A Capital Question

Infrastructure in Western Canada's Big Six

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This research report is part of the Canada West Foundation's ***Western Cities Project,*** a multi-year research and public consultation initiative focused on identifying the policy challenges facing western Canada's largest cities, and best practices in resolving such policy challenges. Through the Canada West Foundation's emphasis on citizen engagement, the ***Western Cities Project*** promotes public awareness of the growing importance of cities to the economic, social and cultural lives of western Canadians. The project, which began in 2000, includes the following research components:

- **Urban Water Management**
- **Urban Infrastructure**
- **Urban Finance**
- **Urban Regions**
- **Urban Aboriginal People**
- **Urban Growth and Affordable Housing**
- **Marketing Western Cities on the Global Stage**
- **Municipalities in Federalism**
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To learn more about the ***Western Cities Project,*** please visit the Canada West Foundation web site (www.cwf.ca).

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HOW LARGE IS THE INFRASTRUCTURE DEFICIT IN THE WEST'S BIG CITIES?

Urban infrastructure in Canada has become a serious issue. The combined infrastructure deficit of the six big western Canadian cities (Vancouver, Edmonton, Calgary, Saskatoon, Regina, and Winnipeg) for the 2003 fiscal year totals $564 million, which is a conservative estimate. On a per capita basis, Winnipeg has the largest annual infrastructure deficit ($298), followed by Edmonton ($188), Regina ($167), Calgary ($150), Saskatoon ($147) and Vancouver ($87). Annual infrastructure deficits add to an accumulated infrastructure debt, which is the backlog of needed maintenance, rehabilitation, and replacement of existing infrastructure assets and unfunded capital projects that are deemed necessary to accommodate growth in the cities. Most big cities in the West are reporting that their infrastructure deficits will rise in the future. Estimates of the total municipal infrastructure debt in Canada have been as high as $57 billion. Estimates of the infrastructure debt for all governments in Canada (federal, provincial, territorial, and municipal) could be as high as $125 to $130 billion.

CAN THESE ESTIMATES BE PUT IN CONTEXT?

A key objective of *A Capital Question* is to set recent estimates of infrastructure deficits and debt in context by examining over 40 years of public capital spending made by the total government sector, the total municipal government sector, and five of the West's biggest cities. The analysis demonstrates that while many of the estimates are indeed large, they are credible. When capital spending in the 1990s is set against the averages prevailing over the 1960-2002 period, it is clear that investment in Canada's infrastructure has fallen dramatically. While this is to be expected given that most infrastructure was put in place in the 1950 to 1970 period, we should begin to see a steady rise as governments begin to renew significant portions of this infrastructure, which is reaching the end of its lifespan. So far, this has not happened.

WHERE IS THE INFRASTRUCTURE DEFICIT?

For most western cities, the largest portion of the infrastructure deficit resides in transportation – roads, traffic control, bridges, interchanges, and public transit. The next largest areas of unfunded infrastructure needs are community buildings, facilities and public works, followed by parks and recreation and community services infrastructure. In general, western cities are not reporting huge infrastructure deficits in water and sewer utilities, which are commercial operations and tend to be funded through user fees and self-supported debt. However, both Saskatoon and Winnipeg are reporting that this may change in the future as issues of capacity and aging systems command increased attention.

WHAT ARE THE CITIES PLANNING TO DO?

A scan of the five-year capital plans of the cities reveals a mixture of good news and bad. On the positive side, most cities are planning to increase their investments in infrastructure over the next five years. On the negative side, some cities will see little provincial and federal support for infrastructure. Because of the lack of funding to finance desperately needed infrastructure, most big cities in the West will likely see increased levels of tax-supported debt. Increased debt-financing of infrastructure in some of the West's cities may be long overdue. With the exception of Vancouver, tax-supported debt levels have dropped significantly since the mid-1980s. With interest rates at historically low levels, now may be the time for increased borrowing to build the West's cities. However, debt-financing alone will not be able to close the infrastructure deficits facing the cities.

WHAT ARE THE COSTS OF FAILING TO ACT?

The potential long-term costs of failing to address the infrastructure issue are numerous, and include higher government operating costs, negative impacts on the environment, and threats to public health and safety. If governments continue to defer critical maintenance and rehabilitation of aging infrastructure, the costs down the road will be much higher – infrastructure will need to be replaced rather than repaired. Finally, public infrastructure supports private capital investment. There may be an economic cost of failing to reinvest in Canada's infrastructure.

CONCLUSION

Of all western industrialized countries in the OECD, Canada has one of the lowest rates of public and private investment as a percentage of GDP, but one of the highest rates of government consumption as a percentage of GDP. Canadians, whether acting by themselves or through their governments, may simply be consuming too much of the national wealth as opposed to investing it. While consumption is key to a well-functioning economy, it is public and private investment that drives economic growth and productivity gains. To protect and even increase our ability to produce wealth in the future, Canadians must reconsider areas where investments need to occur. Public infrastructure is one such area.

INTRODUCTION

As the national discussion about the importance of cities to Canada's political, economic, and social well-being continues to gather steam, a number of recurring themes are becoming evident in the conversation. One of the most important, and troubling, themes concerns what many Canadians are dubbing the "infrastructure deficit." The sheer size and scope of this deficit, estimated to run in the billions of dollars, likely presents Canadians with an issue more intractable than the federal and provincial fiscal deficits recorded in the 1980s and early 1990s. Even with several multi-billion dollar national infrastructure initiatives and the recent 2003 federal budget announcement of another $3 billion over ten years for municipal infrastructure, concerns about the hardware of Canada's cities continue.

In any political and economic debate it is often difficult to separate myths and half-truths from reality. Many of the same difficulties apply in the discussion over infrastructure. Numerous facts and figures are tossed into the public arena where they are often accepted without question, while the serious researcher desperately looks for an appropriate context into which those facts and figures can be placed. In light of this problem, and to frame our discussion over the infrastructure issue in western Canada's six big cities (Vancouver, Edmonton, Calgary, Saskatoon, Regina, and Winnipeg), this report will explore several important questions:

- *What is the reported infrastructure deficit of the total government sector in Canada, the municipal government sector, and western Canada's big cities? How are these estimates determined?*
- *Are there any objective data that can be employed to place these estimates in context?*
- *In what municipal service areas (e.g., roads, transit, water, sewer) are the reported infrastructure "deficits" the largest? What service areas are the most problematic from a financing standpoint?*
- *What do the capital budgets of western Canada's big cities look like? Where will expenditures be made and how will those expenditures be financed?*
- *What are the long-term costs of failing to address the infrastructure deficit?*
- *What research is needed to increase our understanding of the infrastructure issue and address it in a meaningful way?*

METHODOLOGY

To answer these questions, Canada West employed three separate research tracks. First, a comprehensive literature review was conducted to determine what federal, provincial, and municipal governments, as well as independent urban finance experts and municipal associations, are saying about the issue. Canada West also reviewed the five-year capital plans for each city, and any special reports discussing infrastructure needs.

Second, researchers constructed three databases on past capital spending. The first database covers the total government sector in Canada (the federal government and all provincial, territorial, and local governments). The second database focuses on the total local government sector in Canada. To build these two databases, Canada West reviewed more than forty years of National Income and Expenditure Accounts (NIEA) data published by Statistics Canada. These accounts are typically used to draw out the value of gross domestic product (GDP). Part of the annual GDP calculation is the flow of public and private investment in fixed capital formation. NIEA data also present federal, provincial and total local government revenues and expenditures, both for the country as a whole and for each province.

The third database covers the six big western Canadian cities. Because the NIEA system does not present data at the city level, Canada West constructed its own database for the cities. Forty years of population growth, capital expenditures, tax collections, and debenture issues to finance capital expenditures were collected from the Annual Financial Reports as published by each city from 1960-2002. Income data over the same period were secured from Revenue Canada's *Tax Statistics on Individuals,* an annual publication that breaks out data by individual cities. (Vancouver was excluded from this database because of the difficulties in dealing with the fragmented nature of that city-region.) The purpose of the three databases is to provide a bird's eye view on past capital spending that can help inform the discussion over infrastructure issues in Canada.

Finally, researchers developed an economic model to examine whether an increase in the municipal capital stock would yield additional growth in the GDP of the four western provinces. The model is based on a modified form of the Cobb-Douglas production function, and was also used to measure the impact on GDP of the federal and provincial capital stocks.

