

# Canada's infrastructure deficit a sad legacy for future generations

Saeed Mirza, Ph.D., Professor of Civil Engineering and Cristian Sipos, Ph.D. Candidate, McGill University  
Previously printed in *Western Canada Water*, Winter 2008. Used with permission)

The health, socio-economic well being and the quality of life of Canadians depend on basic infrastructure systems such as roads, highways, bridges, water supply systems, sewers, airports, telecommunications facilities and transit systems. Most of Canada's infrastructure was constructed between the 1950s and 1970s in response to the population growth due to the "baby boom," high immigration levels and rapid urbanization.

However, the rapid inflation and high interest rates in the late 1970s and the early 1980s, and the resulting recession led to scarcity of funds for maintenance, which was deferred routinely leading to accelerated deterioration of infrastructure assets. In some cases, the escalating deterioration has resulted in catastrophic failure. For example, de la Concorde Overpass collapsed in Laval in September 2007 killing five people and injuring a number of others. There have been serious problems with water supply in some communities, such as Walkerton, Ontario and North Battleford, Saskatchewan and a few others resulting in both loss of life and significant number of sickness cases.

## Aging infrastructure

The above situation was worsened further by the gradually increasing infrastructure age and the competing fiscal demand on the available resources for socio-cultural and other municipal services. In addition, the above recession led to the resulting annual rate of infrastructure growth to decrease dramatically from 4.8% between 1955 and 1977 to only 0.1% between 1978 and 2000. The consequences of the decreased rate of growth and lack of investment in infrastructure are evident in the observation by the Technology Road Map (CSCE 2003) that only 41% of Canada's infrastructure was less than 40 years old (Figure 1), with another 31% between 40 and 80 years old, while the age of the remaining 28% was between 80 and 100 years; therefore a considerable part of Canada's infrastructure is well past its intended service life (FCM-McGill 2007).

## FCM-McGill Surveys (1996-2007)

Currently, the federal, provincial and municipal shares of the tax dollar are 50%, 42%

and 8%, respectively. The Canadian municipalities draw their authority from their respective provincial governments and they cannot raise any taxes independently. The resulting gross financial imbalance and the resulting lack of investment has made it very difficult to manage the increased infrastructure responsibilities, and has resulted in a serious maintenance and rehabilitation backlog, leading to continuously increasing infrastructure deficits. A detailed Federation of Canadian Municipalities-McGill University survey (FCM-McGill 1996), based on 28% municipal response and representing 55% of Canada's population in four distinct population groups, ranging from less than 10,000 to more than 400,000, estimated a national municipal infrastructure deficit of \$44 billion, with the roads, bridges and sidewalks being in the greatest need of repairs.

Funding shortage was noted as the most serious impediment to successful rehabilitation and replacement of the infrastructure. The survey recommended some immediate steps to halt the infrastructure decline and to meet growth without jeopardizing the provision of any needed new facilities. It also recommended a greater emphasis on maintenance and rehabilitation of infrastructure rather than construction of new infrastructure. The Federal Government was also urged to renew the Canada Infrastructure Program, subject to a set of recommended principles, shared equally between the three levels of government.

In 2007, FCM recognized the need to revise the current infrastructure deficit estimates because of its rapid aging and escalating deterioration, evident in certain categories of infrastructure assets. It was noted that Canada had used up about 79% of the total service life of its public infrastructure. It was emphasized that the cost of upgrading the deteriorated infrastructure assets had increased exponentially with increasing age; in many cases, it was not possible to rehabilitate these assets, even at exorbitantly high costs, and they would have to be decommissioned and dismantled, followed by the removal of the debris, and construction of the replacements at a much higher costs.

Other factors influencing these escalating infrastructure deficits include community demographics, economics, geography, local needs and the anticipated impact of the future climate change. After detailed consultation among the interested parties, a draft survey questionnaire in English and French were developed for comments by a group of municipal infrastructure finance, engineering and planning officials, before it was finalized. The survey questionnaire was distributed to 166 municipalities in October 2007, representing a regionally balanced set of potential respondents, in groups with populations ranging from less than 10,000 to more than one million. Full and partial responses were received from 85 municipalities, representing a high response rate of 51%, representing 46% of Canada's population.

