considered. In dealing with additional cities, the experience gained in the Phase 2 Pilot Project will be valuable in assisting city staff to develop consistent area definitions. Sufficient time to accomplish this will be necessary, which is an important reason for suggesting that an additional two months for data collection be allowed in future surveys.

7. As part of the decision making process on April 21, the Council may wish to consider the extent to which "volunteer" labour can be reasonably utilized and, to the extent that funding is necessary, sources of funding, including drawing on the resources of TAC, FCM, federal and provincial government departments, the National Round Table on the Environment and the Economy, and/or the participating municipalities.

8. In any future surveys, in addition to allowing six or seven months for the survey process rather than four or five months, the response rate might be improved if a brief contractual agreement were drawn up with each participating urban area; the agreement would specify the time available for the survey process, including the deadline for submitting the first round of data and probably two additional deadlines for submitting data revision 1 and data revision 2 after reviewing a first and second display/tabulation of the data collection from all cities. The agreement could include a condition that a city's data will be included in the

report only if these deadlines are met. Council may wish to consider such an approach as a guideline for future surveys.

Clearly, there are other alternatives which can and should be considered at the Council's April 21 meeting, including a positive decision on the program but an accompanying decision to postpone the first full urban transportation indicators survey until 2001 or possibly scheduling the first complete survey for, say, 1998 or 1999, with the following survey scheduled for 2001 with five year intervals thereafter. Such an approach would allow more time for designing and conducting the first survey, but would miss the opportunity to build on the immediate momentum of the Phase 2 Pilot Project Survey in the eight participating cities (a relatively small additional effort would likely increase the completeness and consistency of the responses significantly) and would also miss the opportunity to include other important Canadian cities in the base year for a five year survey program. Such a program would be a very tangible step towards measuring and helping to encourage more sustainable transportation in Canada's urban areas.

REFERENCES

1. Transportation Association of Canada, briefing document ***A New Vision for Urban Transportation***, 1993.

2. ***A New Vision for Urban Transportation: Current Canadian Initiatives***, by Neal Irwin, April, 1994, presented to the Symposium ***New Visions in Urban Transportation*** sponsored by the Federation of Canadian Municipalities, Transportation Association of Canada and Canadian Institute of Planners, held in April, 1994.

3. ***Agenda for Action***, part of the proceedings of the FCM/TAC/CIP Symposium held in April, 1994.

4. ***Urban Transportation Data Base Project: Report on the Initial Pilot Study,*** April, 1995, TAC Urban Transportation Council, Project Steering Committee.

EXHIBIT 2.1
Definitions and Size Comparison of Geographic Areas

(Area in km^2)

Geographic Area	Urban Area							
	EDMONTON	HAMILTON	LONDON	MONTREAL	OTTAWA	QUEBEC	TORONTO	VANCOUVER
Region [1]	9,380	1,129	423	5,117	430	468	3,226	8,109
EUA [2]	700	200	166	966	310	202	1,482	2,634
CA [3]	2.9	10.9	5.5	10.0	17.8	6.7	29.0	5.1
CBD [4]	2.1	2.2	N/A	3.7	2.0	2.0	2.0	1.0

DEFINITIONS:

[1] The region is defined as that area, following jurisdictional boundaries, that is planned/projected to be urbanized over the planning horizon (typically about 20 years). Its boundaries are expected to remain unchanged for such a period or longer, for Urban Transportation Indicators surveying purposes.

[2] The EUA is defined as the existing (generally continuous) urbanized area within the Region as described in [1] above. Its boundaries will change over time as urbanization occurs.

[3] The Central Area (CA) is that area within the Region and EUA which acts as the major, predominantly employment and commercial, activity centre but which may also contain residential development.

[4] The Central Business District (CBD) is that area within the Central Area which has a markedly higher density than the surrounding areas, predominantly office, retail and other commercial activity.

EXHIBIT 2.2
Data Availability in Response to Questionnaire

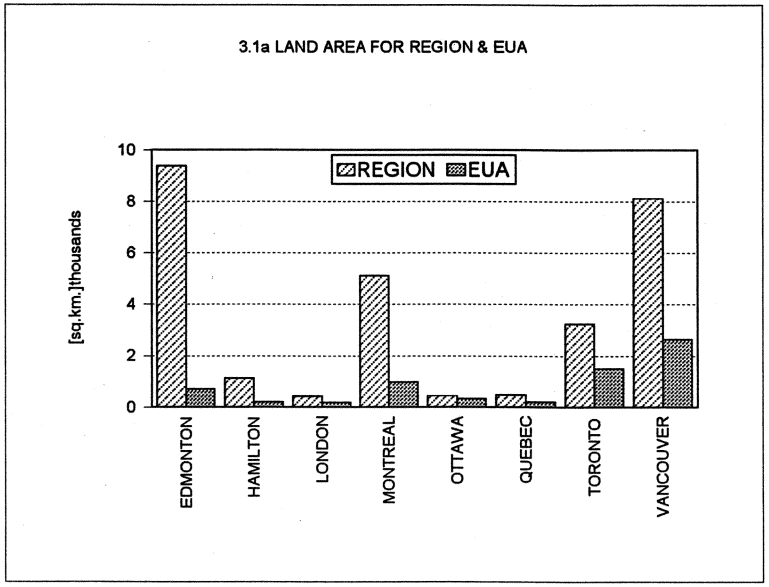
Category	% of requested data provided [1]	Number of cities with incomplete data
URBAN STRUCTURE		
1. Land Area	97%	1
2. Residential population	94%	2
3. Total employment	88%	1
TRANSPORTATION SUPPLY		
4. Arterial, expressway and HOV lane-kilometres	83%	3
5. Bike lane/bike path-kilometres	88%	1
6. Transit seat-kilometres	79%	2
7. Automobiles registered	88%	1
8. Designated park and ride spaces	100%	0
9. Off-street parking	79%	3
TRANSPORTATION DEMAND		
10. AM/PM peak period and 24 hour modal shares (CBD)	75%	3
11. AM/PM peak period and 24 hour modal shares (EUA)	88%	2
12. Weekday person trips	96%	1
13. Annual and weekday transit riders	100%	0
14. Peak period and 24 hour arterial vehicle-kilometres (auto)	35%	7
15. Peak period and 24 hour expressway vehicle-kilometres (auto)	23%	8
TRANSPORTATION SYSTEM PERFORMANCE		
16. Average home-work trip distance	100%	0
17. Annual injuries and fatalities	100%	0
TRANSPORTATION COSTS AND FINANCE		
18. Annual road capital and operating budget	88%	1
19. Annual transit capital and operating budget	94%	1
20. Annual transit farebox revenue	100%	0

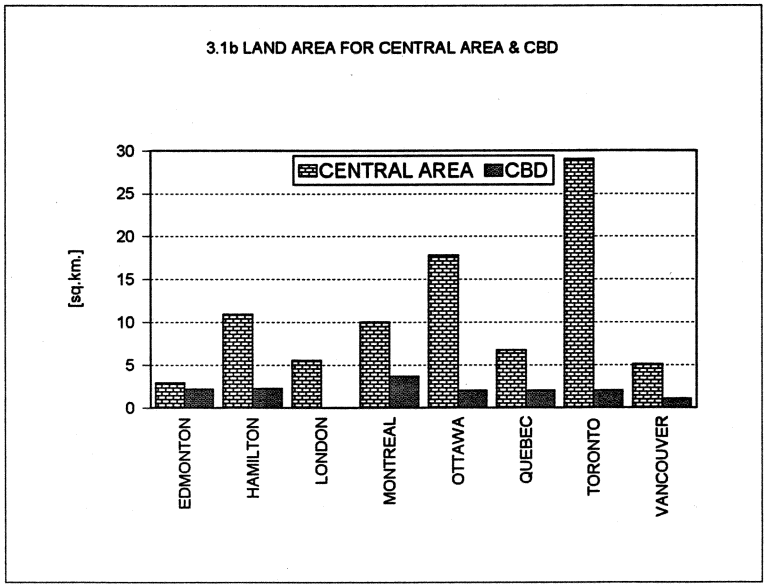
Note:

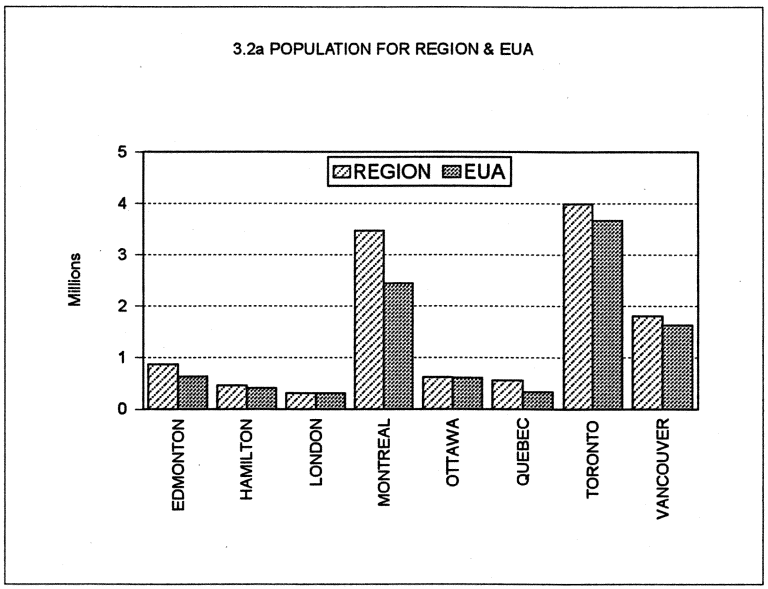
[1] In calculating these percentages, the denominator is the number of data items requested for each indicator (e.g. size in km^2 of each of the 4 geographic areas for the land area indicator) multiplied by 8, the number of cities (e.g. the denominator is 4 x 8 = 32 for the land area indicator) and the numerator is the number of data items actually provided (e.g. 31 items for the land area indicator, since a definition of the CBD was not available for London.

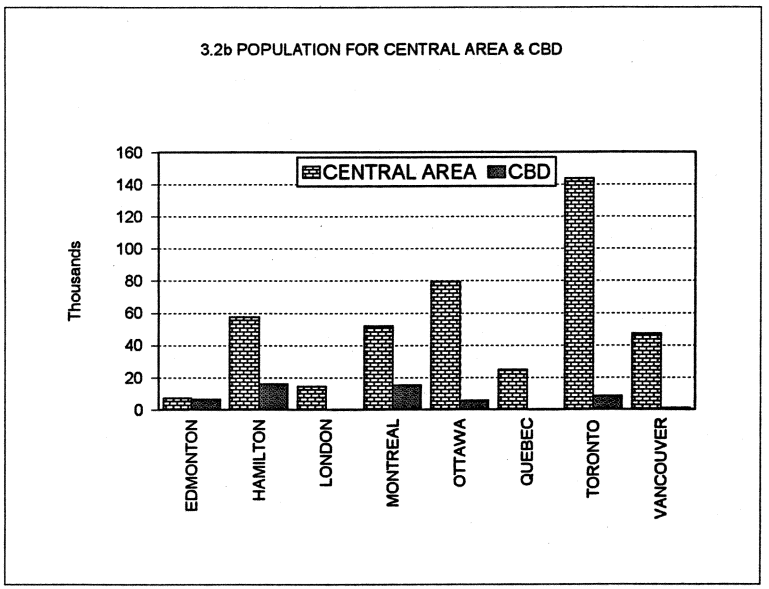
EXHIBIT 2.3
Questionnaire Response by City

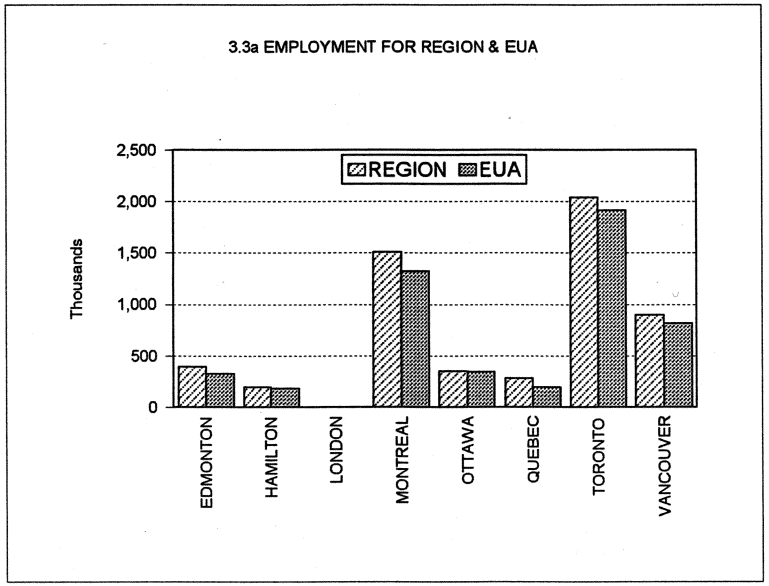
Category	Number of Items in Category	Number of Items Provided (Percent Provided)							
		EDMONTON	HAMILTON	LONDON	MONTREAL	OTTAWA	QUEBEC	TORONTO	VANCOUVER
URBAN STRUCTURE									
1. Land Area	4	4 (100%)	4 (100%)	3 (75%)	4 (100%)	4 (100%)	4 (100%)	4 (100%)	4 (100%)
2. Residential population	4	4 (100%)	4 (100%)	3 (75%)	4 (100%)	4 (100%)	3 (75%)	4 (100%)	4 (100%)
3. Total employment	4	4 (100%)	4 (100%)	0 (0%)	4 (100%)	4 (100%)	4 (100%)	4 (100%)	4 (100%)
TRANSPORTATION SUPPLY									
4. Arterial, expressway and HOV lane-kilometres	3	3 (100%)	1 (33%)	2 (67%)	3 (100%)	3 (100%)	2 (67%)	3 (100%)	3 (100%)
5. Bike lane/bike path-kilometres	1	1 (100%)	1 (100%)	1 (100%)	1 (100%)	1 (100%)	1 (100%)	1 (100%)	0 (0%)
6. Transit seat-kilometres	3	3 (100%)	3 (100%)	3 (100%)	1 (33%)	3 (100%)	0 (0%)	3 (100%)	3 (100%)
7. Automobiles registered	1	1 (100%)	0 (0%)	1 (100%)	1 (100%)	1 (100%)	1 (100%)	1 (100%)	1 (100%)
8. Designated park and ride spaces	1	1 (100%)	1 (100%)	1 (100%)	1 (100%)	1 (100%)	1 (100%)	1 (100%)	1 (100%)
9. Off-street parking	3	3 (100%)	2 (67%)	3 (100%)	3 (100%)	2 (67%)	0 (0%)	3 (100%)	3 (100%)
TRANSPORTATION DEMAND									
10. AM/PM peak period and 24 hour modal shares (CBD)	18	18 (100%)	18 (100%)	0 (0%)	12 (67%)	18 (100%)	18 (100%)	18 (100%)	6 (33%)
11. AM/PM peak period and 24 hour modal shares (EUA)	18	18 (100%)	18 (100%)	18 (100%)	12 (67%)	18 (100%)	18 (100%)	18 (100%)	6 (33%)
12. Weekday person trips	3	3 (100%)	3 (100%)	3 (100%)	2 (67%)	3 (100%)	3 (100%)	3 (100%)	3 (100%)
13. Annual and weekday transit riders	2	2 (100%)	2 (100%)	2 (100%)	2 (100%)	2 (100%)	2 (100%)	2 (100%)	2 (100%)
14. Peak period and 24 hour arterial vehicle-kilometres (auto)	5	3 (60%)	0 (0%)	0 (0%)	2 (40%)	5 (100%)	1 (20%)	3 (60%)	0 (0%)
15. Peak period and 24 hour expressway vehicle-kilometres (auto	5	0 (0%)	0 (0%)	0 (0%)	2 (40%)	3 (60%)	1 (20%)	3 (60%)	0 (0%)
TRANSPORTATION SYSTEM PERFORMANCE									
16. Average home-work trip distance	1	1 (100%)	1 (100%)	1 (100%)	1 (100%)	1 (100%)	1 (100%)	1 (100%)	1 (100%)
17. Annual injuries and fatalities	1	1 (100%)	1 (100%)	1 (100%)	1 (100%)	1 (100%)	1 (100%)	1 (100%)	1 (100%)
TRANSPORTATION COSTS AND FINANCE									
18. Annual road capital and operating budget	2	2 (100%)	2 (100%)	2 (100%)	2 (100%)	2 (100%)	0 (0%)	2 (100%)	2 (100%)
19. Annual transit Capital and operating budget	2	2 (100%)	2 (100%)	2 (100%)	2 (100%)	2 (100%)	1 (50%)	2 (100%)	2 (100%)
20. Annual transit farebox revenue	1	1 (100%)	1 (100%)	1 (100%)	1 (100%)	1 (100%)	1 (100%)	1 (100%)	1 (100%)
TOTAL:	**82**	**75 (91%)**	**68 (83%)**	**47 (57%)**	**61 (74%)**	**79 (96%)**	**63 (77%)**	**78 (95%)**	**47 (57%)**