IMPORTANT CAVEATS

Exercises dealing with fiscal data published by individual municipalities are never perfect. In fact, they can be rather risky. First, each city typically defines and accounts for capital expenditures in its own unique way. Second, all cities do not engage in the same range of activities. Both can result in an increase or a decrease in capital spending relative to other cities. For example, Saskatoon is the only big city in the West that has not sold or converted its electrical utility into a separate corporation, and it is also very heavily engaged in land purchasing and development. Both increase the amount of capital expenditures made by Saskatoon relative to other cities. Since it is impossible to pull the data to a common denominator that reflects an identical definition of what constitutes capital and that also controls for differing service levels, the emphasis needs to remain on similar trends exhibited across the cities rather than comparing and ranking them.

Third, NIEA data are based on the system of national accounts and are relatively consistent. But municipal fiscal data are based on a public accounts system, and shift over time. Governments are not static entities. Certain operations like sewer service and solid waste can be removed from general operations and converted into self-financing utilities, other utilities can be sold, and accounting methods, priorities, and budget presentations change. As a result, the original data secured for the cities had to be massaged to account for some rather drastic changes. In building the database, researchers started with the city operation as it now exists, and then worked backwards. For example, since Calgary no longer includes electrical capital expenditures as part of its operations, all electrical amounts for previous years were subtracted. For most cities, this involved removing amounts for electrical utilities, municipally-owned airports, telephone utilities, city hospitals, and even schools. Researchers are confident that the database represents a reasonable, although incomplete, basis upon which to examine past capital investment.

Finally, there were several holes in some of the data. In such cases, data for the missing years were either interpolated or extrapolated, typically based on a consistent rate of growth or decline from a specific point. Notes, caveats, and qualifiers can be found at the end of each data presentation and throughout the report. Readers are strongly encouraged to keep them in mind when drawing conclusions.

DEFINING TERMS

The debate in Canada over infrastructure employs technical terms like maintenance, rehabilitation, and capital renewal, and more colloquial terms such as infrastructure deficit. However, the meaning of these terms is not always clear. What do we mean by infrastructure? What is infrastructure spending or investment? What is meant by capital expenditure? While most know that deficit means more expenditure than revenue, what does it imply in this context? What about infrastructure debt? What about infrastructure needs and requirements? What about the infrastructure funding gap? Clearly, there is a need to explore what is meant by some of these concepts.

1. Defining Infrastructure

Intuitively, most Canadians are aware of what is meant by the term infrastructure. But rather than define it, many would likely offer examples such as roads, bridges, sidewalks, and water and sewer pipes. One definition is offered by the City of Edmonton in its 2002 Infrastructure Strategy Update: *"Infrastructure is the physical assets developed and used by a municipality to support the community's social and economic activities."* The definition goes on to identify an infrastructure inventory that includes assets such as drainage, roads and right-of-ways, parkland, transit facilities and equipment, a vehicle fleet, buildings, traffic control and street lighting, recreation facilities, affordable housing, waste management facilities, technology equipment and computer networks, and other items including emergency response equipment and libraries (City of Edmonton 2002).

Another definition, complete with examples, is offered by the City of Huntington Beach, California:

"Infrastructure is defined as capital assets owned by the city that require on-going maintenance and eventual replacement. It is the basic support structure for the community, which includes highways, streets, alleys, parking lots, bridges, sidewalks, curbs, parkway trees, landscaped median islands and parkways, block walls along arterial highways, traffic signals, street lights, flood control channels, storm drains and storm water pump stations, sewers, sewer manholes, sewer lift stations, public buildings, beach facilities, parks, sports fields, and the vehicles and equipment used for the operation, maintenance, and repair of infrastructure."

(Huntington Beach, California 1991)

While both definitions certainly seem comprehensive, some would rightly want to add airports, harbours, and seaports, while others would mention telecommunications and energy systems. But such a list would still be incomplete if only because most of the above simply refers to traditional or "hard" types of physical infrastructure. In reality, there is likely a taxonomy of infrastructure that would comprise terms such as traditional and non-traditional infrastructure, core and non-core infrastructure, hard and soft, tangible versus non-tangible, and even notions of natural infrastructure and human potential and capital (Poisson 2002; Swimmer 1993). The development of a comprehensive taxonomy is outside the scope of this report, but it might be helpful to make an initial categorization that builds upon previous attempts (McCracken and Sonnen 1993; Poisson 2002; Swimmer 1993).

- *Basic Inter-Urban Infrastructure:* This infrastructure contains the items that first come to mind, and is comprised of elements that are typically seen as wedding the nation together. Examples include highways, railways, airports, seaports, telecommunications, and energy utilities. This infrastructure is traditional (it is not emerging technology), tangible (it is physical in nature), and hard (it has always been seen as infrastructure essential to a well-functioning society and economy).

- *Basic Urban Infrastructure:* This infrastructure is also traditional, tangible, and hard, but it includes an expanded list generally unique to urban environments. Items include a comprehensive transportation network (e.g., local, collector, and arterial roads, bridges, interchanges, transit systems), environmental and sanitary operations (e.g., water supply and distribution, sanitary sewerage, drainage and flood control, solid waste services), street lighting, pedestrian walkways, protective services (e.g., fire, police, EMS) and other government services (e.g., general-use public buildings and specific-purpose facilities).

- *High-Tech Infrastructure:* This category would clearly include physical systems that support a range of new and emerging technologies that are becoming more and more critical to modern society. Items would include cellular and satellite telecommunications, the Internet, and e-mail. This infrastructure is tangible and hard, but non-traditional.

- *Amenities:* This component is also traditional and tangible, but soft in the sense that it has not typically been viewed as part of the national infrastructure. Items would include public parks, developed green spaces, bicycle pathways, golf courses, museums, theatres, convention centres, and other leisure, recreation, cultural, and community facilities. Tourism-related items such as national and provincial parks are also possible candidates.

- *Knowledge-Based Infrastructure:* Components of this infrastructure can be both traditional and non-traditional, and tangible and intangible, but until recently, most of it has generally been viewed as soft. Traditional and tangible items include elementary, secondary, and post-secondary educational facilities, libraries, research facilities, and laboratories. Traditional intangibles would include the educated and highly skilled workforce that investments in the traditional and tangible infrastructure produce, whether through public education, training, or apprenticeship. Other traditional intangibles might include services such as Statistics Canada and the national weather service. Non-traditional intangibles would include publicly available electronic databases, information and research networks, and business and university links.

- *Health Infrastructure:* Health infrastructure such as the public network of hospitals and health clinics are traditional, tangible, and hard, but they produce intangible and soft infrastructure in the form of a healthy citizenry and workforce, in addition to quality of life considerations.

SUMMARY: While any infrastructure taxonomy is bound to have problems, the exercise underscores a critical point: there is no consensus among experts as to what constitutes infrastructure (Poisson 2002). At the same time, at least one thing is clear – conceptions about infrastructure are changing and the list is expanding to include new, non-physical items that have not traditionally been thought of as infrastructure. Many economists are broadening the definition as a result of the demands of the new information economy, realizing that softer forms of infrastructure are just as important to competitiveness and attracting investment as are the physical, traditional, and hard forms of infrastructure. But as the list expands, it also becomes less meaningful as a term and more difficult to measure (Swimmer 1993).

The specific items that constitute public infrastructure differ between governments and are highly dependent on the types of services delivered and the particular definitions in play. In this study, we are generally concerned with basic urban infrastructure

and amenities. It should be noted that we also follow the basic grouping as employed by most cities, which is generally comprised of transportation (e.g., roadways, bridges, pedestrian walkways, and transit), protection (e.g., fire, police EMS facilities and equipment), community (e.g., parks, recreation, cultural, and community services and amenities), general government (civic buildings, information technology, municipal fleet), and utilities and environment (e.g., water supply, distribution, sanitary sewerage, storm drainage and flood control, and solid waste).

2. Defining Infrastructure Investment

The words infrastructure spending, infrastructure investment, capital spending, and capital investment are often used interchangeably, but they do not always carry the same meaning. Drawing out the difference between spending and investment is relatively easy. Some prefer the word spending to emphasize that it consumes revenue, while others prefer the term investment to emphasize that the costs should be spread out over time. Capital spending may also increase revenues down the road in the form of economic growth and more tax revenue.

The distinction between infrastructure and capital is more difficult to handle. Capital spending is an official accounting designation that does not always equate to the more colloquial term of infrastructure spending. Capital, as defined by accountants and used in government public accounts and Statistics Canada's NIEA data, carries a strict definition. Generally, capital is the cost of acquiring any property that is used in the production or supply of goods and services, has a useful life extending over a number of fiscal years, and is not intended for resale in the ordinary course of operations (Kelly 1993). Infrastructure does not necessarily equal this specific definition of capital.