The responses were analyzed to determine the upgrading requirements of deteriorated assets and new infrastructure needs in the areas of water and wastewater, transportation, transit and other public infrastructure assets, including cultural, social, community and recreational facilities and waste management, involving landfills, recycling and hazardous waste disposal, storage and recycling facilities.

## Water and wastewater systems

The water and wastewater systems comprise about 30% of Canada's infrastructure stock, and include water treatment, supply and distribution systems, and sanitary and storm sewers and related treatment facilities. Statistics Canada (2007) observed recently that environmental management and the management of water systems takes place principally at the level of the municipalities which account for more than 80% of the municipal capital spending in these areas.

These estimates are close to the 2007 FCM-McGill survey estimate of \$31 billion for upgrading the existing deteriorated assets and another \$56.6 billion for new needs. The upgrading deficit has increased significantly from \$21 billion in 1996 because of aging, and the resulting accelerated deterioration of the underground infrastructure, worsened further by

deferred maintenance. A major part of the above needs related to larger cities, such as Montreal, where the service life of about 33% of water supply pipes and 3% of sewers was considerably exceeded in 2002 (SNC-Lavalin/ Dessau-Soprin, 2002). Another 34% of water pipes will attain their service life in 2020, which explains the need for new infrastructure in older cities because of the extensive deterioration. A similar situation prevails in communities with populations smaller than 10,000 – with no water supply infrastructure in some places. This explains the large investments required in the larger and smaller communities.

### Transportation systems

The transportation assets constitute about 55% of Canada’s municipal infrastructure and include paved and unpaved roads, sidewalks, curbs, bicycle paths, bridges and overpasses, and the road cleaning and snow removal facilities. A large part of Canada’s highways and roads were constructed in the 1950s and 1960s and have outlived their service lives and they must be replaced; the backlog of deferred maintenance also needs urgent attention. The 1996 FCM-McGill survey had forecast an \$11.4 billion need for roads, sidewalks, curbs and bridges, and the other transportation assets mentioned above were not considered. The 2007 survey estimate for upgrading all transportation assets is \$21.7 billion, and another \$28.5 billion for new transportation infrastructure with about 38% for the funding needed for smaller rural and northern communities for transportation networks and related facilities. According to Statistics Canada, the investment by the governments in roads has increased from \$4.3 billion in 1998 to \$7.3 billion in 2005 without having any significant influence on the condition of the road network.

### Transit systems

The transit systems comprise rapid and light rail transit systems, subways, trams, including rolling stock, track, service and parking facilities and stations, and buses, including dedicated lanes, rolling stock, service and park-and-ride facilities, and stops and stations. The 1996 FCM-McGill Survey estimated a deficit of \$3.05 billion for transit systems compared with the 2007 deficit of \$22.8 billion to upgrade the existing deteriorated infrastructure, and the new needs were estimated at \$7.7 billion. The Canadian Urban Transit Association (Deloitte 2007) had forecast a deficit of \$14 billion for Canada’s transit facilities, equipment, rolling stock and other related facilities.

### Other public infrastructure systems

This remaining catch-all infrastructure category consists of cultural, social, community and recreational facilities, and waste management comprising landfills, municipal recycling facilities, and hazardous waste disposal, storage and recycling facilities. The cultural, social, community and recreational assets vary widely in terms of the facilities, and the services provided are mostly inadequate in terms of capacity and are generally in poor condition due to aging and accumulated deterioration over the past few decades. The Canadian Parks and Recreation Association (2007) identified a deficit of \$15 billion to repair, rehabilitate and replace the existing deteriorated sports and recreational facilities, and it did not include any new community needs to address the deficient capacity. The 1996 FCM-McGill survey had forecast a deficit of \$7.55 billion to upgrade the existing parks, recreational facilities, and community and social services. The 2007 survey estimated the current upgrading deficit to be \$18.1 billion, which is in addition to the budgetary provisions made

by some municipalities to deal with this situation. The needs for new assets were estimated at \$18.1 billion, mostly in larger cities with rapid urban growth. In addition, several communities with populations less than 100,000 require new facilities over the next few years.