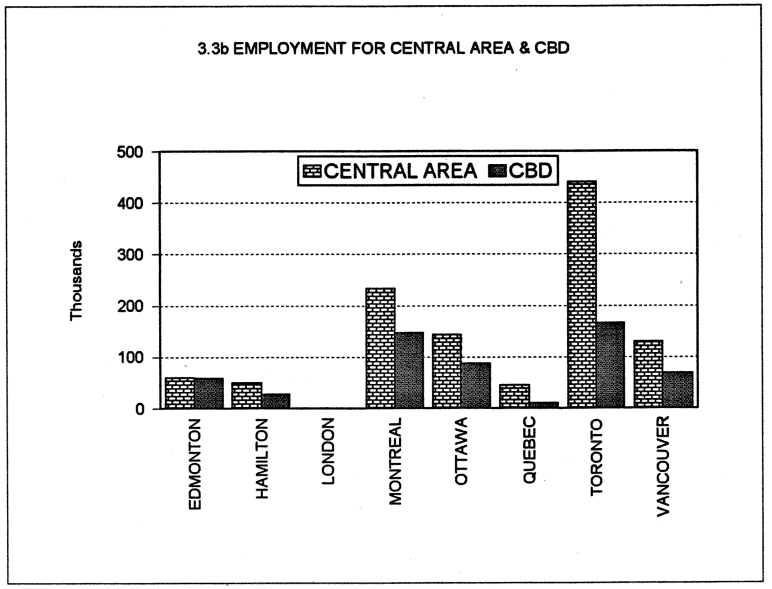

3.1a LAND AREA FOR REGION & EUA
[sq.km.]thousands
REGION
EUA
10
8
6
4
2
0
EDMONTON
HAMILTON
LONDON
MONTREAL
OTTAWA
QUEBEC
TORONTO
VANCOUVER

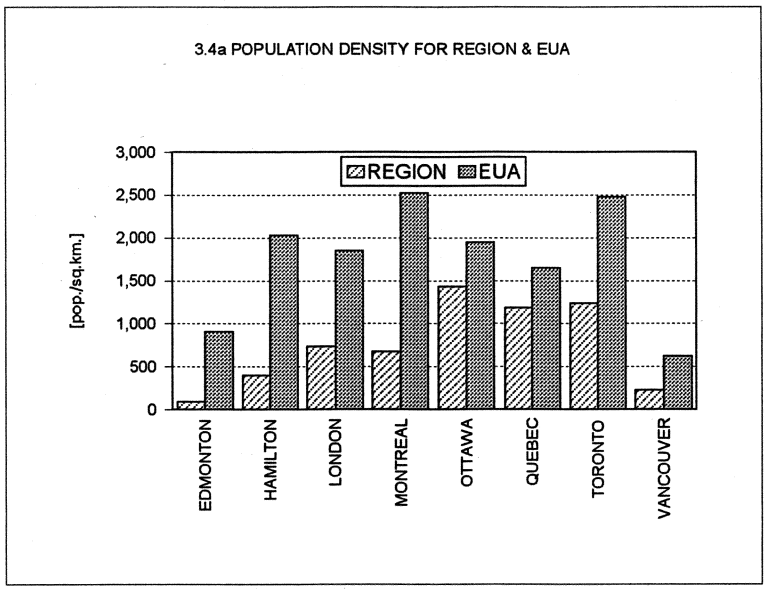

3.1b LAND AREA FOR CENTRAL AREA & CBD
[sq.km.]
CENTRAL AREA
CBD
30
25
20
15
10
5
0
EDMONTON
HAMILTON
LONDON
MONTREAL
OTTAWA
QUEBEC
TORONTO
VANCOUVER

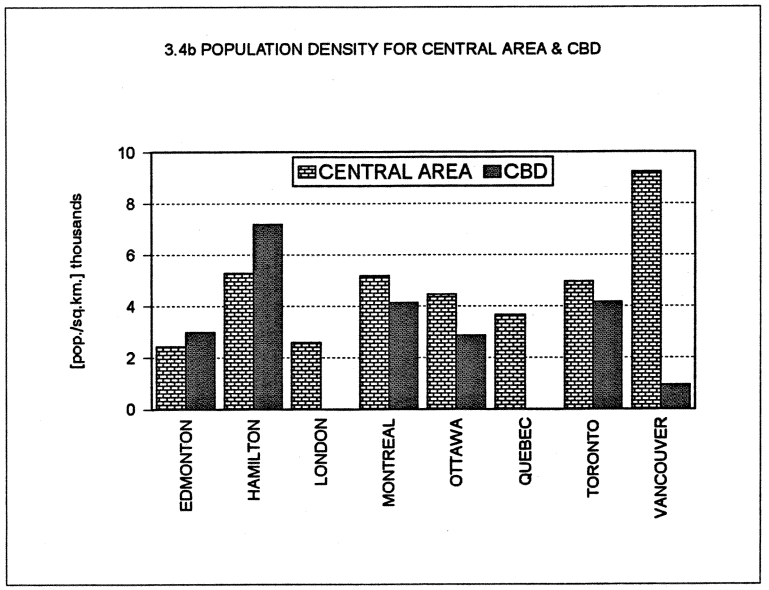

3.2a POPULATION FOR REGION & EUA
Millions
REGION
EUA
5
4
3
2
1
0
EDMONTON
HAMILTON
LONDON
MONTREAL
OTTAWA
QUEBEC
TORONTO
VANCOUVER


3.2b POPULATION FOR CENTRAL AREA & CBD
Thousands
CENTRAL AREA
CBD
160
140
120
100
80
60
40
20
0
EDMONTON
HAMILTON
LONDON
MONTREAL
OTTAWA
QUEBEC
TORONTO
VANCOUVER

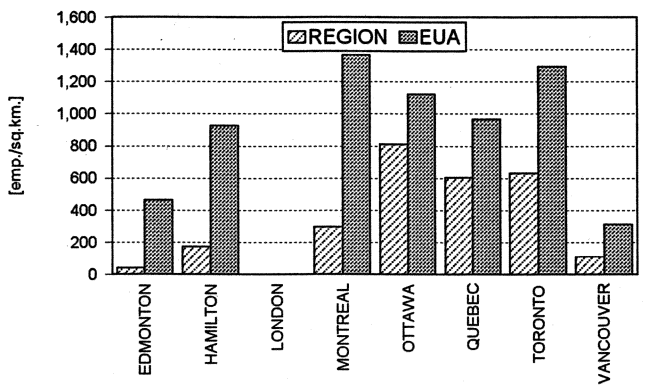

3.3a EMPLOYMENT FOR REGION & EUA
REGION
EUA
Thousands
2,500
2,000
1,500
1,000
500
0
EDMONTON
HAMILTON
LONDON
MONTREAL
OTTAWA
QUEBEC
TORONTO
VANCOUVER


3.3b EMPLOYMENT FOR CENTRAL AREA & CBD
CENTRAL AREA
CBD
Thousands
500
400
300
200
100
0
EDMONTON
HAMILTON
LONDON
MONTREAL
OTTAWA
QUEBEC
TORONTO
VANCOUVER

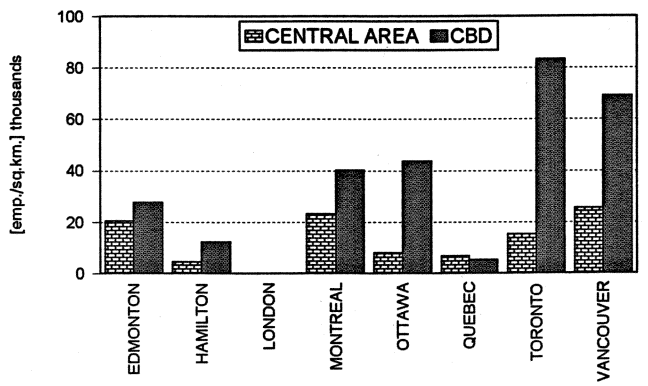

3.4a POPULATION DENSITY FOR REGION & EUA
REGION
EUA
[pop./sq.km.]
3,000
2,500
2,000
1,500
1,000
500
0
EDMONTON
HAMILTON
LONDON
MONTREAL
OTTAWA
QUEBEC
TORONTO
VANCOUVER


3.4b POPULATION DENSITY FOR CENTRAL AREA & CBD
CENTRAL AREA
CBD
[pop./sq.km.] thousands
10
8
6
4
2
0
EDMONTON
HAMILTON
LONDON
MONTREAL
OTTAWA
QUEBEC
TORONTO
VANCOUVER

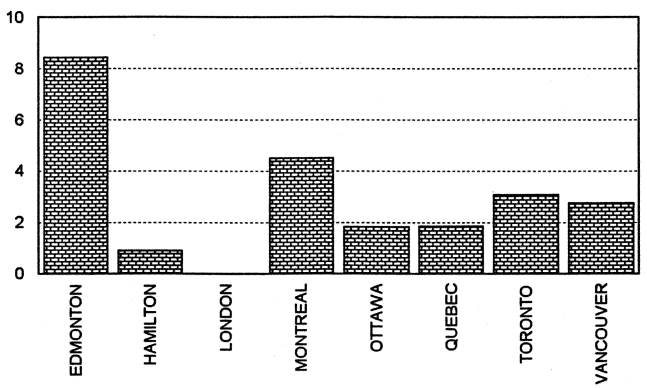
3.5a EMPLOYMENT DENSITY FOR REGION & EUA



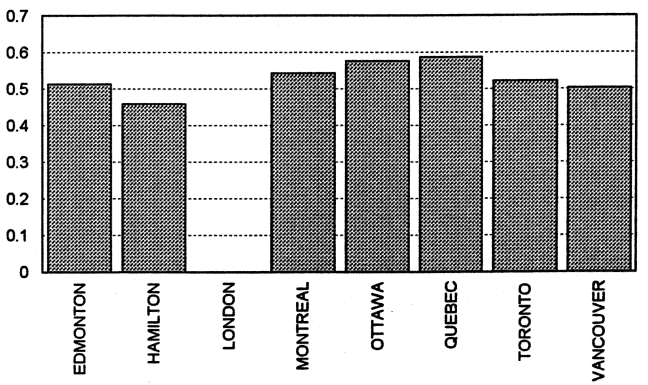
3.5b EMPLOYMENT DENSITY FOR CENTRAL AREA & CBD



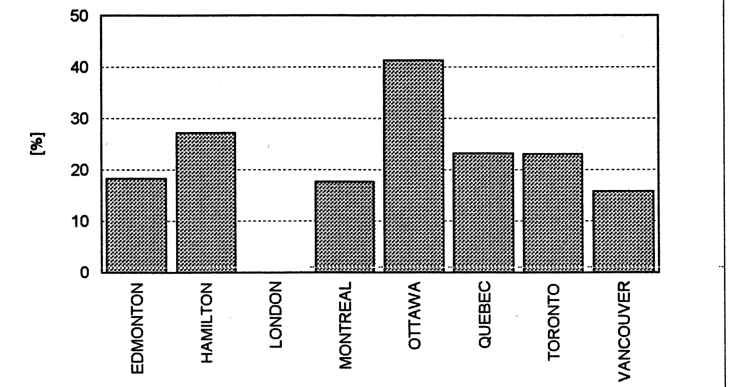
3.6a EMPLOYMENT TO POPULATION RATIO IN CENTRAL AREA



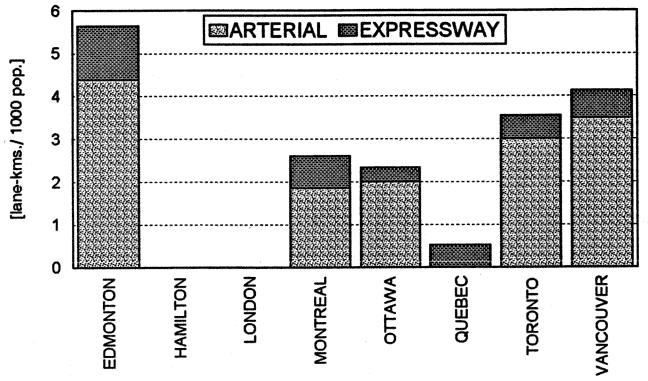
3.6b EMPLOYMENT TO POPULATION RATIO IN THE EUA



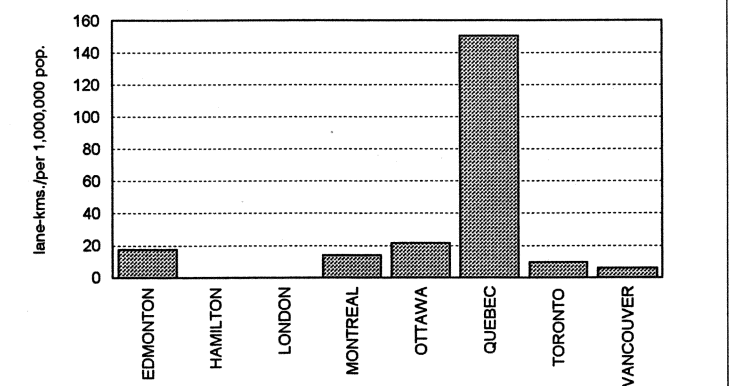
3.7 PERCENTAGE OF EMPLOYMENT IN CENTRAL AREA TO EUA



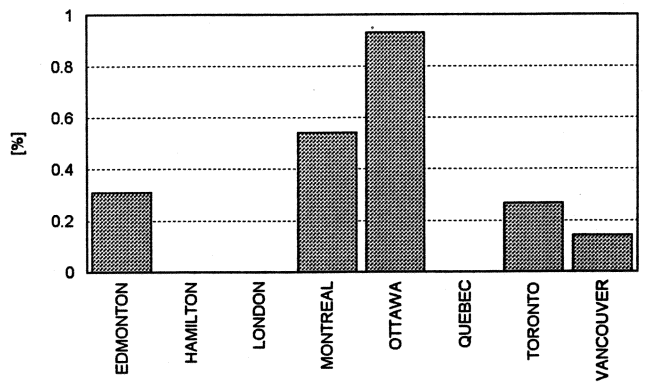
3.8 ARTERIAL + EXPRESSWAY LANE-KILOMETRES PER CAPITA FOR EUA



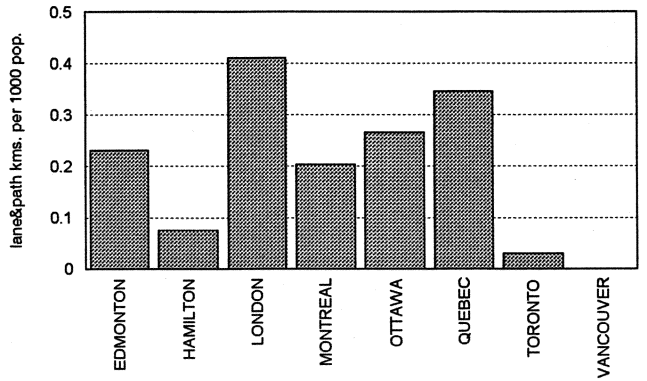
3.9a HOV LANE-KILOMETRES PER CAPITA FOR EUA



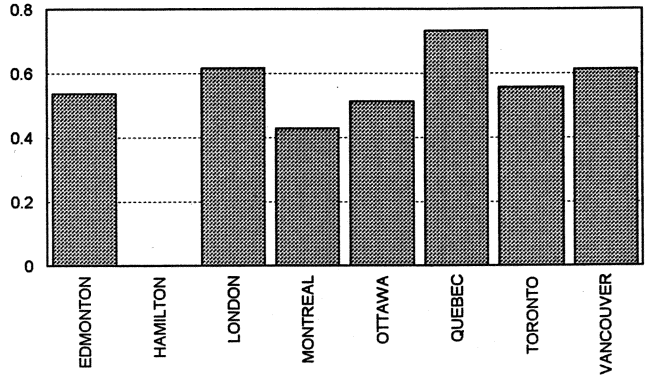
3.9b HOV LANE-KMS. AS % OF ARTERIAL+EXPRESSWAY LANE-KMS. FOR EUA



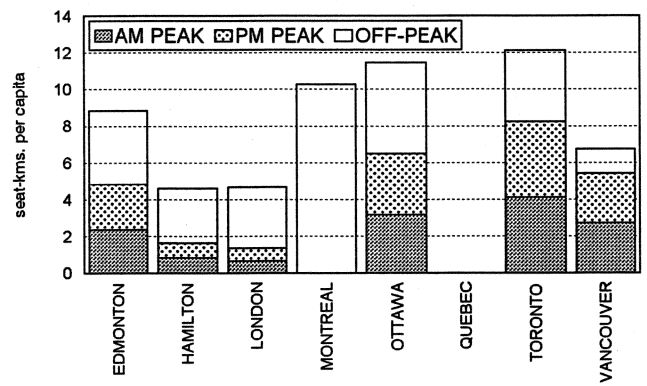
3.10 BIKE LANE/PATH-KILOMETRES PER CAPITA FOR EUA



3.11 AUTOMOBILES PER CAPITA FOR EUA

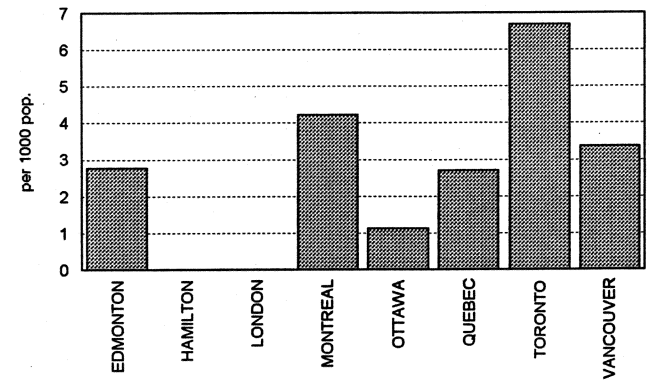


3.12 TRANSIT SEAT-KILOMETRES PER CAPITA FOR EUA

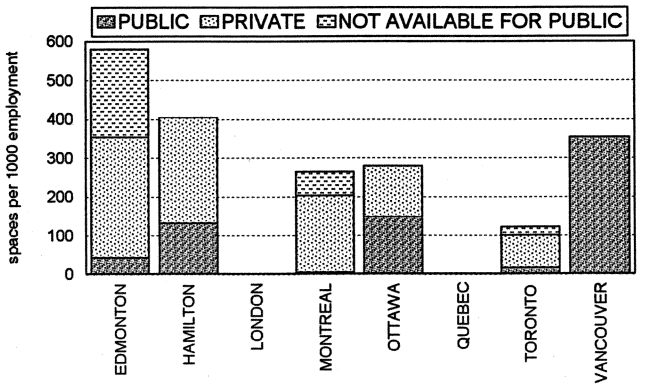


Montreal data is for 24-hour period and not off-peak.