For example, routine maintenance is certainly infrastructure spending, but most governments place it on the current account along with operating costs. This is done despite the fact that maintenance is ultimately intended to preserve the asset. On the other hand, the purchase of land for redevelopment and eventual resale is often treated by governments as a capital asset. Capital also includes a number of other items such as computers, equipment, and machinery. Not all of this may constitute infrastructure in any meaningful sense of the term. Finally, some spending has both current and capital components, making it difficult to separate. This is especially true in the public sector where many expenditures (e.g., education and health) can be viewed as investments and have positive returns, but they are very long-term and cannot be easily quantified.

In short, the problems with measuring infrastructure spending are legion simply because of definitions and data availability. As such, we will alternately refer to both capital spending and investment as it has been defined and operationalized by the agencies whose data we are analyzing and the governments under review. This reflects the capital costs of acquiring and replacing a range of assets that may not be infrastructure proper. Further, it excludes certain maintenance and rehabilitation that is infrastructure-related. This is problematic if only because many estimates of infrastructure "deficits" are based on a backlog of deferred maintenance that the term capital does not capture. All of this is far from ideal, but is forced by external limitations.

Within the term infrastructure spending is an entire range of terms (City of Hamilton 2001; Vanier 2000a; City of Edmonton 2003). Expenditures can be broken into the following types:

- *Capital Acquisition:* Constructing a new infrastructure or purchasing a new asset that did not previously exist. Costs reflect a number of sub components such as engineering specifications, design, manufacturing, installation, and commission.

- *Minor Maintenance:* A broad range of planned activities intended to preserve the service life of an infrastructure asset and to ensure it remains in a condition to serve the purpose for which it was intended. This includes inspections, monitoring, cleaning, flushing, and testing. This activity is preventative in nature.

- *Major Maintenance:* This activity is usually unplanned and occurs as a result of failure. It includes small repairs and actions to restore small components of a system. This expenditure is corrective in nature.

- *Rehabilitation:* This activity is a major scheduled event intended to restore a significant component, system, or entire asset or facility to its former condition. Additional labels for this expenditure include upgrading, adapting, expanding, and converting. Rehabilitation improves a system and can also extend its lifespan.

- *Replacement or Capital Renewal:* This refers to a planned activity that entirely replaces a current system because it has reached the end of its useful (or serviceable) life. Replacements can also occur for reasons of economic efficiency, obsolescence, modernization, or compatibility with other systems. This could also include the costs related to disposal of assets.

SUMMARY: Ultimately, there are two broad infrastructure spending categories. The first relates to the acquisition of new assets. This can be undertaken for a number of reasons, including more services to accommodate population growth, infrastructure to advance or complete ongoing programs and priorities, and providing an entirely new service. The second category is spending to maintain, rehabilitate, or replace and renew existing assets.

3. Defining Infrastructure "Deficit"

The term infrastructure deficit is a phrase heard throughout the current discussion, but its meaning is not altogether clear, and it has also been used in misleading ways. Broadly speaking, a deficit is the annual mismatch between what is required and what is ultimately available to meet the requirement. Several terms will be used in this report:

- *Infrastructure Needs or Requirement:* Before any deficit can be calculated, one first needs a handle on what is needed or required. In the infrastructure context, needs typically refer to the amount of funding necessary to maintain, rehabilitate, or replace existing infrastructure by bringing it back to original condition. In some contexts, needs may also reflect the amount of infrastructure required to meet the demands of population growth or to correct substandard situations.

- *Infrastructure Deficit:* In the infrastructure context, the deficit speaks to the annual shortfall in the funds available or budgeted to meet required infrastructure spending for the year. The difference is also referred to as the funding gap.

- *Infrastructure Debt:* This term is less well-known, but it is the term that should be applied to most estimates of the so-called infrastructure "deficit." Debt accrues as the result of past deficits. When people speak of a "backlog" of infrastructure maintenance, what they are really referring to is an infrastructure debt. Annual infrastructure deficits add to the accumulated deficit, or the infrastructure debt.

SUMMARY: Measuring a fiscal deficit is relatively easy. It is a product of simple mathematics – more expenditures than revenue. But as the above indicates, there is a strong subjective element to the notion of an infrastructure deficit, particularly as it relates to quantifying needs. Needs are dependent on current policies, standards, and citizen expectations. Changes in any of these three can affect perceptions about what is needed.

ESTIMATING INFRASTRUCTURE "DEFICITS" AND "DEBT"

Since the early to mid-1980s, a number of individuals and organizations have come forward with a series of estimates regarding public infrastructure deficits and debt in Canada. These estimates are typically one of three types. The first focuses on the total government sector, which includes the infrastructure debt of the federal and all provincial, territorial, and local governments in Canada. The second focuses only on the combined local government sector in Canada. The third type of estimate speaks to specific public service areas (e.g., highways or water and wastewater systems) and ignores any distinction between the governments providing the service.

Behind the estimates are a number of different methodologies. Some estimates are retrospective – they look backward. Such estimates speak only to the backlog of deferred maintenance, rehabilitation, or replacement of existing infrastructure assets and the amount by which spending must be increased above baseline levels to restore that infrastructure to acceptable levels. Other estimates are both retrospective and anticipative – not only do they capture the investment needed to clear any backlog of maintenance, they also include the infrastructure needed to accommodate future population growth and to correct substandard situations such as the lack of proper water and wastewater treatment. Both of these approaches have been operationalized within six specific methodologies to produce estimates: 1) the survey approach; 2) sector specific studies; 3) benchmarking from existing studies; 4) life cycle costing or asset management approaches; 5) optimizing public infrastructure to maximize economic productivity and output growth; and 6) anecdotal or implied infrastructure deficits.

Thus, while there is almost universal consensus among analysts that Canada does indeed have an infrastructure debt, there are widely diverging estimates of how large this debt might be. For example, survey-based estimates of the total public infrastructure debt of all governments in Canada have yielded a figure of $125 billion (Mirza 2003). Benchmarking from other studies yields an amount in the order of $130 billion (FCM 1999; Mirza 2003). Applying one measure of optimal public capital to maximize productivity and economic output yields a whopping $570 billion (see Aschauer 1998c). Early estimates of Canada's total municipal infrastructure debt in the mid-1980s ranged from $12 billion to $20 billion (FCM 1985; Canadian Society for Civil Engineering 2002). Estimates at the end of the 1980s ranged from $12 billion to $25 billion (IBI Group and Urban Development Institute 2000;

Swimmer 1993). The most recent estimate was made in 2002, and it totalled $57 billion (Canadian Society of Civil Engineering 2002). Estimates of how the total municipal infrastructure debt will grow if remedial action is not taken range from $110 billion by 2027 (Canadian Society of Civil Engineering 2002) to $200-$400 billion by 2020 (Comeau 2001; Mirza 2003).

SUMMARY: All of this brings us to a critical point – there is no shortage of ways to measure an infrastructure debt just as there is no shortage of numbers that inevitably flow from them. A detailed discussion of the various estimates, their methodologies, and their unique problems and weaknesses is found in *Appendix 1.* Further, it is important to remember that Canada is not alone here. Most western industrialized countries are dealing with the same issue. Estimated infrastructure debts range from $5.3 trillion (U.S.) in Japan, $4.0 trillion (U.S.) in the former Soviet Union, and $1.3 trillion (U.S.) in the United States (Mirza 2003).

PUTTING THE ESTIMATES IN CONTEXT

Rather than creating yet another measure of the infrastructure debt in Canada, we have chosen to draw on one of the only objective data sources currently available – the degree to which spending on public capital has fallen. As discussed in *Appendix 1,* this approach is not without its problems. After all, reduced spending does not necessarily imply the presence of an infrastructure debt. At the same time, it remains one of the only avenues currently open. The intent of this analysis is not to validate or verify the estimates, but simply to put the various estimates of Canada's infrastructure debt in context and provide some objective boundaries for public debate.

To accomplish this, past flows of capital spending and the value of the public capital stock from 1961 to 2002 were tracked, both for the total government sector in Canada (federal, provincial, and municipal governments) and the local government sector. By adjusting the capital flow and stock data for population growth and inflation, real per capita amounts of public capital spending can be determined. The data can also be set against other factors such as government revenues, the incomes of Canadians, gross domestic product (GDP), and non-residential private capital investment. Averages over certain periods can be calculated for each measure, and the degree to which spending on fixed capital has deviated from those averages can be converted into current 2002 dollars – a clear measure of reduced government capital spending that can provide context for the various infrastructure debt estimates.