The deficit to upgrade the existing waste management facilities was estimated to be \$7.7 billion (FCM-McGill 2007), compared with the 1996 FCM-McGill estimate of only \$0.98 billion, while the new needs were established at \$4.3 billion

### Discussion of survey results

A comparative summary of the findings of the 1996 and 2007 FCM-McGill surveys is presented in Table 1, while the needs for upgrading the existing deteriorated infrastructure and for new infrastructure in the four categories are summarized graphically in Figures 2 and 3.

The research findings show that the previous infrastructure upgrading deficit estimate should be revised to \$123 billion. The components of this deficit, such as that for water and wastewater, and transit systems are consistent with the estimates of the specialist organizations, such as Canadian Water Network (2005), Canadian Water and Wastewater Association (1997) and Water Strategy Expert Panel (2005) and Canadian Urban Transit Association (Deloitte, 2007). This deficit estimate is comparable with the 2003 Canada West Foundation estimate (FCM 2006) of \$125 billion to upgrade all Canada’s infrastructure. Another 2003 estimate by Mirza and Haider also placed the national infrastructure deficit at \$125 billion, which was expected to grow to \$400 billion by 2020.

### Actions needed

The 2005 biennial survey of all US infrastructures by the American Society of Civil

Figure 1- Age of Canada’s Infrastructure

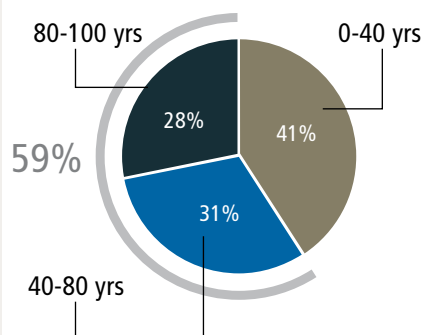
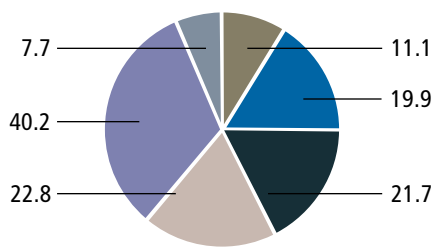


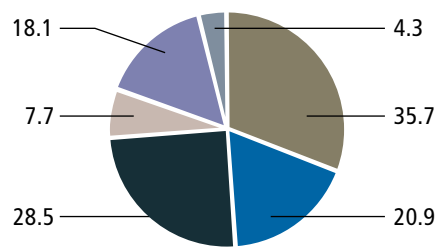
Table 1 - Municipal Infrastructure Deficit in 1996 and 2007

Facilities Considered	Upgrading Needs 1996 Survey (\$Billions)	Upgrading Needs 2007 (\$Billions)	Now Needs 2007 Survey (\$Billions)
Water and wastewater infrastructure	21	31	56.6
Transportation	11.4	21.7	28.5
Transit	3.1	22.8	7.7
Cultural, social, recreational facilities and waste management	8.5	40.2	18.1
<b>TOTAL (\$Billions)</b>	<b>44</b>	<b>123.4</b>	<b>115.2</b>

**Figure 2 - Municipal Deficit for Existing Infrastructure by Category (Billions of Dollars)**



**Figure 3 - New Municipal Infrastructure Needs (Billions of Dollars)**



- Water Supply Systems
- Wastewater and Stormwater Systems
- Transportation
- Transit Systems
- Cultural, Social, Community and Recreational Facilities
- Waste Management

Engineers (ASCE 2005) gave it a failing grade of “D” and estimated the upgrading needs at \$1.65 trillion. Based on the populations of Canada and the US, the rough rule of thumb suggests the Canadian expenditure to be about one-tenth of the corresponding US expenditures; the estimate for upgrading Canada’s infrastructure would be approximately \$165 billion which is close to the projected deficit of \$123 billion. It should be noted that the Federal and the state governments in the US recognized the seriousness of the infrastructure crisis much earlier than any of the governments in Canada and undertook several steps to improve the situation.

It would be appropriate for Canada’s Federal Government to acknowledge the serious infrastructure crisis and to work with the provincial and municipal governments, to develop appropriate national policies, regulations and support mechanisms to combat the current crisis and to at least upgrade Canada’s infrastructure to an acceptable level. The price of not doing anything or continuing to postpone tackling the infrastructure crisis will be quite severe in terms of productivity, economic progress, international competitiveness and the overall quality of life for present and future citizens.