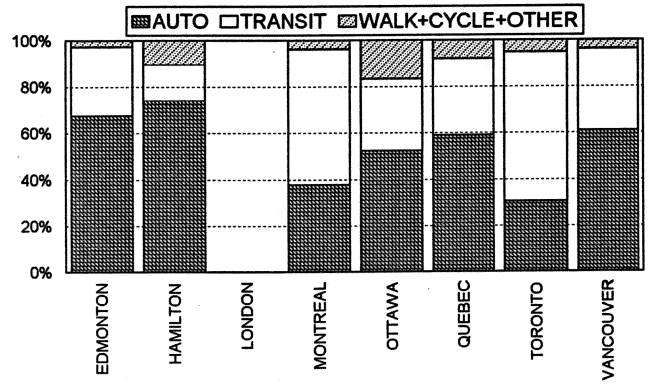
3.13 PARK-N-RIDE SPACES PER CAPITA FOR EUA



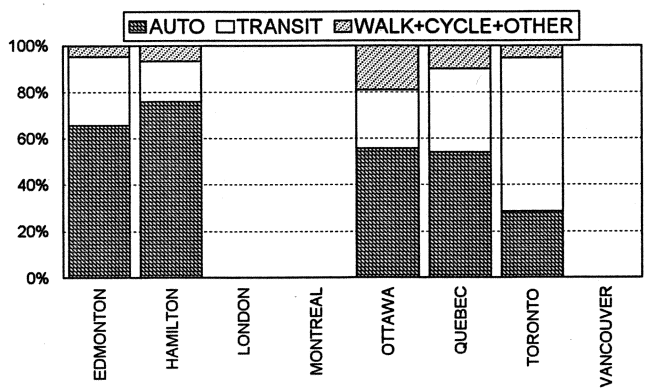
3.14 OFF-STREET PARKING SPACES PER EMPLOYEE IN THE CBD



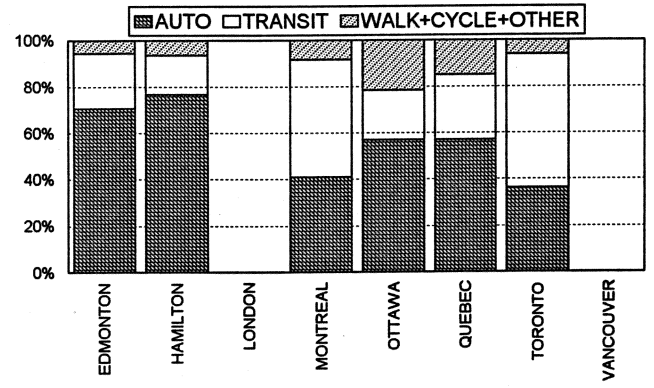
3.15 MODAL SHARES TO AND FROM CBD - AM PEAK PERIOD



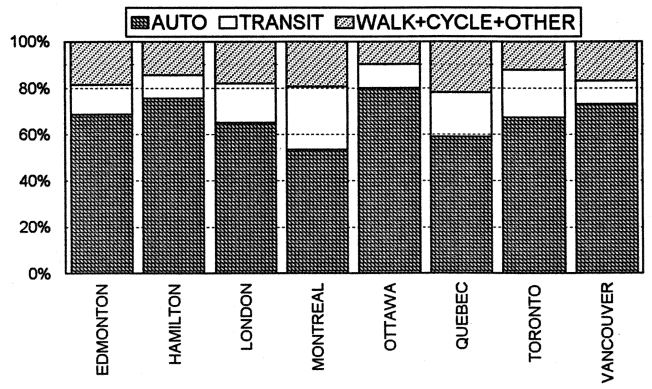
3.16 MODAL SHARES TO AND FROM CBD - PM PEAK PERIOD



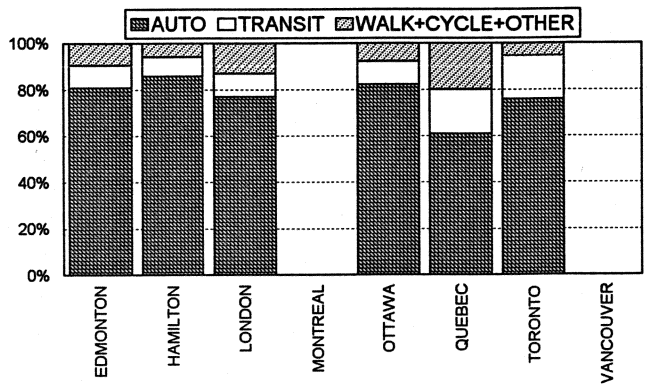
3.17 MODAL SHARES TO AND FROM CBD - 24 HOURS



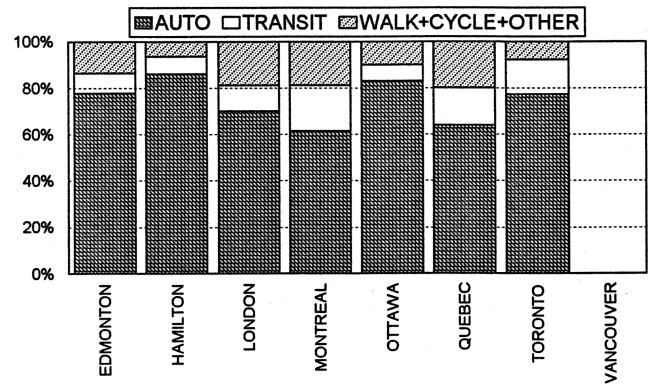
3.18 MODAL SHARES TO, FROM AND WITHIN EUA - AM PEAK PERIOD



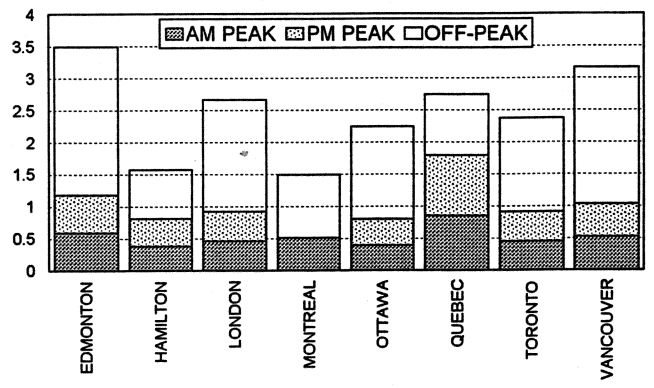
3.19 MODAL SHARES TO, FROM AND WITHIN EUA - PM PEAK PERIOD



3.20 MODAL SHARES TO, FROM AND WITHIN EUA - 24 HOURS

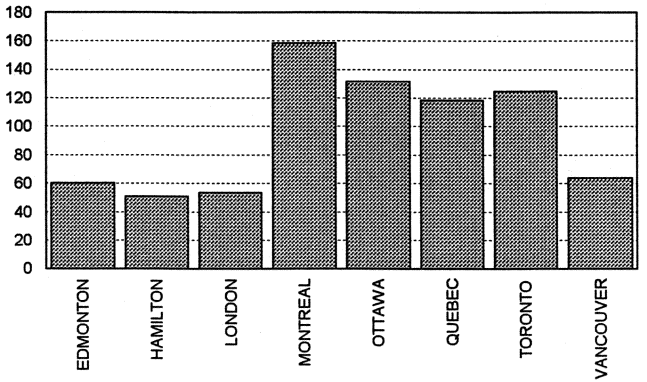


3.21 DAILY & PEAK PERIOD PERSON TRIPS PER CAPITA IN EUA



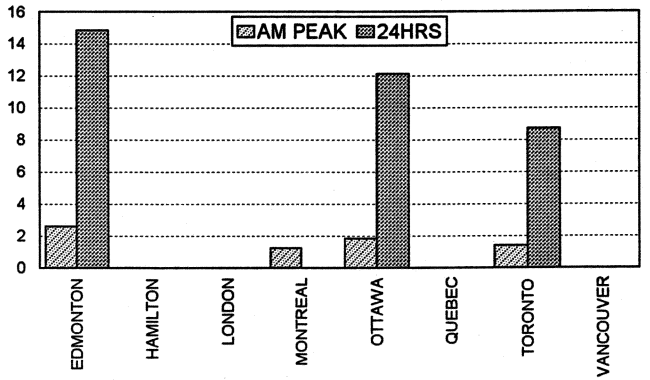
Montreal data is for AM peak and 24-hour. PM peak breakdown not available.

3.22 ANNUAL TRANSIT RIDES PER CAPITA IN EUA

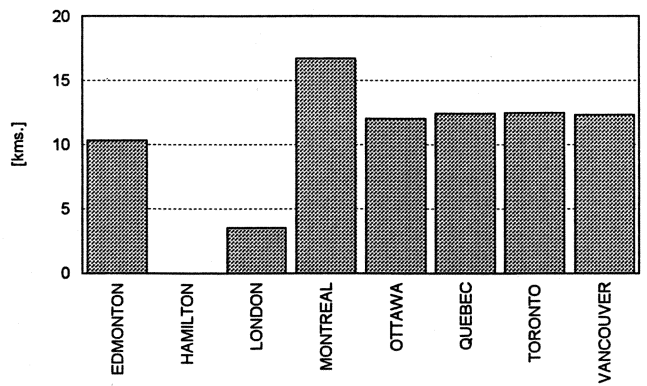


TORONTO: data is for region

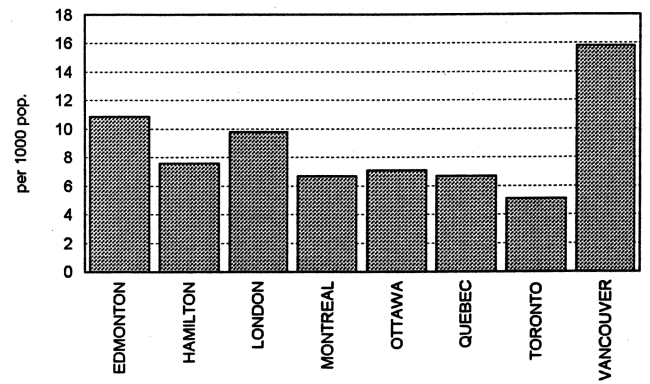
3.23 ARTERIAL AUTO VEHICLE-KILOMETRES PER CAPITA IN EUA



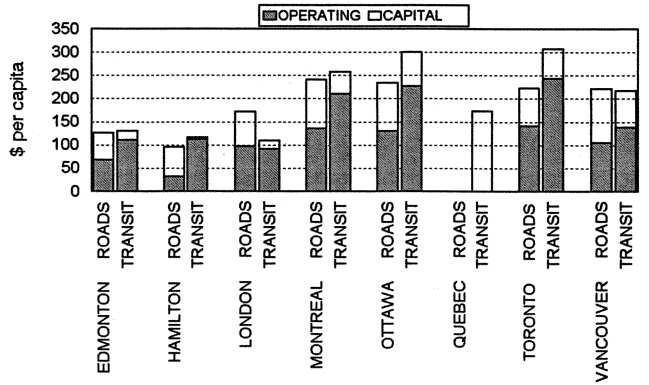
3.24 AVERAGE TRIP DISTANCE, HOME-WORK IN EUA



3.25 ANNUAL INJURIES & FATALITIES PER CAPITA IN EUA

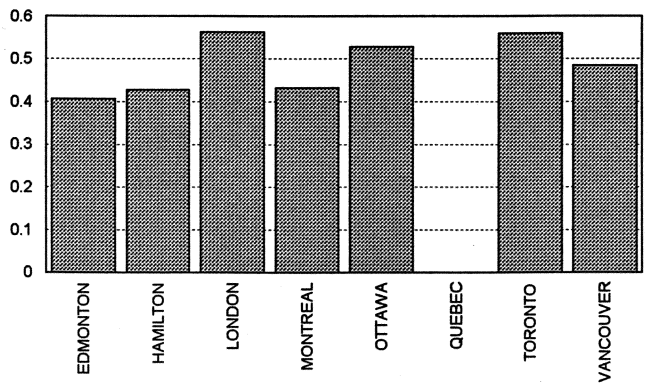


3.26 ROAD & TRANSIT ANNUAL EXPENDITURES PER CAPITA IN REGION



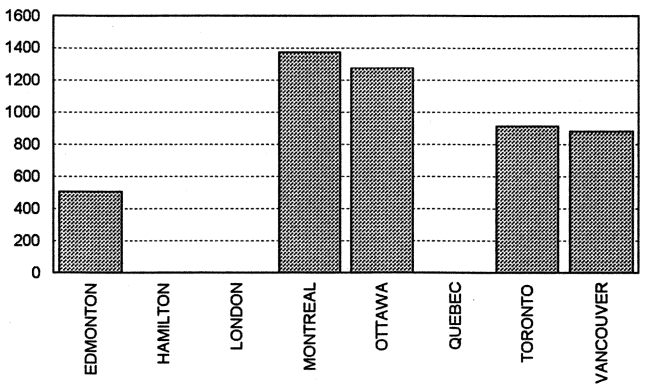
QUEBEC: THE TRANSIT COSTS ARE TOTAL OPERATING PLUS CAPITAL - BREAKDOWN NOT AVAILABLE

3.27 TRANSIT REVENUE/COST RATIO (fare box revenue/operating & maint. budg.)

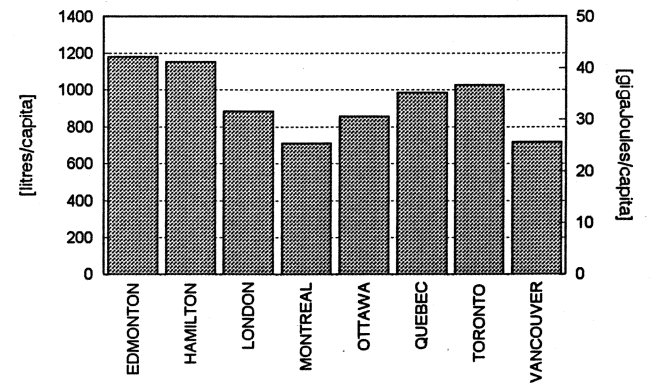


3.28 CONGESTION INDICATOR

AVERAGE WORK TRIP DISTANCE x AM PEAK PERIOD AUTO VEHICLE TRIPS/ARTERIAL & EXPRESSWAY LANE-KM IN EUA

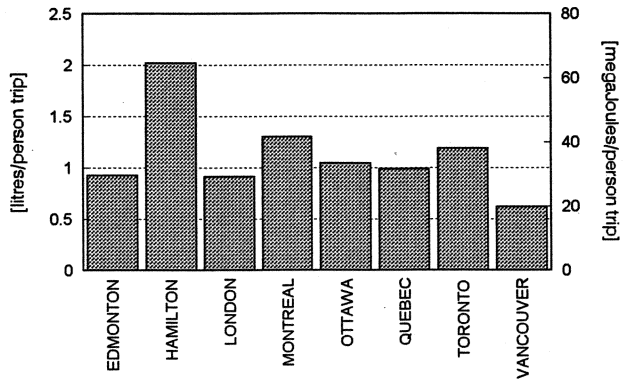


3.29 ANNUAL GASOLINE CONSUMPTION PER CAPITA IN EUA [litres\gigaJoules]



34.66gigaJoules/1000 litres

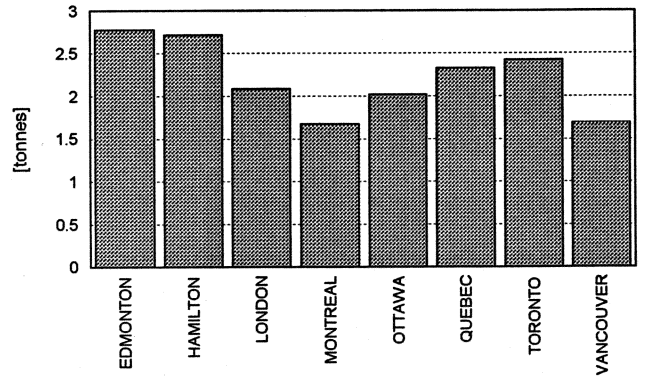
3.30 GASOLINE CONSUMPTION PER PERSON TRIP*



34.66 megaJoules/1 litre

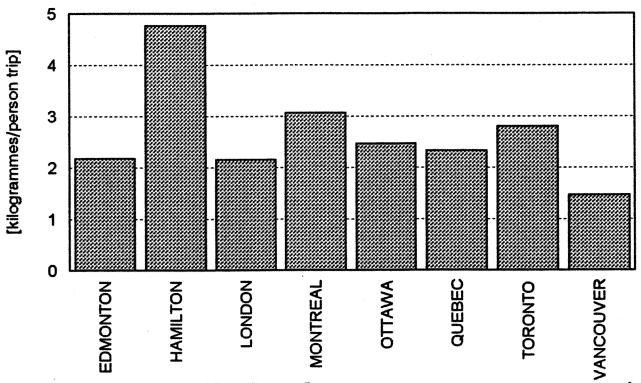
* Includes trips by all modes: auto, transit,walking, cycling.