1. The Total Government Sector

The charts in *Figure 1* demonstrate that public flows of fixed capital for all governments in Canada have fallen from 1961 to 2002, whether measured in real per capita terms, as a percentage of total government revenues, total incomes, gross domestic product (GDP), or private capital investment. The data can be viewed from both a short-term and a long-term perspective. The short-term takes a recent high point for each measure and calculates the value (in 2002 $) of failing to maintain that level of spending up to 2002. (The reference years are not the same for each measure because different measures possess a different recent high point. This increases the size of the spending reduction for measures that have longer periods.)

- In 1994, capital spending by all governments, measured in real per capita terms, fell sharply. This was largely in response to fiscal belt-tightening, and was the single largest drop ever recorded over the 1961 to 2002 period. By the late 1990s, real per capita capital spending was on the rise again – by 2002 it exceeded 1994 levels. If spending had not fallen but had continued its growth trajectory (one that was consistent since 1980), governments would have spent another $23 billion on public capital investment from 1994 to 2002 *(Figure 1, Chart 1).*

- If total government capital spending, measured as a percentage of total government revenue, had been maintained at 1994 levels, another $35 billion in capital would have been spent from 1994-2002 *(Figure 1, Chart 2).*

- If total government capital spending as a percentage of total income had stayed at 1994 levels, governments would have spent $25 billion more on capital from 1994 to 2002 *(Figure 1, Chart 3).*

- If the capital spending of all governments, measured as a percentage of GDP, was kept at 1992 levels, another $38 billion would have been spent from 1992-2002 *(Figure 1, Chart 4).*

- If public capital investment as a percentage of private capital investment had been maintained at 1992 levels, another $83 billion would have been spent. This last measure is quite high relative to the others, and is likely affected by the large drop in private capital investment that occurred in the 1991 recession *(Figure 1, Chart 5).*

FIGURE 1: Historical Review of Total Government (Federal, Provincial, Municipal) Public Capital Flows (1961-2002)

CHART 1: Per Capita Inflation-Adjusted Capital Flows

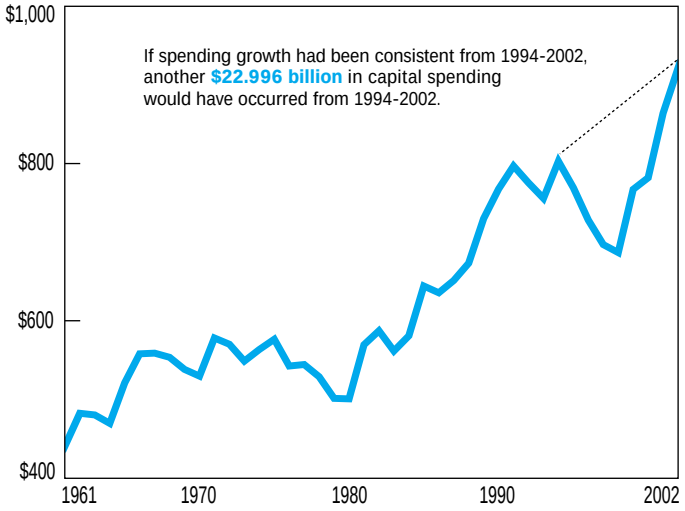


CHART 2: Total Government Capital Flows as a % of Total Revenues

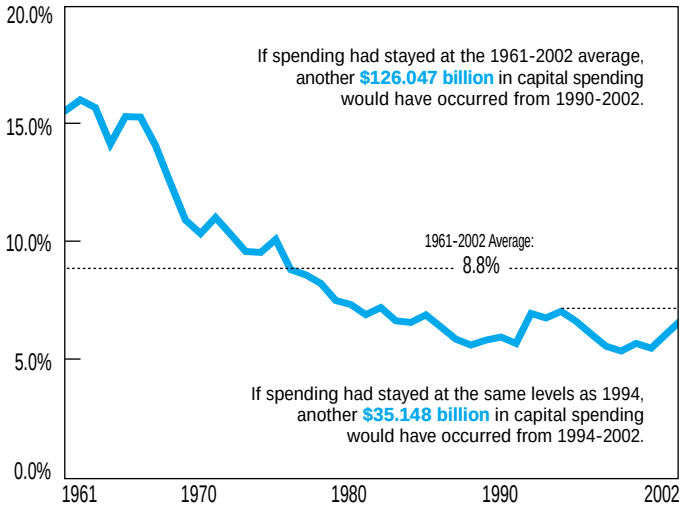


CHART 3: Total Government Capital Flows as a % of Canadians' Income

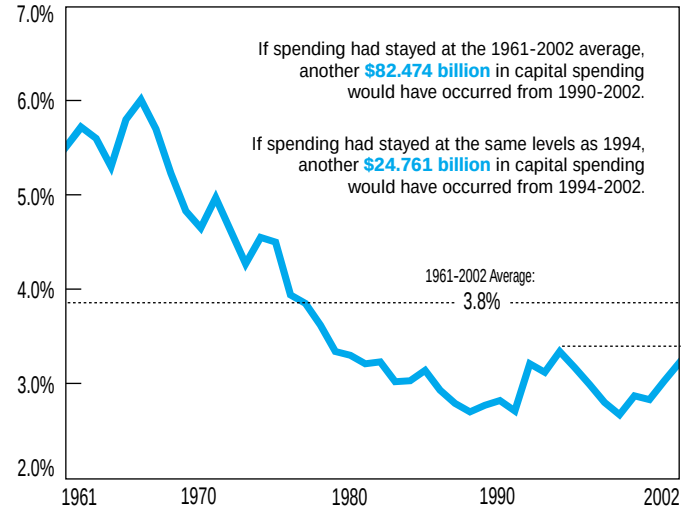


CHART 4: Total Government Capital Flows as a % of GDP

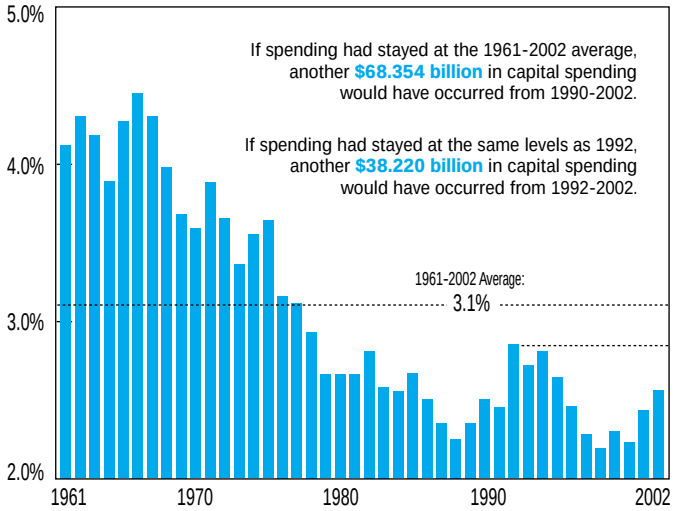
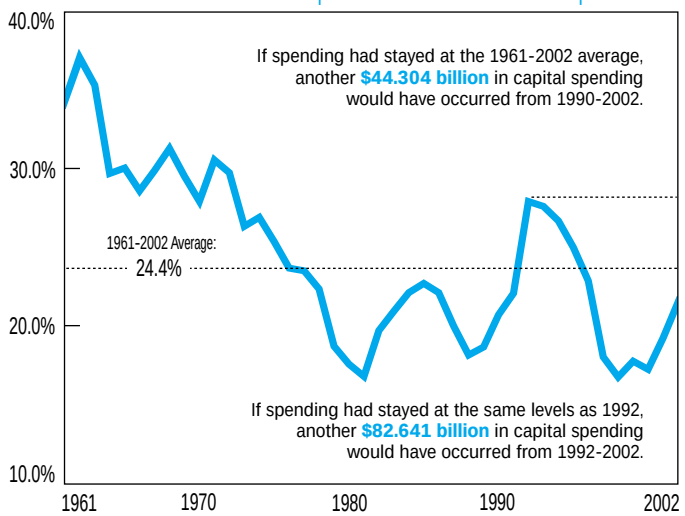


CHART 5: Total Government Capital Flows as a % of Private Capital Flows



SOURCES: Derived by Canada West Foundation from Statistics Canada. Data for all the charts (government investment in fixed capital or government gross fixed capital formation, total government revenues, total personal incomes, GDP, and business investment in non-residential fixed capital) are taken from Statistics Canada Cat. No. 13-213S (Historical Issue 1961-1986) for years 1961-1986, Cat. No. 13-213 (Annual Estimates 1981-1991) for years 1987-1991, Cat. No. 13-213-PPB (2001 Estimates) for years 1992-2000, and Cat. No. 11-010 (March 2003) for 2001 and 2002. Government investment in fixed capital for Chart 1, however, has years 1981-1991 coming from CANSIM II Series V687348 Table No. 3840002 for better data consistency. All population figures are from Canadian Economic Observer Cat. No. 11-210-XPB (Historical Supplement 1998/99) for 1961-1970, and CANSIM II Table No. 510001 for 1971-2002. The price deflator used is the Implicit Chain Price Index for Government Gross Fixed Capital Formation, CANSIM II Series V1997744 Table No. 3800003 (results for each quarter were averaged for the year and then re-based such that 2002 equals 100.0).