Ottawa must show leadership and take appropriate steps to resolve the crisis which would include as a first step the identification and description of the serious problem, followed by definition of the size, nature, extent and geographical and jurisdictional characteristics of the infrastructure deficit. These should constitute the first step in developing both short-and long-term policies for appropriate investments to upgrade Canada’s infrastructure. Logical accurate investment priorities can be developed only through understanding the scope of the crisis in each region. Besides providing the basis for a more rational intergovernmental investment strategy, it will also be the cornerstone for a robust accountability framework. Otherwise our children and

grandchildren will have to pay the cost of the neglect of infrastructure by the current generation and the politicians, which will be several times the monetary value of the current infrastructure deficit of \$123 billion.

A preliminary estimate of the deficit in 2067, if the current conditions are not eradicated and the cycle of deferred or inadequate maintenance is continued, is around two trillion dollars. However, if the assets are inspected and maintained properly, the infrastructure assets will continue to “grow old gracefully” and would continue to appropriately serve the future Canadian generations without exorbitantly expensive investments.

**Summary and conclusions**

Presently, Canada is facing a serious infrastructure crisis, with needs for upgrading the existing deteriorated infrastructure at \$123 billion and for new infrastructure at \$115 billion. All levels of government must acknowledge the serious infrastructure crisis and Ottawa must provide leadership in the development of appropriate national policies, regulations, innovative financing techniques (such as P3’s) and the needed support mechanisms to combat the crisis and take strong steps to restore all of Canada’s infrastructure to an acceptable level. The cost of inaction will be tremendous and it will place a burden on the future generations which will be many times the present infrastructure deficit. A consequence of this inaction and lack of appropriate maintenance, repair and rehabilitation would be the escalation of the current deficit to about two trillion dollars in 2067.

**Acknowledgments**

This paper is based in large part on the results of the FCM-McGill survey of 1996 and 2007. The contributions of the FCM executive and staff, and in particular, those of Gabriel Miller are gratefully acknowledged.

**References**

American Society of Civil Engineers (ASCE), 2005, ASCE Report Card on U.S. Infrastructure, <http://www.asce.org/reportcard/2005/index.cfm>, accessed on January 21, 2006.

Canadian Society of Civil Engineering (CSCE), 2003, The Technology Road Map, CSCE, Montreal, Canada, [www.csce.ca](http://www.csce.ca), accessed on February 15, 2006.

Canadian Parks and Recreation Association (CPRA), 2007, Letter to Infrastructure Canada

Canadian Water Network (CWN), 2004-2005 Annual Report, Bringing Water Research to Life, 2005.

Canadian Water and Wastewater Association (CWWA), 1997, Municipal Water and Wastewater Infrastructure: Estimated Investment Needs 1997-2012.

Deloitte, 2007, <http://www.deloitte.com/dtt/article/0,1002,cidpercent253D53476,00.html>, accessed on April 28, 2007.

FCM, 2006, Building Prosperity from the Ground Up: Restoring Municipal Fiscal Balance, 2006, p.37. (Taken from a chapter authored by Roger Gibbins, Canada West Foundation, and Mario Lefebvre, Conference Board of Canada)

FCM- McGill University, 1996, Report on the State of Municipal Infrastructure in Canada, The Federation of Canadian Municipalities and the Department of Civil Engineering and Applied Mechanics, McGill University, Montreal, Canada.

FCM- McGill University, 2007, Danger Ahead: The Coming Collapse of Canada’s Municipal Infrastructure, FCM- McGill Report, Ottawa.

Mirza, S. and Haider, M., 2003, The State of Infrastructure in Canada: Implications for Infrastructure Planning and Policy. Department of Civil Engineering, McGill University, Montreal, Qc.

SNC-Lavalin/ Dessau-Soprin, 2002, Etude comportant la collecte d’informations et la portrait technique des infrastructures de la gestion publique de l’eau- Rapport final, Montreal.

Statistics Canada, 2007, Canadian Economic Observer, From Roads to Rinks: Government Spending on Infrastructure in Canada, 1961-2005, p. 3.6.

Water Strategy Expert Panel, 2005, <http://www.waterpanel.ontario.ca/mbs/pir/waterpan.nsf/WebContent>, accessed on August 24, 2005.