3.31 ANNUAL CARBON DIOXIDE (GASOLINE-BASED) PER CAPITA IN EUA [tonnes]



Based on 2.356 tonnes CO2 per 1000 litres gasoline

3.32 CARBON DIOXIDE EMISSIONS PER PERSON TRIP*



Based on 2.356 kilogrammes CO2 per litre gasoline
Includes trips by all modes: auto, transit, walking, cycling

EXHIBIT 4.1
Significance of Key Urban Transportation Indicators

Indicator	Type of Information Provided	Relevance to Sustain-ability [3]
Population in Region [1]	Size of Urban Area	B
Employment in Region		B
Population in EUA [1]		B
Employment in EUA		B
Land Use Characteristics		B
Size of EUA (km^2)		B
Population density in EUA (people/km^2)	Urban Structure: extent to which it is transit-supportive and fosters short trips for which walking and cycling are feasible and encouraged	H
Employment density in EUA (people/km^2)		H
Population to employment ratio in CA [1]		H
Transportation Supply		
Arterial lane-km per capita in EUA	Extent of key road networks relative to resident population	M
Expressway lane-km per capita in EUA		M
HOV lane-km per capita in EUA	- A measure to encourage higher vehicle occupancy	H
Automobiles per capita in EUA	- Availability of private autos relative to resident population	M
A.M.peak period transit seat-km per capita in EUA	- A measure of transit level of service: peak period	H
24 hour transit seat-km per capita in EUA	- A measure of transit level of service: all day	H
Off-Street parking spaces per employee in CBD	- A measure of auto use encouragement in CBD	H
Transportation Demand		
A.M. peak period auto mode share to/from CBD [1]	Modal balance for trips to and from CBD	H
A.M. peak period transit mode share to/from CBD		H
A.M. peak period auto mode share for EUA	Modal balance for trips to, from and within EUA	H
A.M. peak period transit mode share for EUA		H
A.M. peak period person trips per capita for EUA	Measures of personal mobility levels	M
24 hour person trips per capita for EUA		M
Annual transit rides per capita for EUA	- A measure of transit market penetration	H
24 hour arterial auto vehicle-km per capita for EUA	- A measure of auto market penetration	H
Transportation System Performance		
Average trip distance, home-work in EUA (km)	- A measure of live-work convenience and travel effort	H
Annual injuries and fatalities per capita in EUA	- A measure of transportation safety relative to population size	M
Road Utilization Index in EUA (veh-km/lane-km) [2]	- A measure of road lane occupancy and congestion	H
Transportation Costs and Finance		
Total gov't road expenditures per capita in the Region ($)	Annual transportation costs relative to population	H
Total transit expenditures per capita in the Region ($)		H
Farebox revenue/operating and maintenance budget	- Degree of transit financial viability from user charges	H
Environmental Impact of Transportation		
Fuel usage per capita in EUA (litres or megajoules/year)	- A measure of energy use per person	H
Fuel usage per person trip in EUA (litres/trip)	- A measure of energy use per trip	H
CO_2 Emissions per capita in EUA (tonnes/year)	- A measure of greenhouse gas emissions per person	H
CO_2 Emissions per person trip in EUA (tonnes/trip)	- A measure of greenhouse gas emissions per trip	H

Notes:

[1] See exhibit 2.1 for definitions and sizes of the Region, Existing Urban Area (EUA), Central Area (CA), and Central Business District (CBD) as used in this study.

[2] Derived from average trip distance*vehicle trips/arterial and expressway lane-km (for A.M. peak period)

[3] Relevance symbols: B=background information, H=highly relevant indicator, M=moderately relevant indicator of sustainable transportation.

EXHIBIT 4.2
Base Year (circa 1991) Values of Key Urban Transportation Indicators

Indicator	Urban Area							
	EDMONTON	HAMILTON	LONDON	MONTREAL	OTTAWA	QUEBEC	TORONTO	VANCOUVER
Population in Region [1]	865,800	450,770	310,000	3,463,139	613,600	552,198	3,986,800	1,808,700
Employment in Region	392,000	194,540		1,506,795	349,000	282,690	2,034,800	901,200
Population in EUA [1]	633,300	406,065	307,000	2,436,616	602,500	332,812	3,667,100	1,631,700
Employment in EUA	324,500	185,600		1,319,435	347,000	194,964	1,912,800	819,000
Land Use Characteristics								
Size of EUA (km^2)	700	200	166	966	310	202	1,482	2,634
Population density in EUA (people/km^2)	905	2,026	1,849	2,522	1,944	1,645	2,474	619
Employment density in EUA (people/km^2)	464	926		1,366	1,119	964	1,290	311
Population to employment ratio in CA [1]	0.12	1.14		0.22	0.55	0.55	0.33	0.36
Transportation Supply								
Arterial lane-km per capita in EUA	4.4			1.9	2.0		3.0	3.5
Expressway lane-km per capita in EUA	1.3			0.7	0.3	0.5	0.5	0.6
HOV lane-km per capita in EUA	17			14	22	150	9	6
Automobiles per capita in EUA	0.54		0.62	0.43	0.51	0.73	0.56	0.61
A.M.peak period transit seat-km per capita in EUA	2.36	0.81	0.67		3.15		4.12	2.70
24 hour transit seat-km per capita in EUA	8.82	4.61	4.67	10.27	11.45		12.12	6.74
Off-Street parking spaces per employee in CBD	579	403		264	278		122	353
Transportation Demand								
A.M. peak period auto mode share to/from CBD [1]	68%	74%		38%	52%	59%	31%	61%
A.M. peak period transit mode share to/from CBD	30%	16%		58%	31%	33%	64%	35%
A.M. peak period auto mode share for EUA	69%	76%	65%	53%	80%	59%	67%	73%
A.M. peak period transit mode share for EUA	13%	10%	17%	27%	10%	19%	20%	10%
A.M. peak period person trips per capita for EUA	0.6	0.4	0.5	0.5	0.4	0.9	0.5	0.5
24 hour person trips per capita for EUA	3.5	1.6	2.7	1.5	2.2	2.7	2.4	3.2
Annual transit rides per capita for EUA	60	51	53	158	131	118	135	64
24 hour arterial auto vehicle-km per capita for EUA	15				12		9	
Transportation System Performance								
Average trip distance, home-work in EUA (km)	10.3		3.5	16.7	12.0	12.4	12.5	12.3
Annual injuries and fatalities per capita in EUA	11	8	10	7	7	7	5	16
Road Utilization Index in EUA (veh-km/lane-km) [2]	504			1,369	1,273		910	879
Transportation Costs and Finance								
Total road expenditures per capita in the Region ($)	126	96	171	240	233		222	221
Total transit expenditures per capita in the Region ($)	130	116	109	257	300	173	307	217
Farebox revenue/operating and maintenance budget	0.41	0.43	0.56	0.43	0.53		0.56	0.48
Environmental Impact								
Fuel usage per capita in EUA (litres/capita/year)	1,178	1,153	884	708	854	985	1,027	717
Fuel usage per person trip in EUA (litres/trip)	0.92	2.02	0.91	1.30	1.04	0.99	1.19	0.62
CO_2 Emissions per capita in EUA (tonnes/year)	2.78	2.72	2.08	1.67	2.01	2.32	2.42	1.69
CO_2 Emissions per person trip in EUA (kg/trip)	2.18	4.76	2.15	3.06	2.46	2.32	2.80	1.46

Notes:

[1] See exhibit 2.1 for definitions and sizes of the Region, Existing Urban Area (EUA), Central Area (CA), and Central Business District (CBD) as used in this study.

[2] Derived from average trip distance*vehicle trips/arterial and expressway lane-km (for A.M. peak period)

APPENDIX A

PHASE 2 QUESTIONNAIRE

THE MUNICIPALITY OF METROPOLITAN TORONTO

METRO PLANNING

J. A. Gartner
Commissioner

D. Gurin
Deputy Commissioner

The Municipality of
Metropolitan Toronto
55 John Street
Stn. 1220, 22nd Flr., Metro Hall
Toronto, ON M5V 3C6
Fax: (416)392-3821
Telephone: (416)392-8101

October 2,1995

Monsieur Jean Bertrand
Suprintendant - Division du transport
Ville de Montreal
303, rue Notre-Dame est, Bureau 4.625
Montreal (QC) H2Y 3Y8

Dear Monsieur Bertrand:

RE: Transportation Association of Canada, Urban Transportation Data Base project- Phase 2 Questionnaire

The Transportation Association of Canada (TAC) has decided to proceed to Phase 2 of this project to create an ongoing transportation data base, by refining the information collected during the first phase in 1994/1995. Our department is assisting TAC by updating the questionnaire and coordinating data collection and summarization. Neal Irwin of IBI Group (tel. 416-596-1930, fax 416-596-0644) has been retained by TAC to assist in this project. We are sending you the Phase 2 questionnaire and request your cooperation in coordinating the collection of the data requested.

This second phase questionnaire has evolved from the experience gathered in the previous phase. We have greatly reduced the number of data elements requested, in light of the availability of information and its usefulness in relation to the objectives of the project. We apologise for any duplication of data items requested in this questionnaire with respect to the previous one.

We would like to bring to your attention the four geographic areas for which the data is being requested. The areas have been defined in the preamble (attached) and an example of how those areas are demarcated in Toronto has also been given. We suggest that you define the boundaries of these four geographic areas in association with any other agencies who you may be cooperating with to compile the data. Neal Irwin or an associate will be contacting you during the week of October 9, 1995 to discuss the definitions of these areas. Consistency of the area definitions is vital to allow comparative analysis across the eight cities involved in this effort.

A final report will be presented to TAC in early 1996 and a copy of this report will be made available to all participants. **In light of this time schedule, we would appreciate receiving the completed questionnaire from you by November 24, 1995.** Thank you very much for your cooperation. Should you have any questions, please do not hesitate to contact Rob Pringle at (416) 392-8115.

A. R. Gordon, Director
Transportation Division

Encl.

DD/

TRANSPORTATION ASSOCIATION OF CANADA
URBAN TRANSPORTATION DATA BASE - PHASE 2

PREAMBLE TO THE QUESTIONNAIRE

This second phase of the Urban Transportation data base has evolved from the experiences gathered in the first phase. This phase involves some changes in definitions of certain variables and also the collection of only the more commonly collected data to enable more complete comparison across the cities.

We apologise for certain duplication of data requested in relation to the first phase. We would however like to emphasize the importance of complying with the definitions provided below when filling in the questionnaire to ensure consistency of data with other cities.

DEFINITIONS/NOTES

REGION:

The region should be defined as that area, following jurisdictional boundaries, that is planned/projected to be urbanized over the planning horizon (typically about 20 years). This definition of the region should be stable over time. In the case of Toronto, it includes those local municipalities within the GTA which are predominantly urban in nature. The attached map shows the "region" as defined in the case of Toronto.

Please attach a definitional map showing relationship of the defined region to the jurisdictional boundaries and the Census Metropolitan Area.

EXISTING URBANISED AREA (EUA)

The EUA should be the existing (generally continuous) urbanised area within the region as described above. The EUA should exclude large undeveloped or farm land areas as much as possible to avoid distortion of measures such as population density. The defined EUA should cover most (e.g. 90-95%) of the peak period commuter-shed and need not follow local jurisdictional boundaries. It could be tailored to use data on a traffic zone basis. The EUA may change over time in the context of future surveys.

If most of the data asked for is not available for the defined EUA, then the EUA could be defined by the Census Metropolitan Area (CMA) used by Statistics Canada or the transit service area as defined locally might be substituted. The attached map shows the EUA for Toronto, as an example.

Please attach a definitional map showing EUA's relationship to the defined region and the CMA.

CENTRAL AREA (CA)

The CA is that area within the region and the EUA which acts as the major, predominantly employment and or commercial, activity centre but which may also contain residential development. It could be defined by existing cordons set in place to monitor transportation characteristics or by other planning boundaries.

In the case of Toronto, the Central Area encompasses an area of approximately 29 sq.kms. The Central Area of Toronto, apart from acting as an employment hub, also includes residential communities, entertainment facilities, educational institutions and hospitals. Refer to the attached map for Toronto as an example.

Please attach a definitional map showing the relationship of the Central Area to the EUA and the defined region.

.../2

Central Business District (CBD)	The CBD is that area within the Central Area, which has a markedly higher density than the surrounding areas, of predominantly office, retail and other commercial activity. In the case of Toronto, the CBD is centred on the financial core around King and Bay Street intersection. The CBD is predominantly characterised by high density, high rise office buildings. Refer to the attached map showing the CBD for Toronto. **Please attach a definitional map showing the relationship of the CBD to the CA.**
A M P E A K PERIOD	Between 7:00 a.m. and 9:00 a.m.
P M P E A K PERIOD	Between 4:00 p.m. and 6:00 p.m.
M O D A L SHARES	Note that with respect to modal shares for the CBD (Q.10) do not include trips within the CBD (internal trips) whereas for the EUA (Q.11) trips within i.e. internal trips should be included.
YEAR	We would like to focus on a common year for comparison, in this case the year 1991 which was a Census year. If specific data is not available for 1991 then the closest year to 1991 should be used.
TRANSIT	Transit also includes commuter rail and paratransit services.

Please use the remarks column to indicate any variations/interpretation of the data definitions in the data you have provided.

This questionnaire is designed to relate as closely as possible to data available to transportation planning agencies. This basic data will be manipulated in some cases to derive a set of indicators for comparative reporting. These indicators include the following:

1. Population density
2. Employment density
3. Registered autos per capita
4. Designated park-and-ride spaces per capita
5. Off-street parking spaces per employee
6. Peak period person trips per capita
7. Annual transit riders per capita
8. Road Congestion Index (e.g. veh-km per lane km)
9. Transit Revenue/Cost Ratio
10. Injuries & fatalities per capita
11. Daily veh-km per capita
12. Annual transportation fuel consumption per capita (from fuel sales data)
13. Annual transportation CO_2 emissions per capita (estimates from fuel consumption)
14. Average veh-km per person trip

TRANSPORTATION ASSOCIATION OF CANADA

URBAN TRANSPORTATION DATA BASE QUESTIONNAIRE - PHASE 2

IMPORTANT: Please read attached notes for definitions and additional instructions before filling in this questionnaire.

URBAN STRUCTURE

		AREA	DATA	YEAR	NOTES	YOUR REMARKS
1	Land area [sq.km.]	Region				
		EUA				
		Central Area				
		CBD				
2	Residential population	Region				
		EUA				
		Central Area				
		CBD				
3	Total employment	Region				
		EUA			#3 Total employment includes	
		Central Area			both full and part-time	
		CBD			employment.	

TRANSPORTATION SUPPLY

		AREA	DATA	YEAR	NOTES	YOUR REMARKS
4	Arterial lane-kilometres	EUA			#4 HOV lane-kms. includes reserved	
	Expressway lane-kilometres				transit lanes	
	HOV(including exclusive transit) lane-kilometres				#5 Bike lane/bike path-kms.	
5	Bike lane/bike path-kilometres	EUA			apply to designated or marked on-street	
6	Peak period transit seat-kilometres	EUA			or off-street facilities.	
	AM peak period				#7 Data on registered autos may	
	PM peak period				come from travel surveys or may	
	24 -hr transit seat-kilometres				require analysis of provincial	
7	Automobiles registered (leased & private)	EUA			motor vehicle records.	
8	Designated park-and-ride spaces	EUA				
9	Off-street parking spaces	CBD				
	- publicly owned (available for use by public)					
	- privately owned (available for use by public)					
	- spaces not available for use by public					

TRANSPORTATION DEMAND	AREA	DATA	YEAR	NOTES	YOUR REMARKS
10 AM peak period modal shares [%]					
- Auto driver	CBD				
- Auto passenger					
- Transit				#10 If no CBD data available, then provide CA data instead.	
- Cycle					
- Walk					
- Other (taxi, motorcycle etc.)				Modal shares are for trips to and from the CBD (excludes trips within the CBD)	
		100%			
PM peak period modal shares					
- Auto driver	CBD				
- Auto passenger					
- Transit					
- Cycle					
- Walk					
- Other (taxi, motorcycle etc.)					
		100%			
24-hour modal shares					
- Auto driver	CBD				
- Auto passenger					
- Transit					
- Cycle					
- Walk					
- Other (taxi, motorcycle etc.)					
		100%			
11 AM peak period modal shares					
- Auto driver	EUA				
- Auto passenger				# 11 Modal shares are for trips to, from and within the EUA.	
- Transit					
- Cycle					
- Walk					
- Other (taxi, motorcycle etc.)					
		100%			

Urban Transportation Data Base Questionnaire cont.