NOTES: Government investment in fixed capital represents new construction and the replacement of assets including structures, machinery, and equipment, but excludes certain maintenance expenditures. As such, this spending is not directly comparable to "infrastructure spending" proper, but it is the only data currently available under the National Accounts system. There were breaks in the time series data for investment in gross government fixed capital, but because the data was set against other factors possessing similar breaks, this does not drastically affect the analysis.

The short-term is augmented by the long-term perspective, which takes the average over the entire 1961-2002 period for each measure, and then calculates the value of the reduced spending from 1990 to 2002 based on the difference between this average and the spending that actually occurred. The long-term analysis is intentionally restricted to the post-1990 period for several reasons. First, it was in the early 1990s that infrastructure emerged to become a significant issue. Second, there are good reasons why capital spending fell in the 1970s and 1980s – much of the public capital stock had already been built. However, it is also in the 1990s where one might expect to see increased capital spending as the infrastructure laid down 20 and even 50 years ago now comes up for rehabilitation or replacement.

Because real per capita spending has always trended upward, the long-term perspective provides no results for this measure. However, the other measures are instructive:

- The largest reduction in spending is recorded when viewing capital investment as a percentage of total government revenues. If the capital spending of all governments in Canada as a percentage of total revenues had been maintained from 1990-2002 based on the average from 1961-2002, another $126 billion in public capital investment would have occurred since 1990 *(Figure 1, Chart 2).*

- If total government capital spending as a percentage of Canadians' incomes had been maintained at the average level prevailing over the 1961-2002 period, another $82 billion would have been invested between 1990-2002 *(Figure 1, Chart 3).*

- If total government capital spending measured as a percentage of GDP had been maintained from 1990-2002 based on the average from 1961-2002, another $68 billion in capital would have been invested from 1990-2002 *(Figure 1, Chart 4).*

- If the capital investments of all governments in Canada as a percentage of private capital investment had been maintained from 1990-2002 at the average recorded over the 1961-2002 period, governments would have spent another $44 billion in capital *(Figure 1, Chart 5).*

All of this is reinforced by *Figure 2,* which shows the annual percentage increase of the total government public capital stock in real per capita terms *(Chart 1)* and the ratio of the total public capital stock to the private capital stock *(Chart 2)* over the 1961-2002 period. Again, a short-term and a long-term perspective can be employed to quantify any reduction in public capital formation:

FIGURE 2: Historical Review of Total Government (Federal, Provincial, Municipal) Public Capital Stocks (1961-2002)

CHART 1: Annual % Change in Real Per Capita TOTAL Public Capital Stock

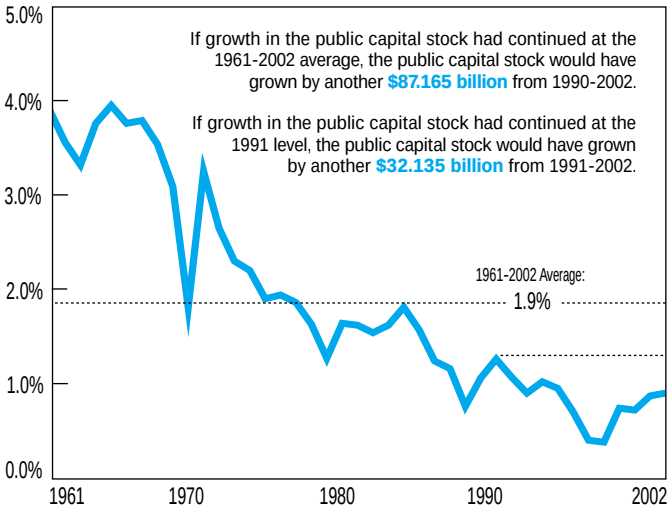
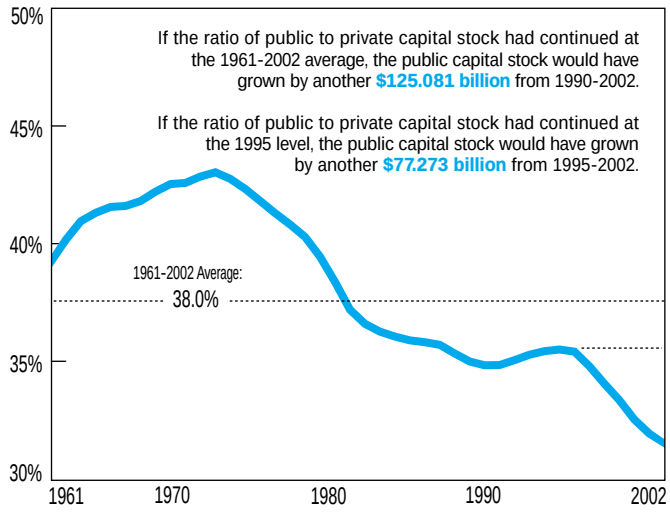


CHART 2: TOTAL Public Capital Stock as a % of Private Capital Stock



SOURCES and NOTES: Derived by Canada West Foundation from Statistics Canada. Population data from Canadian Economic Observer Cat. No. 11-210-XPB (Historical Supplement 1998/99) for 1961-1970, and CANSIM II Table No. 510001 for 1971-2002. Total public capital stocks are the combined value of CANSIM II Table No. 310002, Series Nos. V1126602, V1125834, and V1126090. Private capital stocks are CANSIM II Table No. 310002 Series V1408349. Total public capital stocks include health and education. Because a portion of the health and education capital stock is privately owned, the public capital stock relative to the private stock is actually overstated. The original data was provided by Statistics Canada in real 1997 dollars (stocks were geometrically depreciated). The dollar amounts were re-based into 2002 dollars using the Implicit Chain Price Index for Government Gross Fixed Capital Formation.

- In the short-term, if the growth rate of the real per capita public capital stock had not declined since 1991, governments would have spent $32 billion more in capital from 1991-2002 *(Figure 2, Chart 1).*

- In the long-term, if governments had kept growth in the real per capita public capital stock at the average prevailing from 1961-2002, another $87 billion would have been spent from 1990-2002 *(Figure 2, Chart 1).*

- If the public capital stock measured as a percentage of the private capital stock had been maintained at 1995 levels, another $77 billion would have been spent *(Figure 2, Chart 2).*

- If the ratio of public to private capital stock had been maintained at the 1961-2002 average, another $125 billion in capital would have been spent by governments from 1990-2002 *(Figure 2, Chart 2).*

SUMMARY: Like the various estimates of Canada's total government infrastructure debt, these measures present a wide range of reduced capital spending – anywhere from $23 billion to $82 billion based on a short-term perspective, and $44 billion to $126 billion based on a long-term perspective. Despite the wide range, the measures are still helpful in that they set a boundary and provide perspective on the various infrastructure debt estimates.

For example, *Appendix 1* discusses how one estimate of Canada's total government infrastructure debt can be drawn from the notion of optimal public capital investment to maximize productivity and economic output. If the total public capital stock should be 61% of the private capital stock as one economist has suggested (Aschauer 1998c), then Canada could face a $570 billion infrastructure debt. However, this is clearly at odds with Canada's experience over the 1961-2002 period. To avoid an infrastructure debt this large, capital spending should never have fallen, but should have risen dramatically between 1961-2002. Further, it would appear that Canada has never reached an optimal level of public capital stock. The highest ratio of public capital investment to private investment in Canada was 43.0% in 1972 (31.5% in 2002). On the other hand, the estimate of $125 billion (emerging from a survey approach) for all governments in Canada appears to make more sense. Although this estimate would be on the high end of our measures, it is not at all outside the realm of possibility.