		AREA	DATA	YEAR	NOTES	YOUR REMARKS
11 cont.	PM peak period modal shares					
	- Auto driver	EUA				
	- Auto passenger					
	- Transit					
	- Cycle					
	- Walk					
	- Other (taxi, motorcycle etc.)					
			100%			
	24-hour modal shares					
	- Auto driver	EUA				
	- Auto passenger					
	- Transit					
	- Cycle					
	- Walk					
	- Other (taxi, motorcycle etc.)					
			100%			
12	Weekday person trips (all modes)	EUA			#12 Trips are to, from and within the EUA.	
	AM peak period					
	PM peak period					
	24-hours					
13	Annual transit riders	EUA			#13 One ride represents a trip for which a single fare was paid.	
	Riders on a typical weekday					
14	Peak period arterial vehicle-kilometres (auto)	EUA			#14 & 15 Vehicles as used in estimation of veh-km should be passenger autos. Percent commercial vehicles (medium & heavy trucks) best calculated on a veh-km basis. If this is not possible, the percent commercial vehicles may be calculated as an area average based on traffic volume classification counts. These percentages should be of total vehicular traffic.	
	AM peak period					
	PM peak period					
	% commercial vehicles					
	24-hour arterial vehicle-kilometres (auto)					
	% commercial vehicles					
15	Peak period expressway vehicle-kilometres (auto)	EUA				
	AM peak period					
	PM peak period					
	%commercial vehicles					
	24-hour arterial vehicle-kilometres (auto)					
	% commercial vehicles					

TRANSPORTATION SYSTEM PERFORMANCE **

		AREA	DATA	YEAR	NOTES	YOUR REMARKS
16	Average home-work trip distance [kilometres]	EUA			# 16 Trip distance should be for trips to, from & within the EUA. Average home-work person trip distance can be derived from travel behaviour surveys or Stats Canada POR-POW data. The actual distance is preferred over the straight-line distance	
17	Annual injuries & fatalities	EUA				

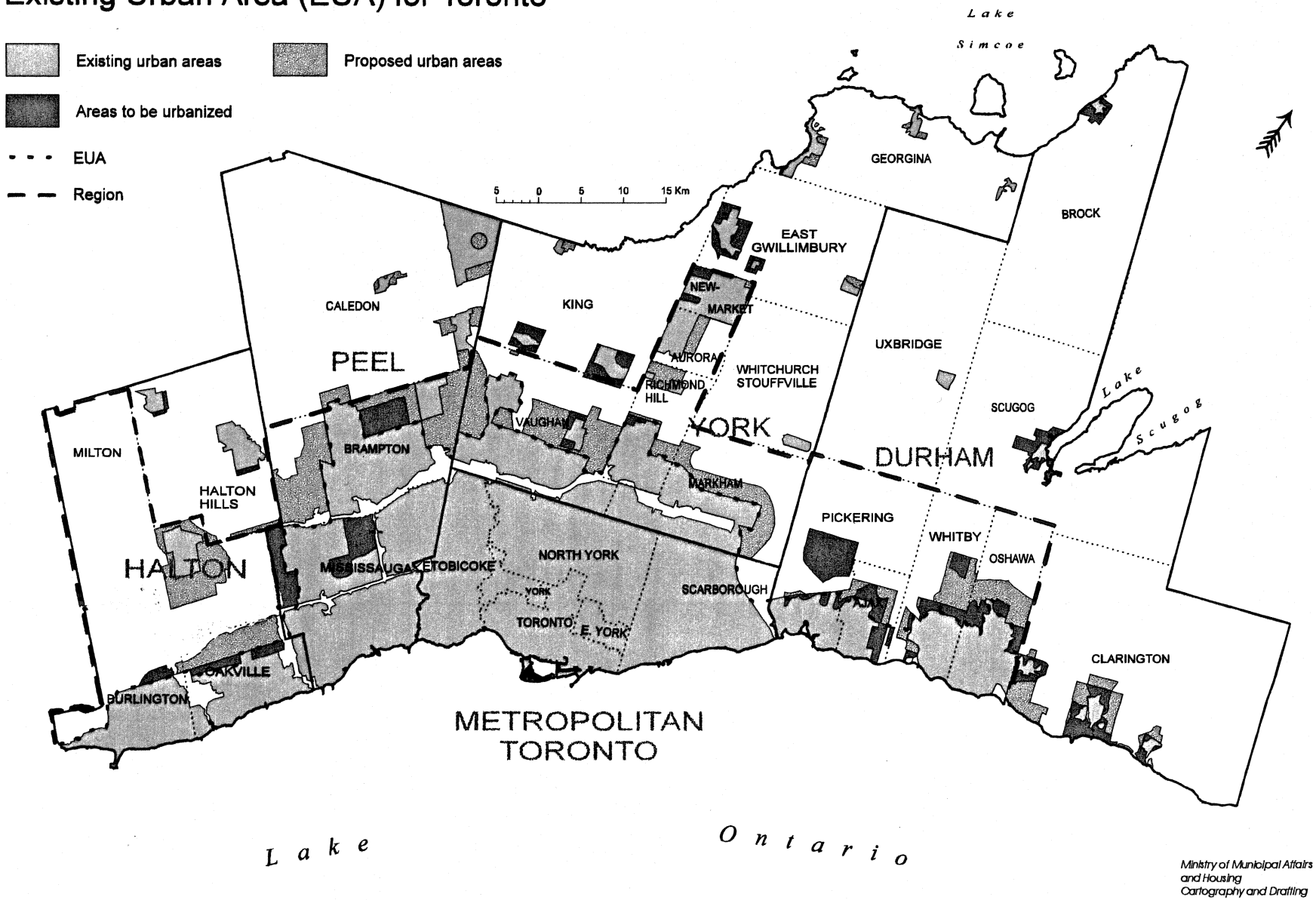
TRANSPORTATION COSTS & FINANCE

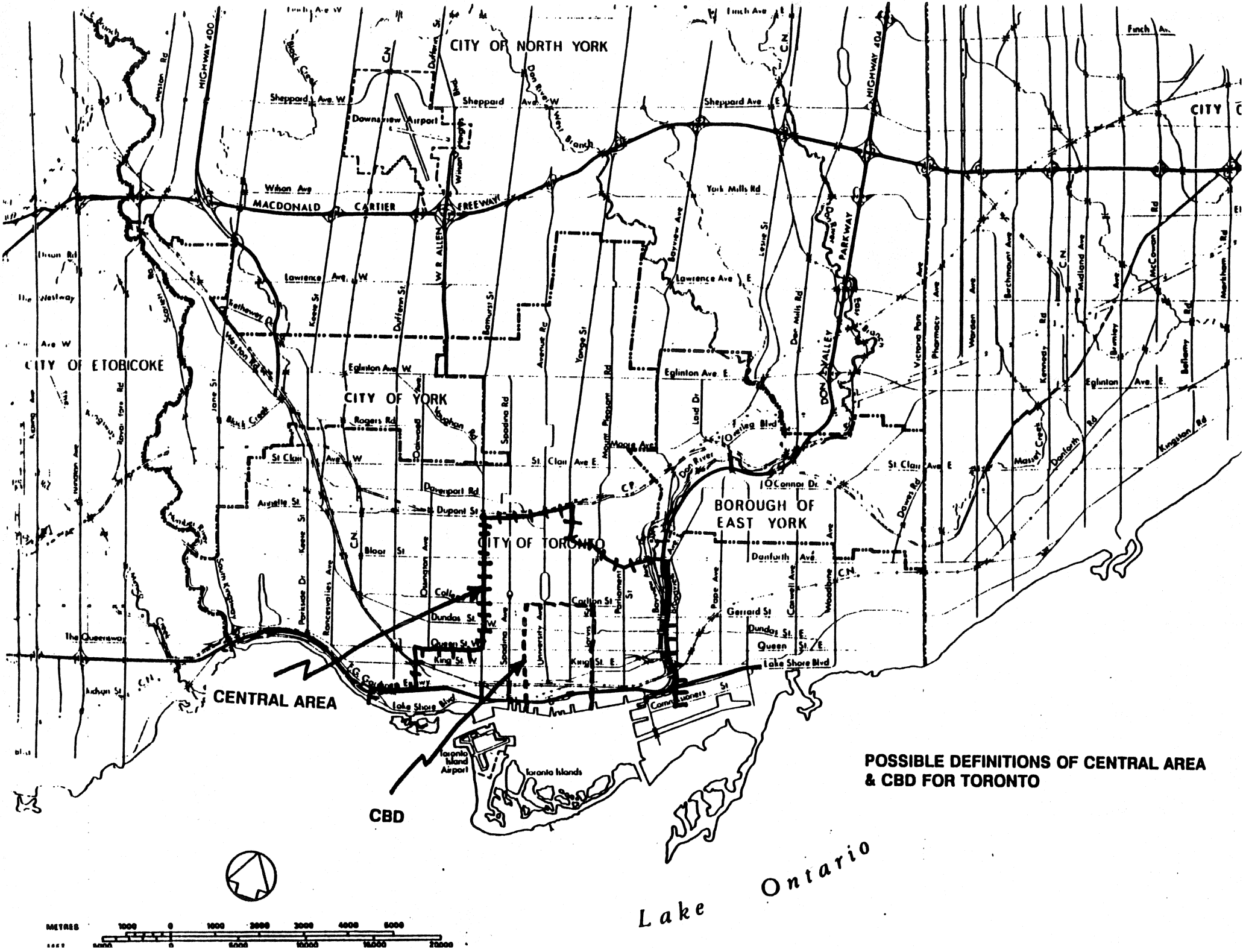
		AREA	DATA	YEAR	NOTES	YOUR REMARKS
18	Annual road capital budget	Region				
	Annual road operating & maintanance budget					
19	Annual transit capital budget	Region				
	Annual transit operating & maintanance budget					
20	Annual Transit Fare Box Revenue	Region				

** *Additional Performance Indicators to be derived from the basic data may include:*

- *Road Congestion Index (e.g. veh-km of travel per lane -km).*
- *Daily veh-km per capita*
- *Annual transportation fuel consumption per capita (from fuel sales data)*
- *Annual emissions per capita (estimates from fuel consumption)*
- *Average veh-km per person trip*

Possible Definitions of the Region and Existing Urban Area (EUA) for Toronto





POSSIBLE DEFINITIONS OF CENTRAL AREA & CBD FOR TORONTO

APPENDIX B

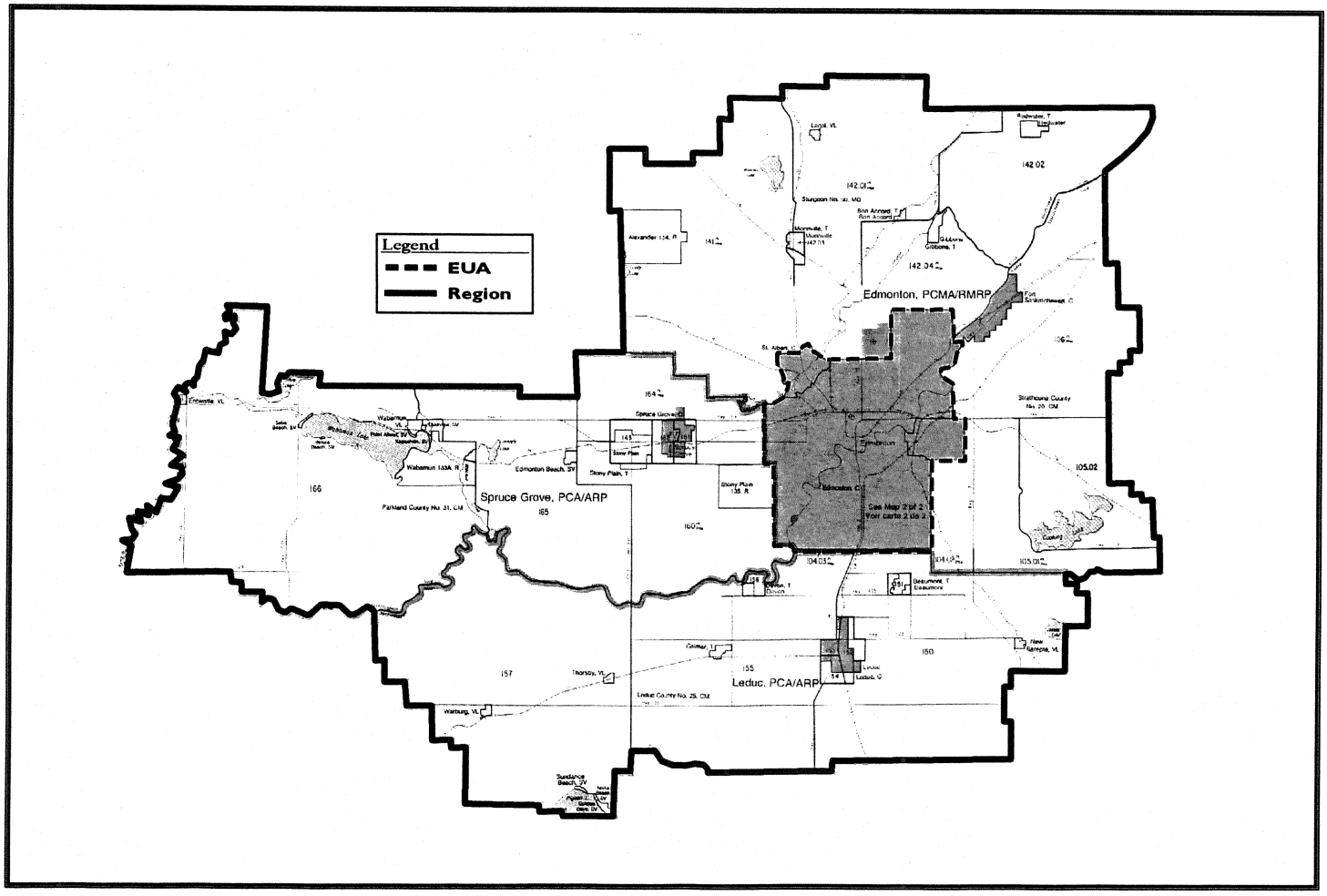
MAPS OF ANALYSIS AREAS

EXHIBIT B.1
Summary of Geographic Areas by City

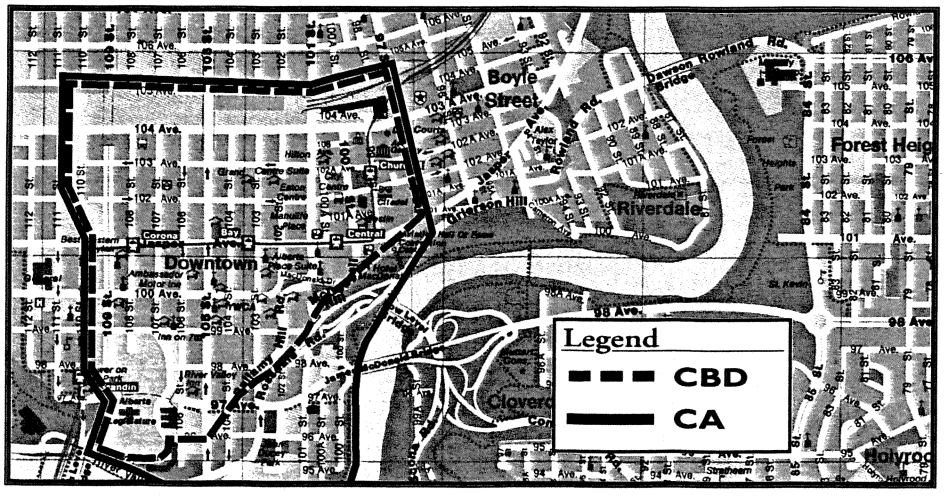
Area	City							
	EDMONTON	HAMILTON	LONDON	MONTREAL	OTTAWA	QUEBEC	TORONTO	VANCOUVER
REGION	Based on Primary Census Metropolitan Area (CMA)	Based on Regional Municipality of Hamilton-Wentworth Traffic Zone System (roughly CMA without Burlington or Grimsby)	Based on new City Boundary (Post Annexation)	Larger than CMA - Based on areas with public transit systems	Smaller than CMA and RMOC boundary - includes part of greenbelt	Much smaller than CMA- Based on most densely urbanized municipalities	Same as the GTA, which is comprised of Halton, Peel, York, Durham and Metro Toronto	Based on GVRD Travel Survey - Lower Mainland Area
EUA	Based on the City of Edmonton Boundary	Continuous boundary of urban areas - roughly based on Hamilton and Dundas census subdivisions.	Based on old City boundary (Pre-Annexation)	Based on aggregation of the three main transit service areas (STCUM, STL, STRSM)	Similar to Region definition with fewer outlying areas included	As defined in Transport Plan	Comprised of Metro Toronto and surrounding areas, mainly built-up	Corresponds to Vancouver CMA
CENTRAL AREA	CBD cordon boundary plus Rossdale area	Aggregation of traffic zones, generally described as area bounded by CNR, Sherman Ave, Aberdeen Ave, and Hwy 403	Generally described as the area bounded by Thames River, CNR Tracks, Colborne St. and Kent St./ Princess Ave.	Ville-Marie District	Generally described as area bounded by Rideau River, CP Tracks, and the Ottawa River	Based on two central planning service areas (STCTQ) and historic old Quebec City district plus Parlement Hill	Transportation Planning District 1	Roughly comprised of the West End and Downtown
CBD	CBD cordon boundary - traditional downtown	Aggregation of Traffic Zones	Same as Central Area	1993 O-D survey Municipal Sector 1	Aggregation of five core transportation zones	Partially based on public transit study areas and predominantly employment oreiented land use	Downtown office district	Small portion of Downtown (Waterfront Area)

Edmonton

REGION & EUA BOUNDARIES



CENTRAL AREA & CBD BOUNDARIES

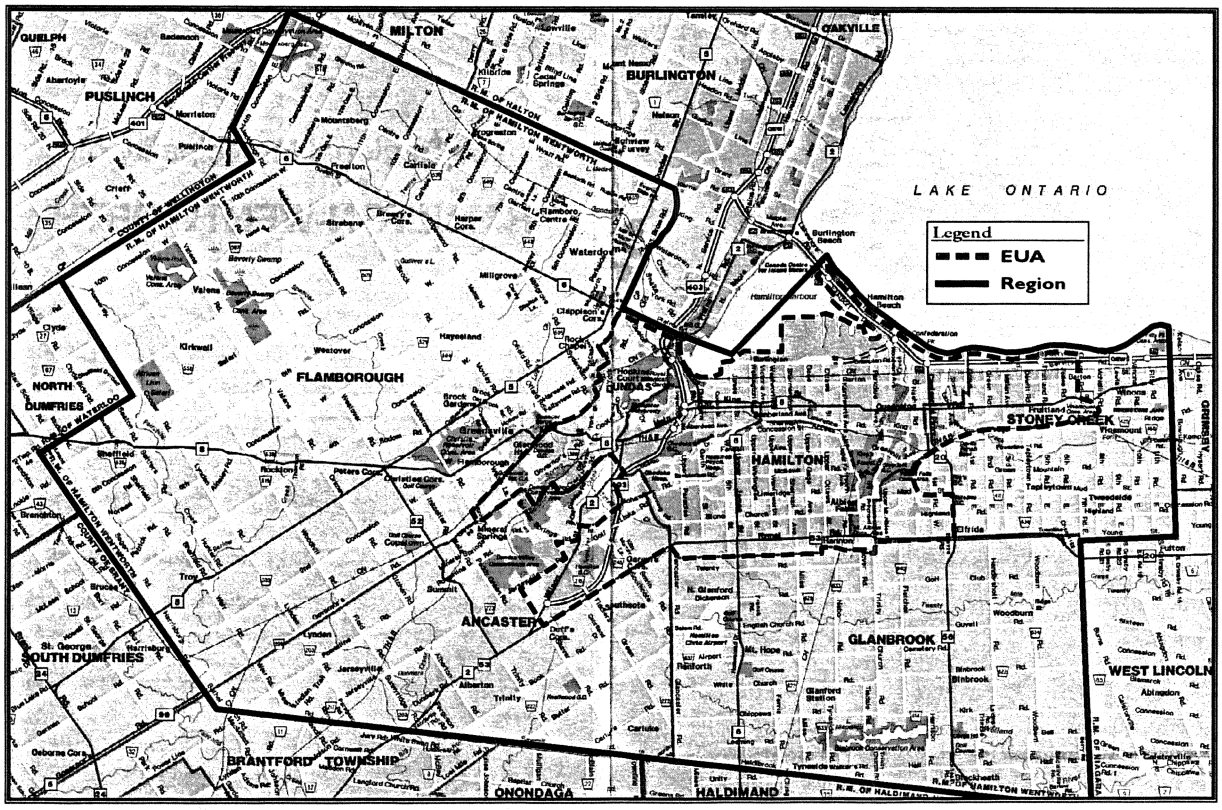


AREAS:	
REGION	9,380 km²
EUA	700 km²
CA	2.9 km²
CBD	2.1 km²

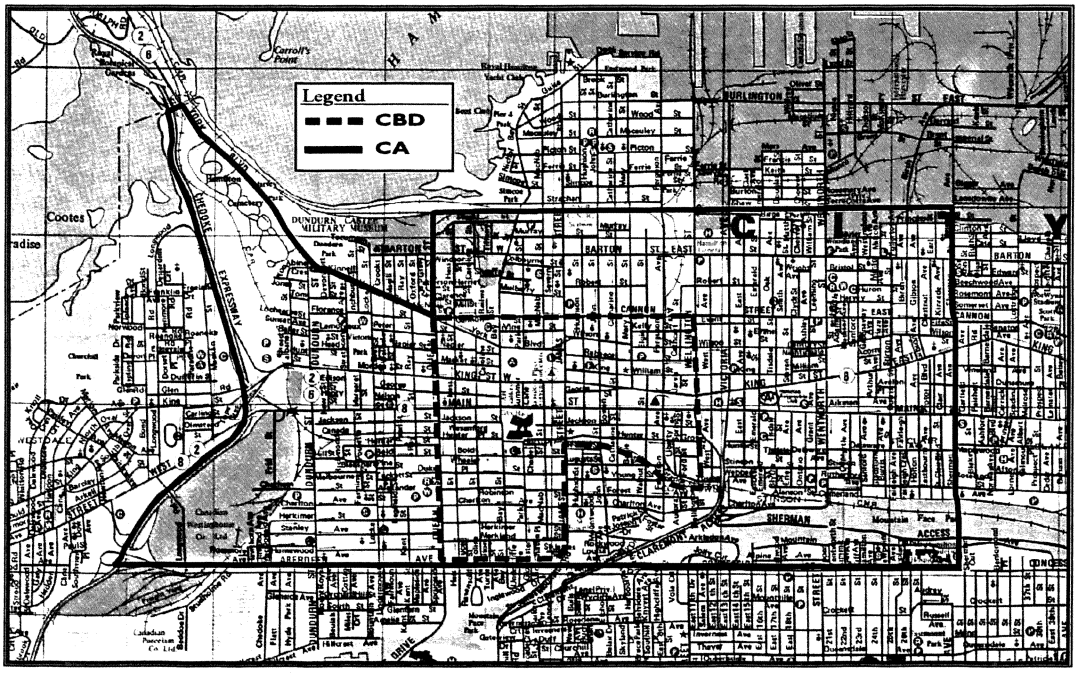
DEFINITIONS: **EUA** = Existing Urbanized Area **CA** = Central Area **CBD** = Central Business District

Hamilton

REGION & EVA BOUNDARIES



CENTRAL AREA & CBD BOUNDARIES

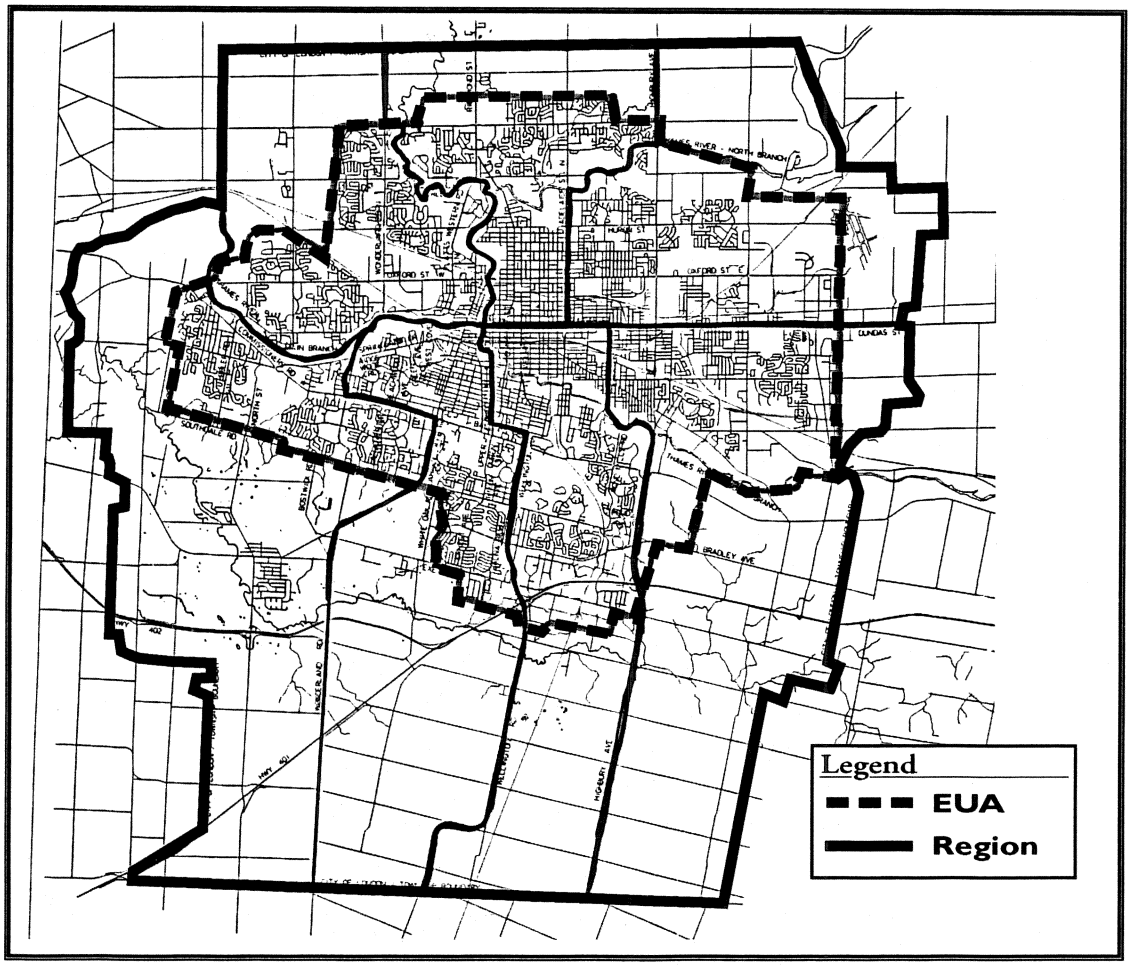


AREAS:	
REGION	1,129 km^2
EUA	200 km^2
CA	10.9 km^2
CBD	2.2 km^2

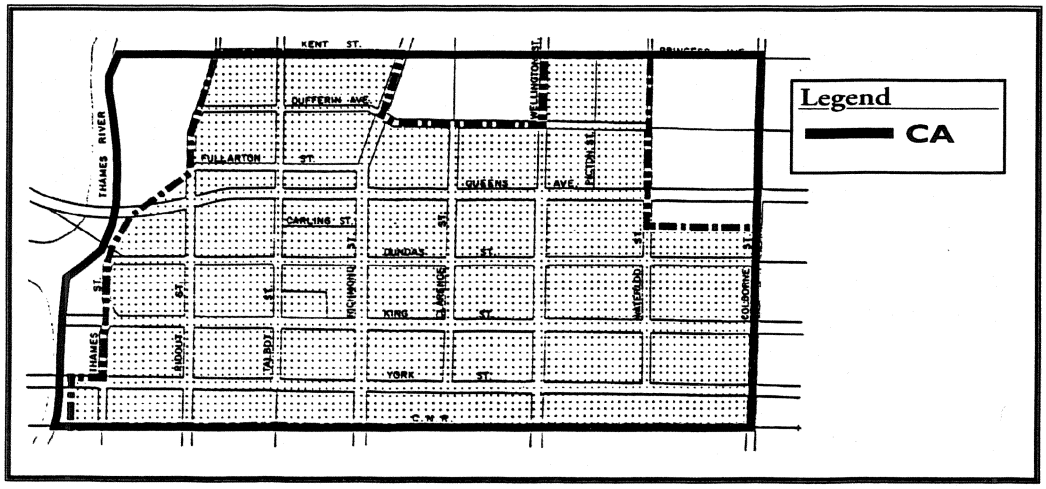
DEFINITIONS: **EUA** = Existing Urbanized Area **CA** = Central Area **CBD** = Central Business District

London

REGION & EUA BOUNDARIES



CENTRAL AREA BOUNDARY

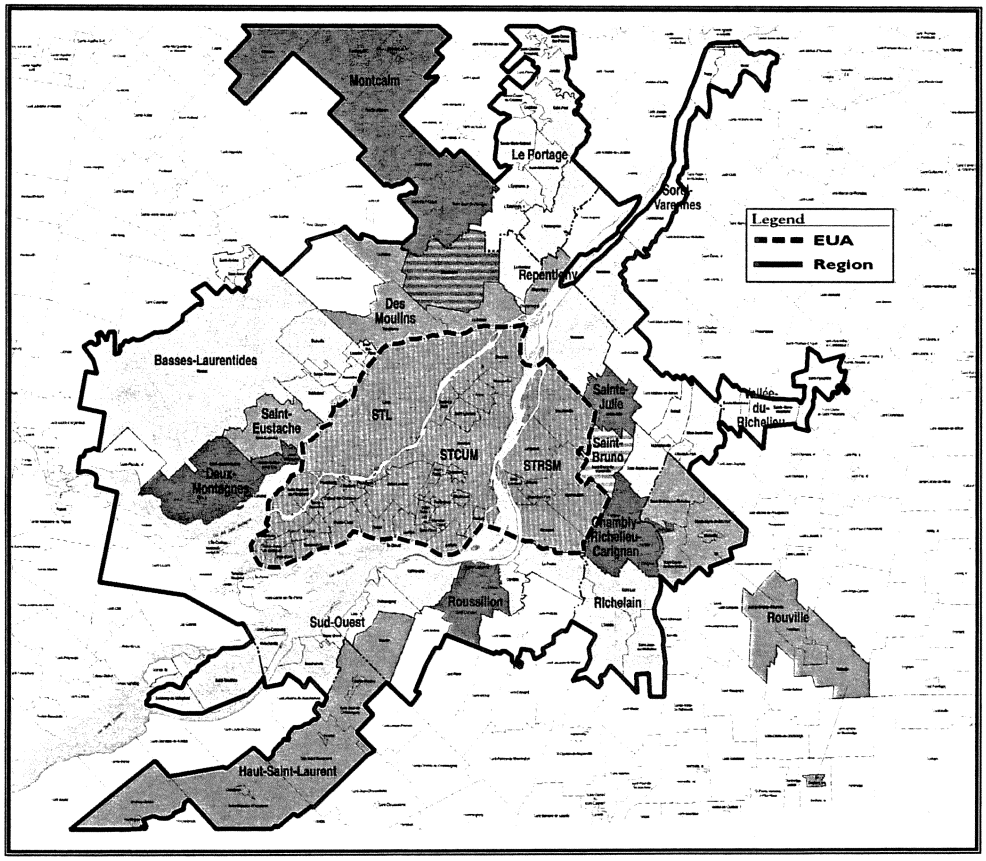


AREAS:	
REGION	423 km²
EUA	166 km²
CA	5.5 km²
CBD	5.5 km²

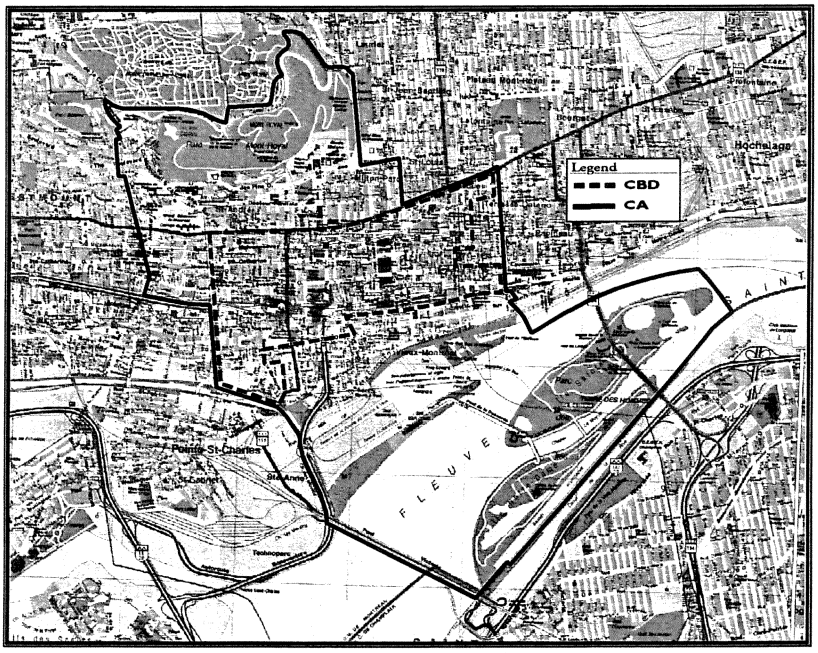
DEFINITIONS: **EUA** = Existing Urbanized Area **CA** = Central Area **CBD** = Central Business District

Montréal

REGION & EUA BOUNDARIES



CENTRAL AREA & CBD BOUNDARIES

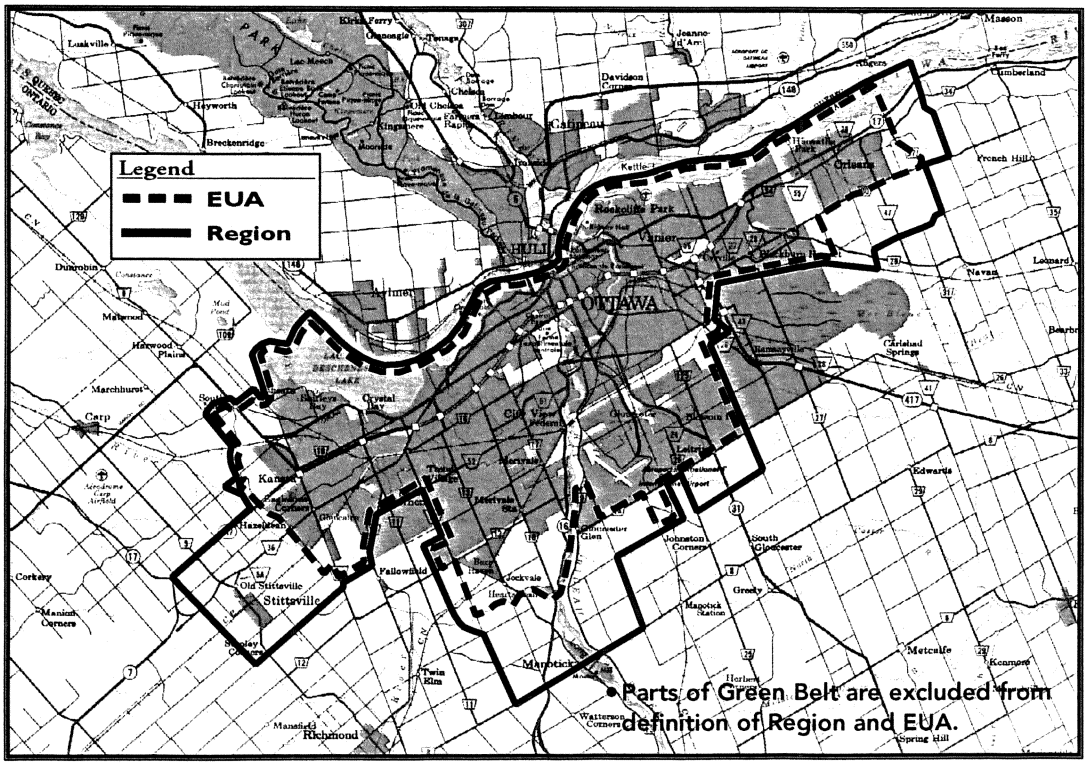


AREAS:	
REGION	5,117 km²
EUA	966 km²
CA	10 km²
CBD	3.7 km²

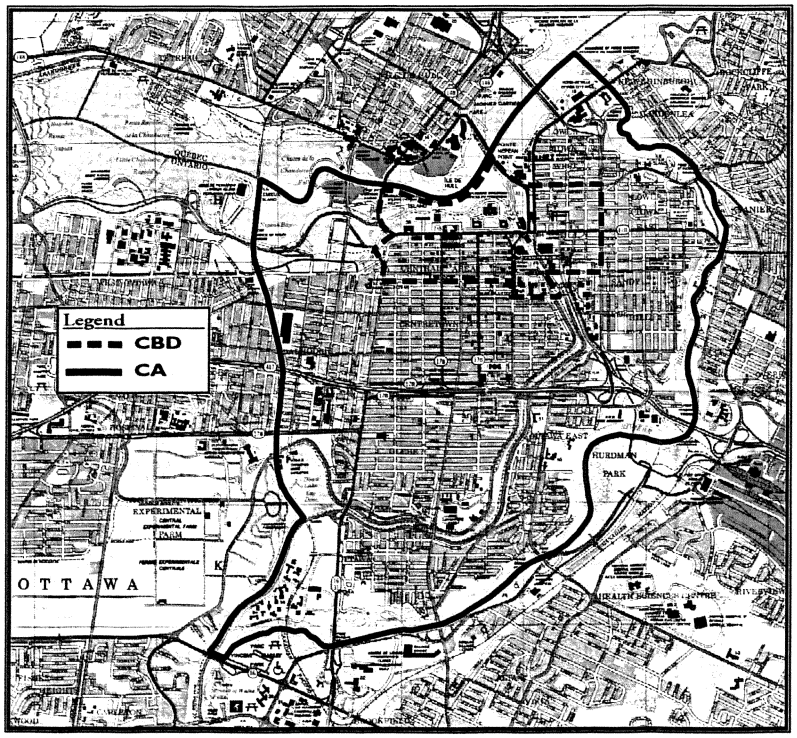
DEFINITIONS: **EUA** = Existing Urbanized Area **CA** = Central Area **CBD** = Central Business District