2. The Local Government Sector

The various charts in *Figure 3* present the same information for the combined local government sector in Canada. The data demonstrate that municipal governments in Canada share the same trends as the larger total government sector, although the absolute value of the reductions in capital spending are smaller. (This is to be expected since the local government sector is only one component of the total government sector. In addition, much of the available data for the local government sector in Canada also ends in 2000 as opposed to 2002.)

As with the total government sector, a short-term and long-term view of the data for local governments can be taken:

- A short-term view of recent trends in the local government sector shows reduced capital spending in the order of $4 billion to $21 billion over the five measures. Reduced spending appears to be the smallest when measured in real per capita terms, and it is the largest when measured as a percentage of private capital investment *(Figure 3, Chart 1 and Chart 5).*

- Moving to the long-term view, the numbers rise. The measurements tracking the flows of local government capital investment indicate that spending from 1990-2000, marked against the averages prevailing over the 1961-2000 period, have fallen anywhere from $13 billion (local capital spending as a percentage of private spending) to $27 billion (capital spending as a percentage of revenue collected). Most measurements indicate a reduction in spending in the order of $25 billion *(Figure 3, Charts 1 through 5).*

- The reduction in local government capital spending is reinforced by *Figure 4, Chart 1,* which tracks the annual percentage change in the real per capita local capital stock from 1961-2002. If growth in the local public capital stock had continued at the 1995 level, the combined local government capital stock would be $14 billion higher in 2002. If growth in the real per capita local public capital stock had been maintained at the average prevailing over the 1961-2002 period, the local public capital stock in Canada would be $26 billion higher in 2002.

FIGURE 3: Historical Review of Local Government Capital Flows (1961-2000)

CHART 1: Per Capita Inflation-Adjusted Capital Flows

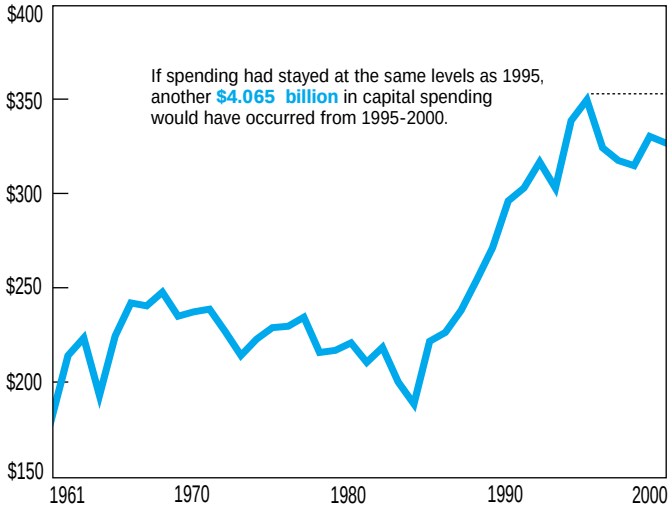


CHART 2: Total Local Government Capital Flows as a % of Local Revenues

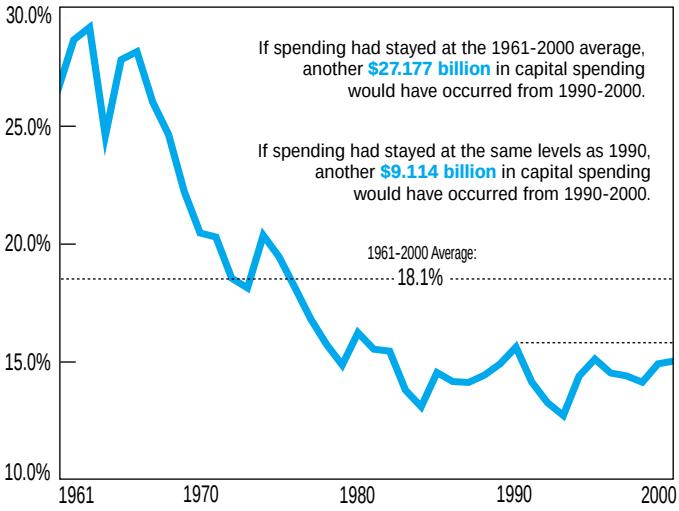


CHART 3: Local Government Capital Flows as a % of Canadians' Incomes

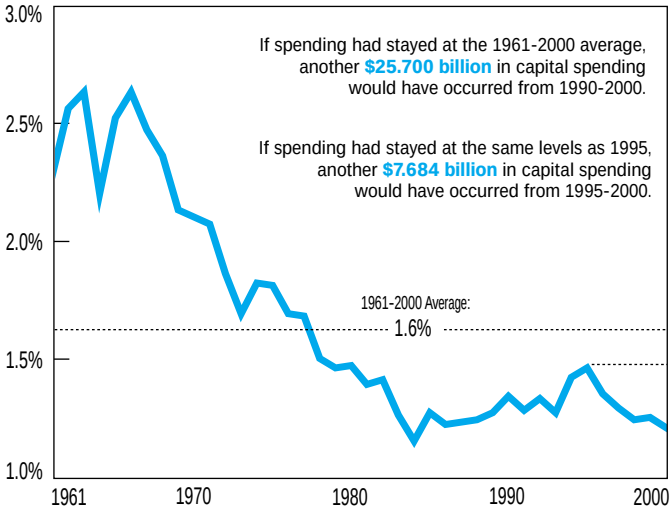


CHART 4: Local Government Capital Flows as a % of GDP

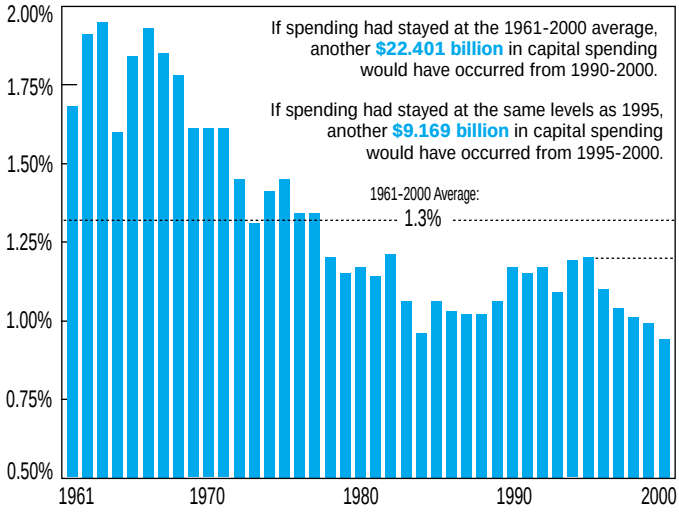
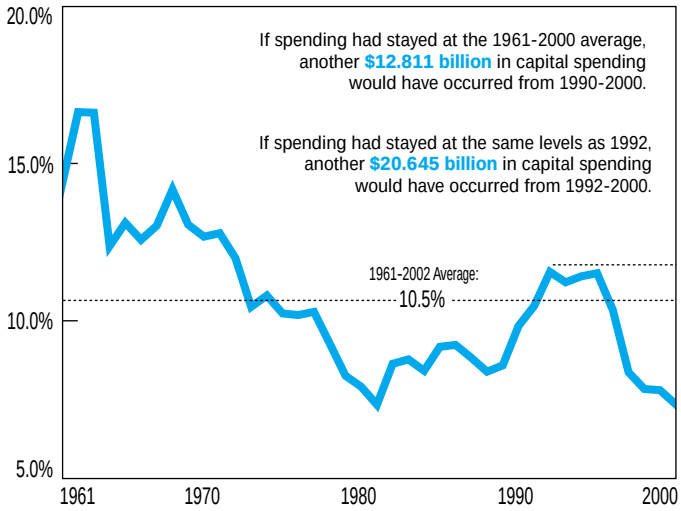


CHART 5: Local Government Capital Flows as a % of Private Capital Flows



SOURCES: Derived by Canada West Foundation from Statistics Canada. Data for all the charts (local government investment in fixed capital or local government gross fixed capital formation, local government revenues, total personal incomes, GDP, and business investment in non-residential fixed capital) are taken from Statistics Canada Cat. No. 13-213S (Historical Issue 1961-1986) for years 1961-1986, Cat. No. 13-213 (Annual Estimates 1981-1991) for years 1987-1991, and Cat. No. 13-213-PPB (2001 Estimates) for years 1992-2000. Data for 2001 and 2002 were unavailable. All population figures are from Canadian Economic Observer Cat. No. 11-210-XPB (Historical Supplement 1998/99) for 1961-1970, and CANSIM II Table No. 510001 for 1971-2002. The price deflator used is the Implicit Chain Price Index for Government Gross Fixed Capital Formation, CANSIM II Series V1997744 Table No. 3800003 (results for each quarter were averaged for the year and then re-based such that 2000 equals 98.8, and if 2002 data were available, would equal 100.0).