Ottawa

REGION & EUA BOUNDARIES



CENTRAL AREA & CBD BOUNDARIES

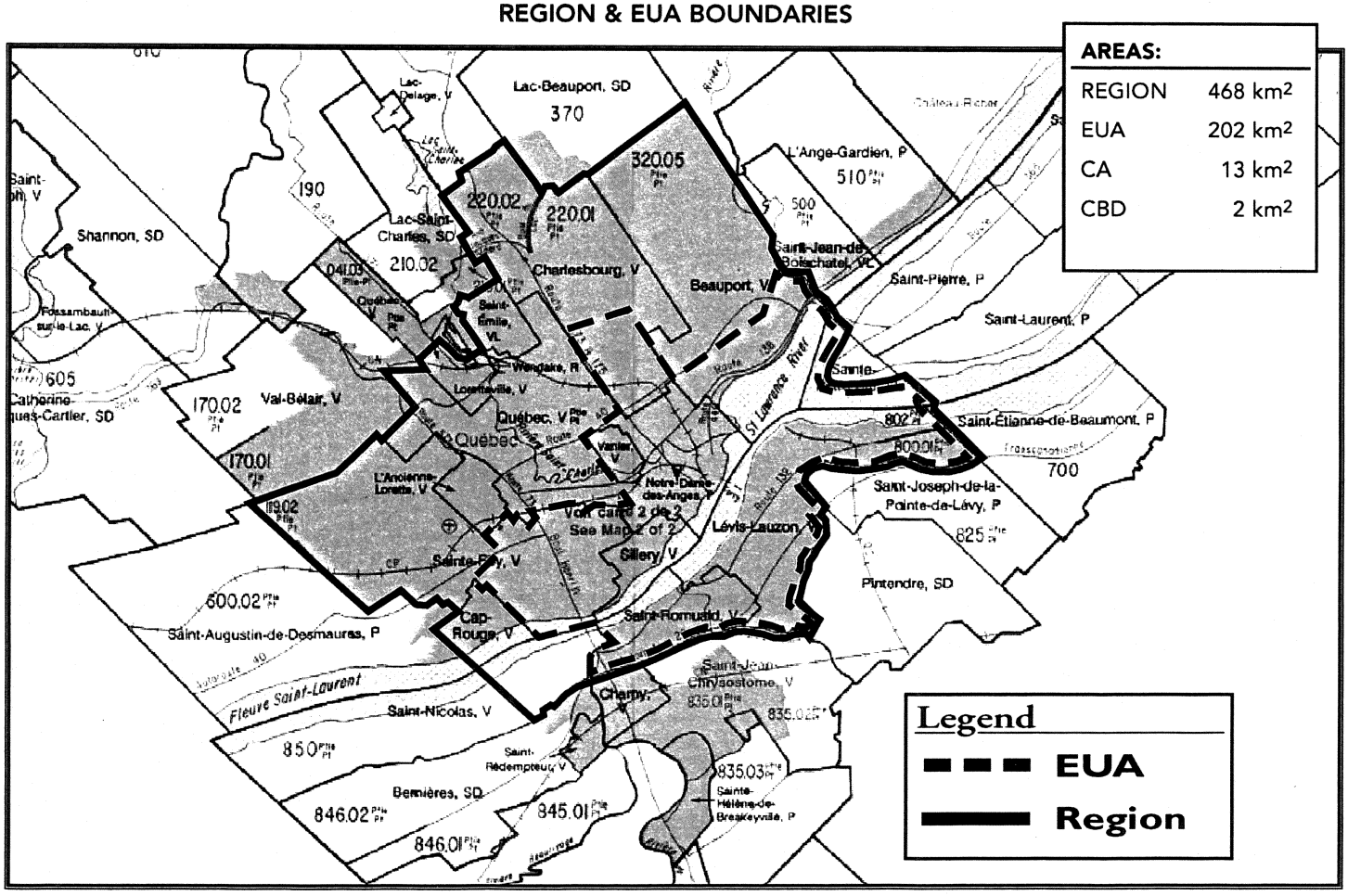


AREAS:	
REGION	430 km²
EUA	310 km²
CA	17.8 km²
CBD	2 km²

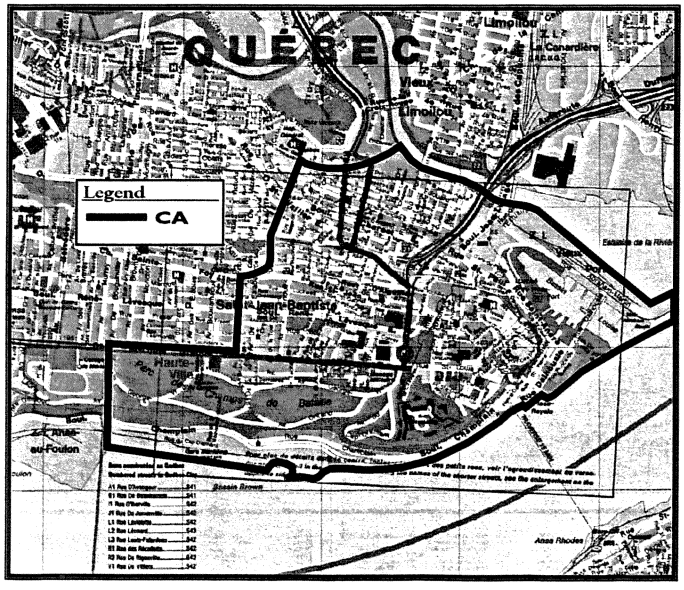
DEFINITIONS: **EUA** = Existing Urbanized Area **CA** = Central Area **CBD** = Central Business District

Quebec

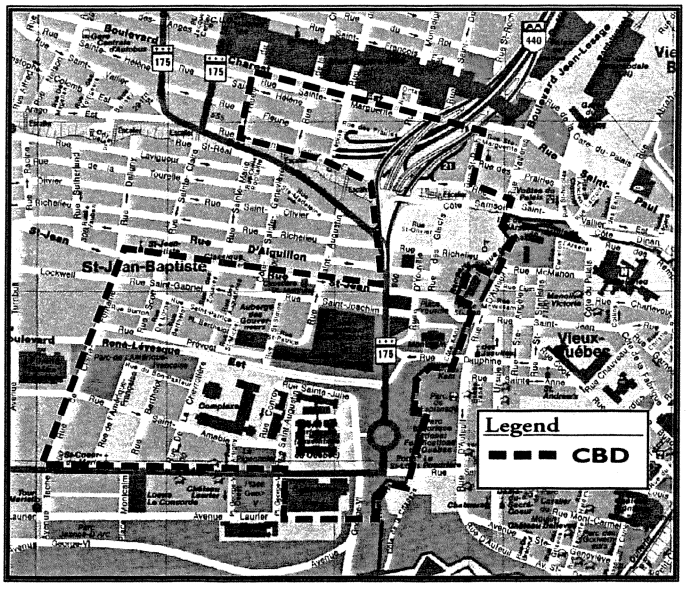
REGION & EUA BOUNDARIES



CENTRAL AREA BOUNDARY



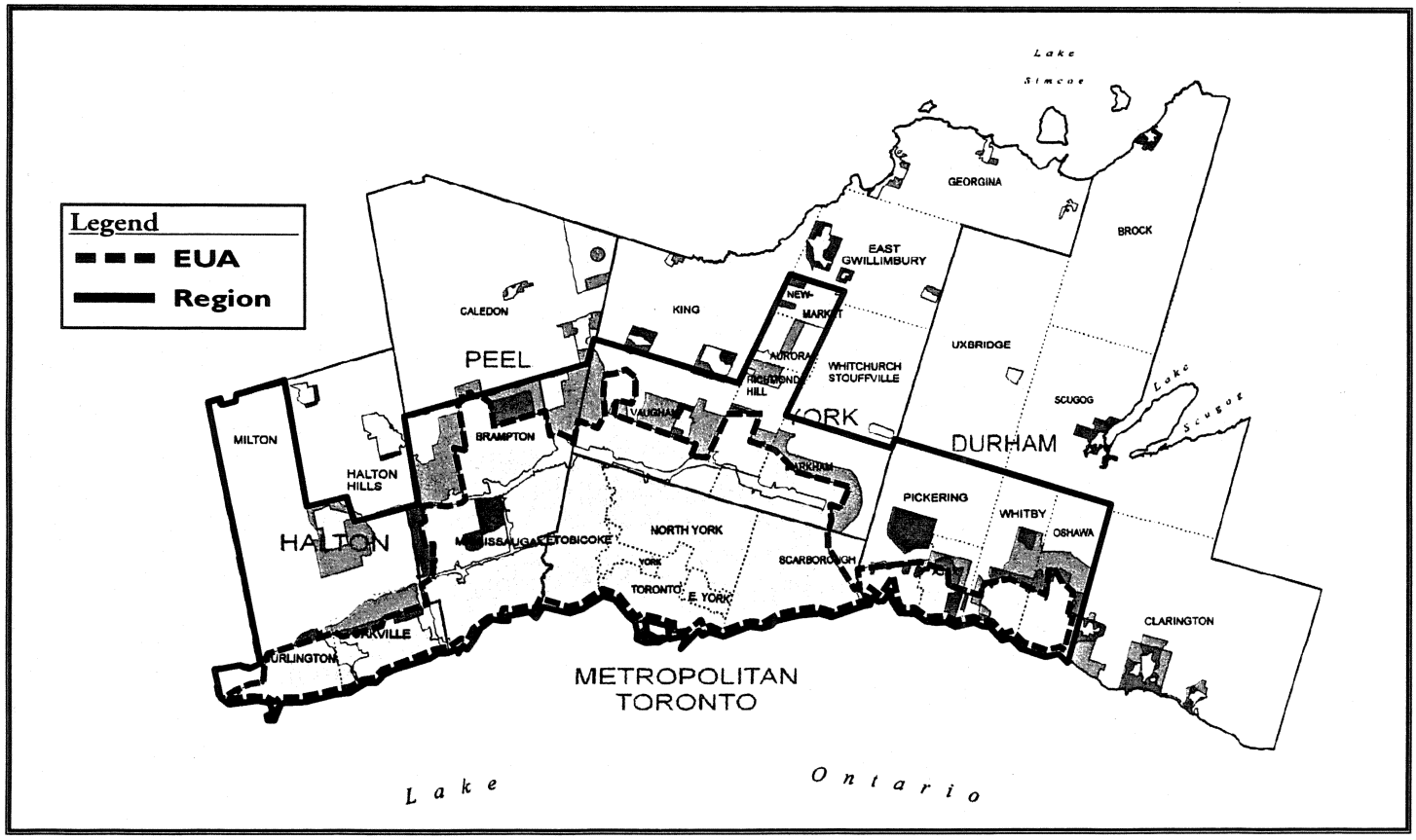
CBD BOUNDARY



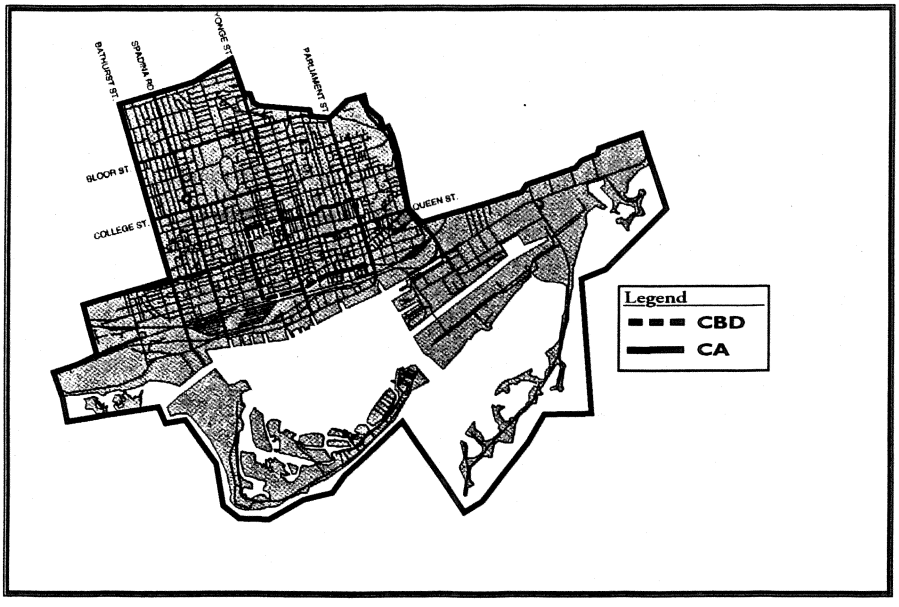
DEFINITIONS: **EUA** = Existing Urbanized Area **CA** = Central Area **CBD** = Central Business District

Toronto

REGION & EUA BOUNDARIES



CENTRAL AREA & CBD BOUNDARIES

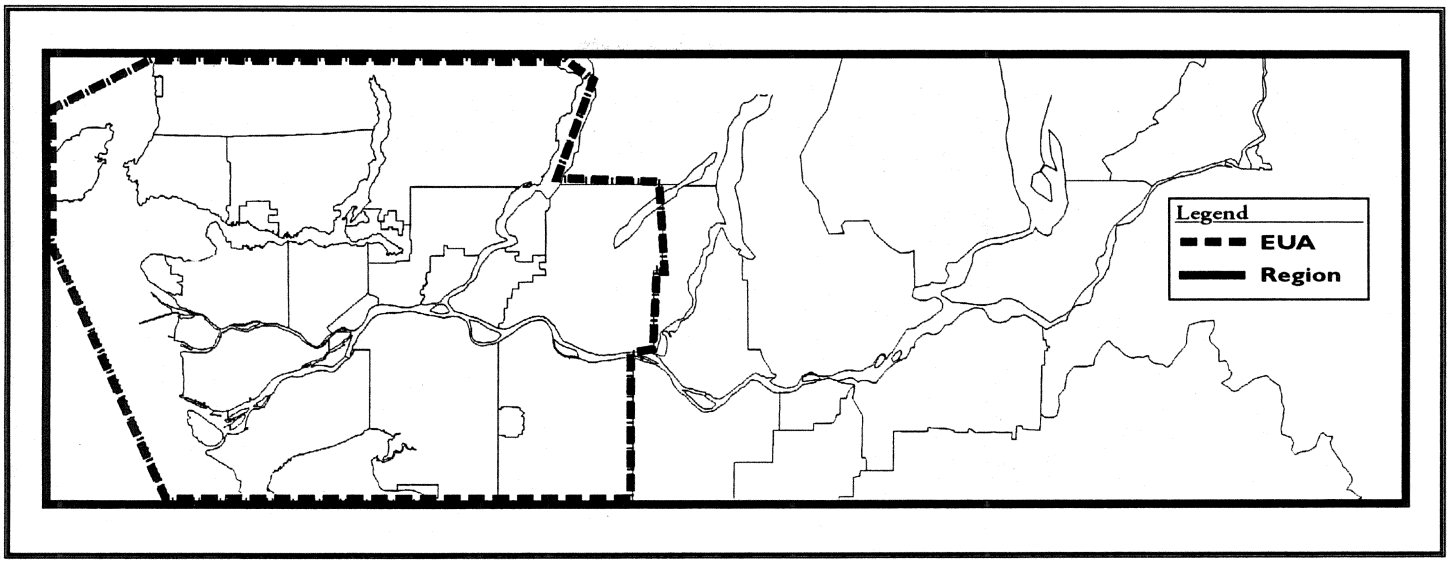


AREAS:	
REGION	3,225 km²
EUA	1,482 km²
CA	29 km²
CBD	2 km²

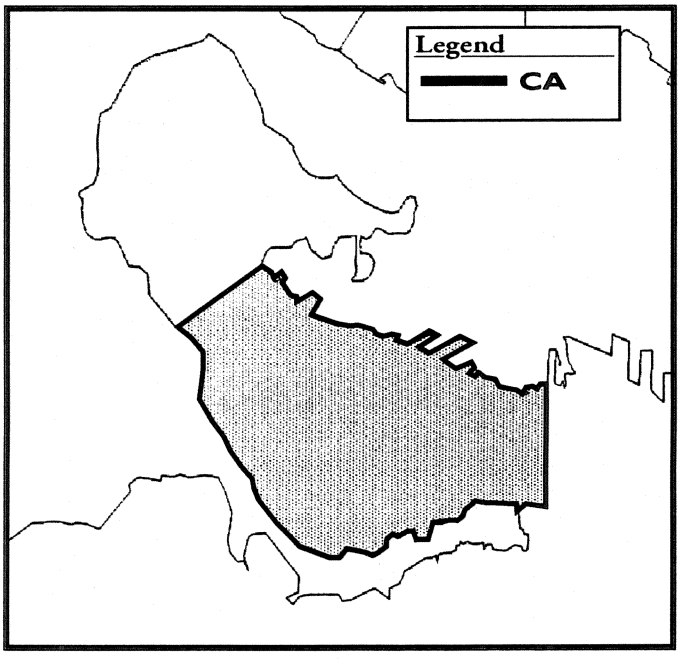
DEFINITIONS: **EUA** = Existing Urbanized Area **CA** = Central Area **CBD** = Central Business District

Vancouver

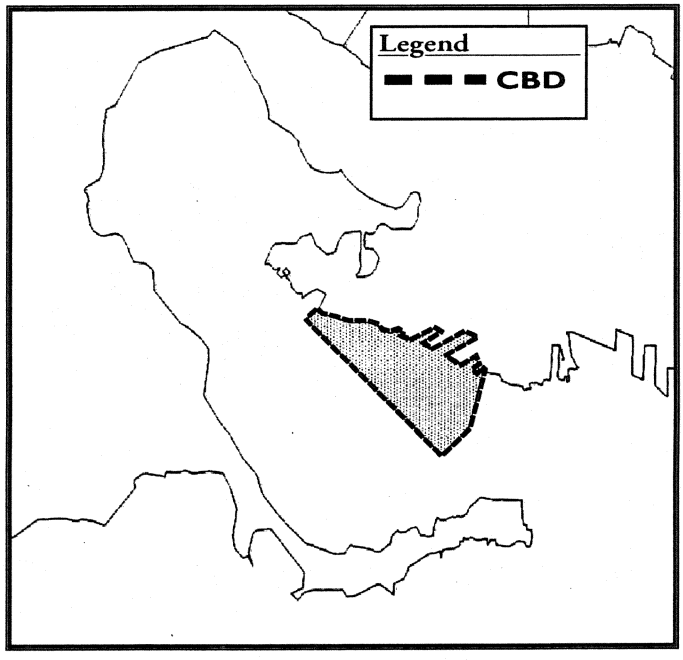
REGION & EUA BOUNDARIES



CENTRAL AREA BOUNDARY



CBD BOUNDARY



AREAS:	
REGION	8,108 km²
EUA	2,634 km²
CA	5.1 km²
CBD	1.0 km²

DEFINITIONS: **EUA** = Existing Urbanized Area **CA** = Central Area **CBD** = Central Business District

APPENDIX C

DATABASE TABULATION: RESPONSE TO PHASE 2 QUESTIONNAIRE

APPENDIX C
DATA BASE TABULATION: RESPONSE TO PHASE 2 QUESTIONNAIRE

		EDMONTON		HAMILTON		LONDON		MONTREAL		OTTAWA		QUEBEC		TORONTO		VANCOUVER	
URBAN STRUCTURE	**AREA**	**YR**	**DATA**	**YR**	**DATA**	**YR**	**DATA**	**YR**	**DATA**	**YR**	**DATA**	**YR**	**DATA**	**YR**	**DATA**	**YR**	**DATA**
1 Land area [sq.km.]	Region	('94)	9,380.0	('95)	1,128.7	('93)	423.0	('93)	5,117.0	('91)	430.0	('95)	467.8	('91)	3,225.7	('91)	8,108.8
	EUA	('94)	700.0		200.4	('93)	166.0	('93)	966.2	('91)	310.0	('95)	202.3	('91)	1,482.3	('91)	2,634.1
	Central Area	('94)	2.9		10.9	('93)	5.5	('93)	10.0	('91)	17.8	('95)	6.7	('91)	29.0	('91)	5.1
	CBD	('94)	2.1		2.2			('93)	3.7	('91)	2.0	('95)	2.0	('91)	2.0	('91)	1.0
2 Residential population	Region	('94)	865,800	('91)	450,770	('91)	310,000	('93)	3,463,139	('91)	613,600	('91)	552,198	('91)	3,986,800	('92)	1,808,700
	EUA	('94)	633,300		406,065	('91)	307,000	('93)	2,436,616	('91)	602,500	('91)	332,812	('91)	3,667,100	('92)	1,631,700
	Central Area	('94)	7,050		57,410	('91)	14,243	('93)	51,847	('91)	79,200	('91)	24,623	('91)	143,700	('92)	47,000
	CBD	('94)	6,325		15,790			('93)	15,143	('91)	5,700			('91)	8,300	('92)	927
3 Total employment	Region	('94)	392,000	('91)	194,540				1,506,795	('91)	349,000	('91)	282,690	('91)	2,034,800	('92)	901,200
	EUA	('94)	324,500		185,600				1,319,435	('91)	347,000	('93)	194,964	('91)	1,912,800	('92)	819,000
	Central Area	('94)	59,300		50,320			('92)	232,900	('91)	143,000	('93)	45,151	('91)	440,000	('91)	129,110
	CBD	('94)	58,900		27,101				147,681	('91)	87,000	('93)	10,309	('91)	166,300	('91)	69,012
TRANSPORTATION SUPPLY	**AREA**	**YR**	**DATA**	**YR**	**DATA**	**YR**	**DATA**	**YR**	**DATA**	**YR**	**DATA**	**YR**	**DATA**	**YR**	**DATA**	**YR**	**DATA**
4 Arterial lane-kilometres	EUA	('92)	2,772						4,520	('91)	1,200			('91)	10,995	('92)	5,675
Expressway lane-kilometres		('92)	796				0		1,816	('91)	200	('95)	170	('91)	2,001	('92)	1,050
HOV(including exclusive transit) lane-kilometres		('93)	11		0		0		34	('91)	13	('95)	50	('91)	35	('94)	10
5 Bike lane/bike path-kilometres	EUA	('93)	146	('95)	31	('91)	126		495	('91)	160	('95)	115	('91)	109		
6 Peak period transit seat-kilometres	EUA																
AM peak period		('93)	1,496,000	('95)	330,101	('91)	204,339			('91)	1,900,000			('91)	15,107,709	('92)	4,401,038
PM peak period		('93)	1,560,000	('95)	330,101	('91)	207,082			('91)	2,000,000			('91)	15,107,709	('92)	4,401,038
24 -hr transit seat-kilometres		('93)	5,585,000	('95)	1,871,524		1,433,142	('93)	25,019,230	('91)	6,900,000			('91)	44,434,437	('92)	11,002,596
7 Automobiles registered (leased & private)	EUA	('92)	339,000			('91)	188,880	('93)	1,043,097	('91)	308,000	('93)	243,399	('91)	2,041,517	('92)	999,419
8 Designated park-and-ride spaces	EUA	('93)	1,750		0	('91)	0	('93)	10,256	('91)	680	('95)	900	('91)	24,500	('92)	5,477
9 Off-street parking spaces	CBD																
- publicly owned (available for use by public)		('94)	2,500	('94)	3,563	('91)	4,117		639	('91)	12,800			('93)	2,558	('92)	24,389
- privately owned (available for use by public)		('94)	18,310	('94)	7,368	('91)	2,456		29,365	('91)	11,400			('93)	14,077		
- spaces not available for use by public		('94)	13,300			('91)	6,523		9,045					('93)	3,601		
TRANSPORTATION DEMAND	**AREA**	**YR**	**DATA**	**YR**	**DATA**	**YR**	**DATA**	**YR**	**DATA**	**YR**	**DATA**	**YR**	**DATA**	**YR**	**DATA**	**YR**	**DATA**
10 AM peak period modal shares [%]																	
- Auto driver	CBD	('94)	55.0%	('91)	62.7%			('93)	28.4%	('91)	39.5%	('91)	42.0%	('91)	25.0%	('92)	52.0%
- Auto passenger			12.7%		11.4%				9.4%		12.9%		17.0%	('91)	5.5%		9.0%
- Transit			29.5%		15.5%				58.4%		31.0%		33.0%	('91)	64.2%		35.0%
- Cycle			0.1%		0.3%				0.6%		2.6%		0.0%	('91)	0.5%		1.0%
- Walk			2.2%		8.7%				2.7%		8.7%		7.0%	('91)	4.1%		2.0%
- Other (taxi, motorcycle etc.)			0.5%		1.4%				0.5%		5.3%		1.0%	('91)	0.7%		1.0%
			100.0%		100.0%				100.0%		100.0%		100.0%		100.0%		100.0%
PM peak period modal shares																	
- Auto driver	CBD	('94)	53.5%	('91)	63.4%					('91)	38.7%	('91)	37.0%	('91)	22.9%		
- Auto passenger			12.2%		12.4%						16.8%		17.0%	('91)	5.6%		
- Transit			29.5%		17.5%						25.2%		36.0%	('91)	66.1%		
- Cycle			0.1%		0.0%						3.0%		0.0%	('91)	0.5%		
- Walk			4.1%		6.0%						11.3%		9.0%	('91)	3.9%		
- Other (taxi, motorcycle etc.)			0.6%		0.7%						5.0%		1.0%	('91)	1.0%		
			100.0%		100.0%						100.0%		100.0%		100.0%		
24-hour modal shares																	
- Auto driver	CBD	('94)	56.2%	('91)	59.9%			('93)	31.2%	('91)	40.5%	('91)	41.0%	('91)	29.3%		
- Auto passenger			14.5%		16.9%				9.7%		16.6%		16.0%	('91)	7.0%		
- Transit			23.6%		16.7%				50.7%		21.3%		28.0%	('91)	57.5%		
- Cycle			0.1%		0.4%				0.9%		2.6%		0.0%	('91)	0.6%		
- Walk			4.4%		4.6%				6.4%		12.6%		13.0%	('91)	4.0%		
- Other (taxi, motorcycle etc.)			1.2%		1.5%				1.1%		6.4%		2.0%	('91)	1.6%		
			100.0%		100.0%				100.0%		100.0%		100.0%		100.0%		

APPENDIX C

DATA BASE TABULATION: RESPONSE TO PHASE 2 QUESTIONNAIRE

TRANSPORTATION DEMAND (Con't)		EDMONTON	HAMILTON	LONDON	MONTREAL	OTTAWA	QUEBEC	TORONTO	VANCOUVER
11 AM peak period modal shares									
- Auto driver	EUA	('94) 47.2%	('91) 64.9%	('87) 53.0%	('93) 42.0%	('91) 63.2%	('91) 47.0%	('91) 57.3%	('92) 57.0%
- Auto passenger		21.4%	10.7%	12.0%	11.3%	16.8%	12.0%	('91) 10.0%	16.0%
- Transit		12.9%	9.9%	17.0%	27.3%	10.1%	19.0%	('91) 20.4%	10.0%
- Cycle		0.7%	0.5%	1.0%	0.7%	1.1%	0.0%	('91) 0.6%	1.0%
- Walk		12.8%	9.6%	16.0%	11.8%	2.1%	14.0%	('91) 8.5%	14.0%
- Other (taxi, motorcycle etc.)		5.0%	4.4%	1.0%	6.9%	6.7%	8.0%	('91) 3.2%	2.0%
		100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
11 PM peak period modal shares									
- Auto driver		('94) 58.4%	('91) 70.4%	('87) 63.0%		('91) 62.7%	('91) 48.0%	('91) 63.5%	
- Auto passenger	EUA	22.4%	15.4%	14.0%		19.6%	13.0%	('91) 12.3%	
- Transit		9.7%	8.2%	10.0%		9.8%	19.0%	('91) 18.7%	
- Cycle		0.7%	0.3%	1.0%		1.1%	0.0%	('91) 0.4%	
- Walk		7.3%	4.5%	10.0%		1.3%	13.0%	('91) 4.0%	
- Other (taxi, motorcycle etc.)		1.5%	1.2%	2.0%		5.5%	7.0%	('91) 1.1%	
		100.0%	100.0%	100.0%		100.0%	100.0%	100.0%	
24-hour modal shares									
- Auto driver		('94) 54.3%	('91) 66.2%	('87) 56.0%	('93) 47.5%	('91) 63.4%	('91) 50.0%	('91) 62.7%	
- Auto passenger	EUA	23.4%	19.8%	14.0%	14.0%	19.6%	14.0%	('91) 14.4%	
- Transit		8.6%	7.5%	11.0%	19.7%	6.9%	16.0%	('91) 15.1%	
- Cycle		0.5%	0.3%	1.0%	0.8%	1.0%	0.0%	('91) 0.5%	
- Walk		11.5%	4.5%	14.0%	14.7%	2.2%	15.0%	('91) 5.3%	
- Other (taxi, motorcycle etc.)		1.7%	1.7%	4.0%	3.3%	6.9%	5.0%	('91) 2.0%	
		100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	
12 Weekday person trips (all modes)	EUA								
AM peak period		('94) 370,000	('91) 151,760	('87) 140,905	('93) 1,236,281	('91) 235,000	('91) 283,400	('91) 1,655,726	843,110
PM peak period		('94) 376,000	174,450	('87) 139,450		245,000	('91) 311,740	('91) 1,661,658	('94) 831,900
24-hours		('94) 2,210,000	634,700	('87) 815,716	('93) 3,635,493	1,350,000	('91) 912,000	('91) 8,673,624	('94) 5,152,000
13 Annual transit riders	EUA	('94) 38,050,000	('94) 20,662,823	('91) 16,343,000	('93) 385,800,000	('91) 79,227,000	('93) 39,400,000	('91) 496,816,525	('92) 104,230,167
Riders on a typical weekday		('94) 185,000	('94) 74,866	('91) 55,891	('93) 1,345,000	312,200	('93) 157,000	('91) 1,427,000	('92) 347,400
14 Peak period arterial vehicle-kilometres (auto)	EUA								
AM peak period		('94) 1,638,600			3,004,908	('91) 1,100,000		('91) 5,110,000	
PM peak period		('94) 1,917,300				1,200,000			
% commercial vehicles					2.4%	1.5%		('91) 12.0%	
24-hour arterial vehicle-kilometres (auto)		('94) 9,384,000				7,300,000		('91) 31,937,500	
% commercial vehicles						2.5%	('93) 5% to 9%		
15 Peak period expressway vehicle-kilometres (auto)	EUA								
AM peak period					3,963,009	('91) 650,000		('91) 5,315,000	
PM peak period						690,000			
%commercial vehicles					6.40%			('91) 12.00%	
24-hour expressway vehicle-kilometres (auto)						4,300,000		('91) 33,218,750	
% commercial vehicles							('93) 10% to 15%		

TRANSPORTATION SYSTEM PERFORMANCE	AREA	YR	DATA	YR	DATA	YR	DATA	YR	DATA	YR	DATA	YR	DATA	YR	DATA	YR	DATA
16 Average home-work trip distance [kilometres]	EUA	('94)	10.3	('91)	5,19,30 WITHIN/TO/FROM	('87)	3.5		16.7	('91)	12	('91)	12.4	('91)	12.46	('92)	12.3
17 Annual injuries & fatalities	EUA	('94)	31 fatalities 6846 injuries	('94)	9 fatalities 3061 injuries	('93)	3003 combined injuries and fatalities	('93)	112 fatalities 16124 injuries	('91)	33 fatalities 4240 injuries	('93)	2224 combined injuries and fatalities	('91)	18700	('92)	135 fatalities 25649 injuries

TRANSPORTATION COSTS & FINANCE	AREA	YR	DATA	YR	DATA	YR	DATA	YR	DATA	YR	DATA	YR	DATA	YR	DATA	YR	DATA
18 Annual road capital budget	Region	('93)	50,400,000	('91)	29,253,000	('95)	23,000,000	('93)	365,000,000	('91)	63,200,000			('91)	321,654,000	('92)	210,800,000
Annual road operating & maintanance budget		('93)	58,520,000	('91)	14,014,330	('95)	30,000,000	('93)	467,000,000	('91)	80,000,000			('91)	564,146,000	('92)	189,500,000
19 Annual transit capital budget	Region	('93)	17,177,000	('91)	1,621,585	('91)	5,582,611	('93)	163,600,000	('91)	44,700,000	('93)	95,300,000	('91)	252,068,257	('92)	142,700,000
Annual transit operating & maintanance budget		('93)	95,455,000	('91)	50,506,535	('91)	28,155,121	('93)	727,000,000	('91)	139,600,000			('91)	973,380,490	('92)	249,600,000
20 Annual Transit Fare Box Revenue	Region	('93)	38,730,000	('91)	21,579,434	('91)	15,815,862	('93)	313,200,000	('91)	73,700,000	('93)	34,100,000	('91)	543,877,762	('92)	120,800,000

NOTES:

Year for which data was provided is shown in brackets. [i.e. ('91) = 1991]