NOTES: Local government investment in fixed capital represents new construction and the replacement of assets including structures, machinery, and equipment, but excludes certain maintenance expenditures. As such, this spending is not directly comparable to municipal "infrastructure spending" proper, but it is the only data currently available under the National Accounts system. There were breaks in the time series data for investment in gross government fixed capital, but because the data was set against other factors possessing similar breaks, this does not drastically affect the analysis.

FIGURE 4: Historical Review of Local Government Public Capital Stocks (1961-2002)

CHART 1: Annual % Change in Real Per Capita LOCAL Public Capital Stock

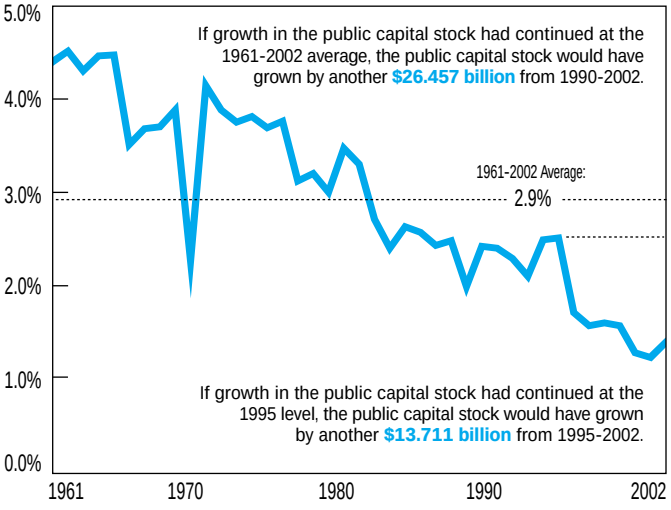
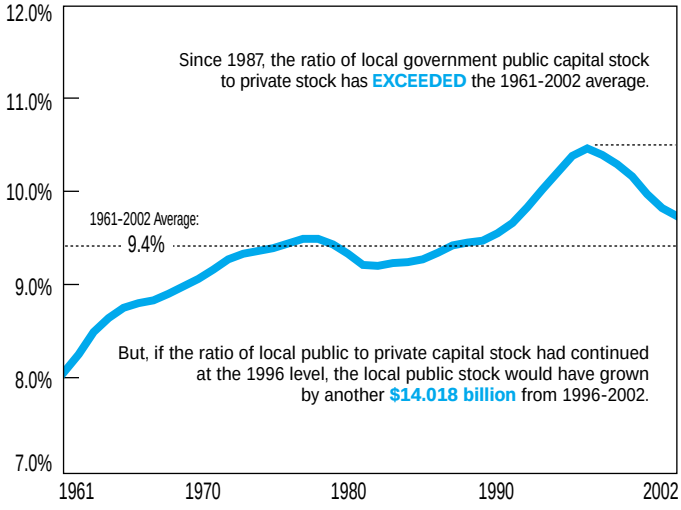


CHART 2: LOCAL Government Capital Stock as % of Private Capital Stock



SOURCES and NOTES: Derived by Canada West Foundation from Statistics Canada. Population data from Canadian Economic Observer Cat. No. 11-210-XPB (Historical Supplement 1998/99) for 1961-1970, and CANSIM II Table No. 510001 for 1971-2002. Total municipal public capital stocks are from CANSIM II Table No. 310002, Series No. V1126698. Private capital stocks are CANSIM II Table No. 310002 Series V1408349. The original data was provided by Statistics Canada in real 1997 dollars (stocks were geometrically depreciated). The dollar amounts were re-based into 2002 dollars using the Implicit Chain Price Index for Government Gross Fixed Capital Formation.

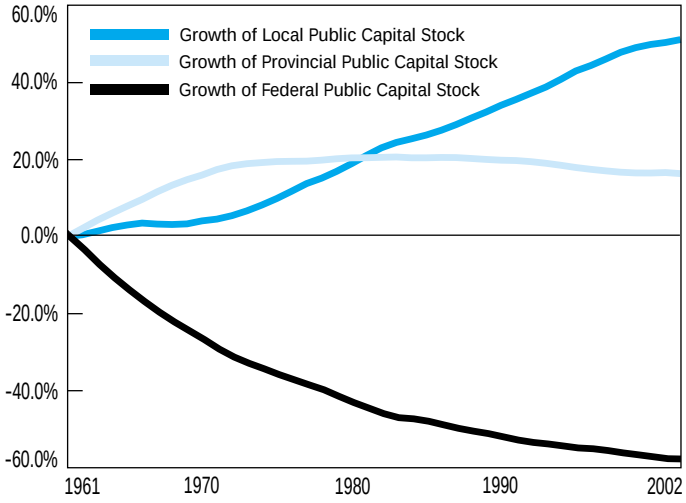
SUMMARY: First, many of the measures of reduced capital spending by local governments do not appear to be completely at odds with estimates of the municipal infrastructure debt, which depend on the time they were made and range anywhere from $40 to $60 billion. While the estimates are somewhat higher, they are not completely out of the ballpark.

Second, the data on the local government sector combines with our review of the total government sector, and can be seen as forming the initial basis for an argument – that Canada's commitment to public capital infrastructure not only needs to move upward, but must do so significantly. Proponents of increased public infrastructure investment, given the size of their estimates, are not arguing for a return to the levels experienced before the fiscal belt-tightening of the mid-1990s, but rather, a return closer to the historical average experienced over the last 40 years. For example, a current estimate of Canada's infrastructure debt was pegged at $125 billion (Mirza 2003). To address this amount, it would appear that all government spending on capital, expressed as a percentage of total revenue, would have to move up to the average of 8.8% recorded over the 1961-2002 period *(Figure 1, Chart 2)*.

Third, the short-term trend in the flows of local government capital spending is interesting *(Figure 3)*. The infusion of federal and provincial funds for infrastructure work at the local level can be clearly seen across all measures in the early to mid-1990s as spending rose, but spending has since fallen. Unlike the total government sector, whose flows of capital have recovered from the sharp dip in the mid-1990s, the local government sector has yet to demonstrate a similar recovery. Again, this could be the result of the local government data ending in 2000 as opposed to 2002. But at the same time, the last year measured for the local government sector also shows a small dip downward for most measures. In other words, it is likely that much of the short-term recovery in capital spending for the total government sector is due to increases in provincial capital investment as opposed to increased spending by local governments or the federal government, which spends very little on capital.

A final conclusion concerns the long-term. Here, there is evidence that public capital investment made by local governments is becoming more important relative to federal and provincial public capital investment. *Figure 5* (page 12) tracks the cumulative percentage change in the local, provincial, and federal share of the total public capital stock over the entire 1961-2002 period. The trend line of the federal government has steadily fallen. The provincial trend line increased from 1961 to 1970, where it stabilized. This likely reflects the impact of large capital outlays required by a spate of province-building initiatives as well as the infrastructure needed to support a wide range of new provincially-delivered social programs. But note the post-1970 trend line of the local government sector's share of the total public capital stock. After growth in the share held by the provincial sector stabilized, it was local governments that picked up the slack from a declining federal role. Because of reduced capital investment, the local government trend line has recently flattened, but that hardly extinguishes the long-term pattern.

FIGURE 5: Cumulative % Growth in Each Government's Share of the Total Government Public Capital Stock



SOURCE: Derived by Canada West Foundation from Statistics Canada using CANSIM II Table No. 310002, Series Nos. V1126634, V1126666, and V1126698.

This finding is reinforced by *Chart 2 in Figure 4,* which shows the stock of local government public capital increasing relative to the private capital stock over the 1961-2002 period. There are some drastic shocks along the way – most notably the recession of the early 1980s when the local public capital stock relative to private capital stock dipped in response to a spike in interest rates, and a sharp upward swing in the recession of the 1990s when private sector capital investment stalled. But the long-term picture still pulls into focus the critical role played by local governments today in building Canada's stock of public capital. When debating infrastructure issues in Canada, we are clearly debating issues of local government.

INFRASTRUCTURE DEFICITS IN WESTERN CANADA'S BIG SIX

Running a similar analysis with western Canada's six big cities (Vancouver, Edmonton, Calgary, Saskatoon, Regina, and Winnipeg) helps determine the extent to which they share in the broader trends above. A comprehensive dataset for each city is located on pages 13 to 24. Each dataset highlights the estimated annual infrastructure deficit or the deficit for 2003, and provides a short-term history of past capital spending. A complete profile of the 2003-2007 capital budget (2003-2005 for Vancouver) is also outlined, along with a long-term analysis of past capital spending measured in real per capita terms, as a percentage of taxes collected, and as a percentage of incomes in the city. (Vancouver is excepted from the long-term analysis due to the fragmented nature of the Vancouver city-region. Rather, a short discussion on the impacts of the 2010 Winter Olympic Games is provided.)

Estimates of the annual capital deficits in western Canada's six big cities range from a low of $31 million in Saskatoon and Regina to a high of $188 million in Winnipeg. The combined total for all six big cities is almost $564 million for 2003 alone. Controlling for population size, Vancouver has the smallest deficit at $87 per capita. This is followed by Saskatoon ($147 per capita), Calgary ($150 per capita), Regina ($167 per capita), Edmonton ($188 per capita) and Winnipeg ($298 per capita). The average size across the six cities is $173 per capita.

While there are outliers, most of the infrastructure deficit estimates tend to fit within a relatively narrow range, despite the different methods with which they were calculated. For example, the Vancouver estimate was derived by taking the total funding requests of city departments less the actual capital expenditures to be made over the entire 2003-2005 budget cycle, and dividing the result by the number of years in the budget cycle. Edmonton and Calgary follow a similar approach, but the separate capital funding deficits are broken out for the 2003 year and the remaining 2004-2007 period. Both approaches include the capital needs for maintenance of existing assets as well as accommodating new growth. However, the Regina estimate is the result of a macro level analysis conducted by city administration as part of the 2003-2007 capital budget process. Saskatoon's estimate is based on a similar approach, and was highlighted in the city's 10-Year Capital Discussion Paper. Winnipeg's estimate is the result of a detailed analysis conducted in 2003. For the most part, these latter three estimates exclude growth considerations and refer primarily to the amounts required to rehabilitate existing infrastructure assets.

The city-specific estimates are likely more reliable than the estimates reviewed earlier, if only because they result from an ongoing, detailed, and comprehensive budgeting process (e.g., Vancouver, Edmonton, Calgary), or substantial in-depth analysis (e.g., Regina, Saskatoon, Winnipeg). But that is not the end of the matter. In many ways, these deficit estimates understate the extent of the problem. For example, in the introduction to Saskatoon's 10-year *Capital Funding Discussion Paper,* the city administration notes that many capital needs in the city are not being adequately reflected because departmental managers recognize that there will be no funds to proceed with anyway. In other words, some municipal departments may not be requesting capital funds even if they are deemed necessary – needs are not being accurately measured.

VANCOUVER

BRITISH COLUMBIA

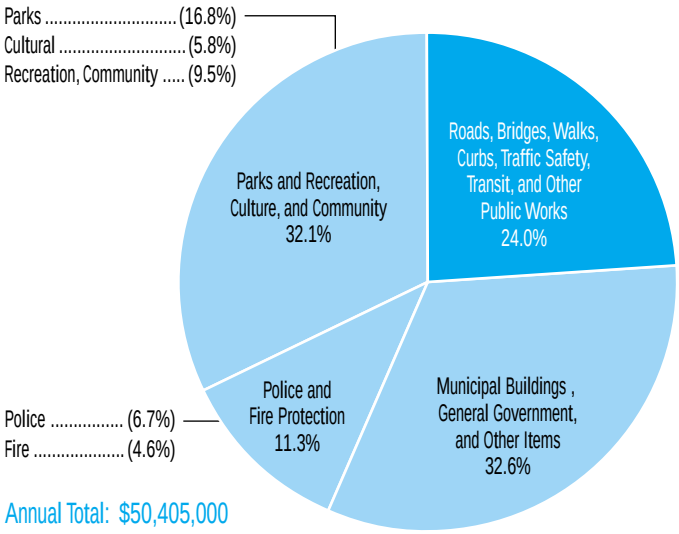
Estimated Annual Capital Shortfall $50,405,000
Per Capita $87.24

2000-2002 Actual Capital Spending $396,192,000
Per Capita (Total of Annual Per Capita Amounts) $689.23

2003-2005 Three-Year Capital Plan $335,238,000
Per Capita (Using 2002 population) $580.23

THE ANNUAL CAPITAL SHORTFALL

(As Determined From The City of Vancouver)



Annual Total: $50,405,000

QUALIFIERS AND KEY POINTS

- Vancouver has not formally estimated an infrastructure shortfall, but it can be calculated from various reports issued by the city. In 2002, total funding requests for the *tax-supported* 2003-2005 Capital Plan were $360 million. (Vancouver's utilities appear to be adequately funded.) Since $209 million in tax-supported capital is expected to be spent, that leaves $151 million in unfunded projects over the three-year plan, or about $50 million annually.
- Before approving each three-year capital plan, Vancouver City Council must hold a referendum (in conjunction with the civic election) where the electorate can vote on any proposed borrowing for non-utility purposes. At the last referendum (November 2002), the voters approved the borrowing in the capital plan. They also agreed to allow Council to borrow an additional $20 million for certain capital projects, assuming that other financing can be found.
- The 2003-2005 Capital Plan funds projects according to three different priorities. First priority projects are those that maintain existing infrastructure, increase safety, and accomplish environmental improvements. (Over recent capital plans, 75% of expenditures went into maintaining existing assets, and 25% went to new projects.) Second priority projects seek to maintain existing service levels or act on service deficiencies. Third priority projects increase service levels or provide new services.

SOURCES: Derived by Canada West Foundation from Vancouver City Administrative Report RTS No. 02998, CC File No. 1611 (dated October 1, 2002) and the 2003-2005 Capital Plan (both documents available at http://www.city.vancouver.bc.ca). All other data secured from 1989-2003 Annual Reports and Financial Statements. Population figures are from BC Stats (http://www.bcstats.gov.bc.ca).

CAPITAL EXPENDITURE HISTORY

CAPITAL ITEM	2000-2002 (000s)	%
Roadways	$ 139,900	35.3%
Police Protection	13,000	3.3%
Fire Protection	7,256	1.8%
Parks and Recreation	46,974	11.9%
Culture and Community	14,118	3.6%
General	38,624	9.7%
TOTAL GENERAL	259,872	65.6%
Water	67,790	17.1%
Sanitary Sewer	68,530	17.3%
TOTAL UTILITY	136,320	34.4%
TOTAL CAPITAL	396,192	100.0%
PER CAPITA	$ 689.23	100.0%

YEAR	Total (000s)	Per Capita
1988	$ 74,348	$ 159.80
1989	81,015	171.41
1990	92,195	192.97
1991	83,872	172.70
1992	129,514	261.94
1993	143,732	286.54
1994	233,788	456.08
1995	180,324	343.94
1996	117,353	218.30
1997	133,708	244.07
1998	141,173	254.73
1999	160,036	284.78
2000	135,910	238.57
2001	110,908	192.13
2002	149,374	258.53

2003-2005 CAPITAL PLAN

REVENUES	Budgeted (000s)	Per Capita (2002 Pop)	%
Current Revenues and Operations	$ 45,900	$ 79.45	13.7%
Federal and Provincial Grants	72,798	126.00	21.7%
Development Fees	13,000	22.50	3.9%
Other Fees and Contributions	2,000	3.46	0.6%
Debt (some covered by reserves)	201,540	348.82	60.1%
TOTAL CAPTAL REVENUES	$ 335,238	$ 580.23	100.0%

EXPENDITURES	Budgeted (000s)	Per Capita (2002 Pop)	%
Roads, Walks, Bridges, Traffic Control	$ 93,682	$ 162.14	27.9%
Transit	13,154	22.77	3.9%
TOTAL Transportation and Public Works	106,836	184.91	31.8%
Police Protection	9,620	16.65	2.9%
Fire Protection	300	0.52	0.1%
TOTAL Protective Services	9,920	17.17	3.0%
Parks and Green Spaces	26,015	45.03	7.8%
Recreation, Culture, and Community	34,410	59.55	10.2%
TOTAL Community Services	60,425	104.58	18.0%
Civic Buildings and Facilities	17,307	29.96	5.2%
Other General and Government	11,500	19.90	3.4%
TOTAL General	28,807	49.86	8.6%
TOTAL Other (Supplemental Capital)	3,000	5.19	0.9%
Water Utility	48,900	84.64	14.6%
Sanitary Sewerage Utility	77,350	133.88	23.1%
TOTAL Environment and Utility	126,250	218.52	37.7%
TOTAL CAPITAL EXPENDITURES	$ 335,238	$ 580.23	100.0%

VANCOUVER: Unique Among Western Canadian Cities

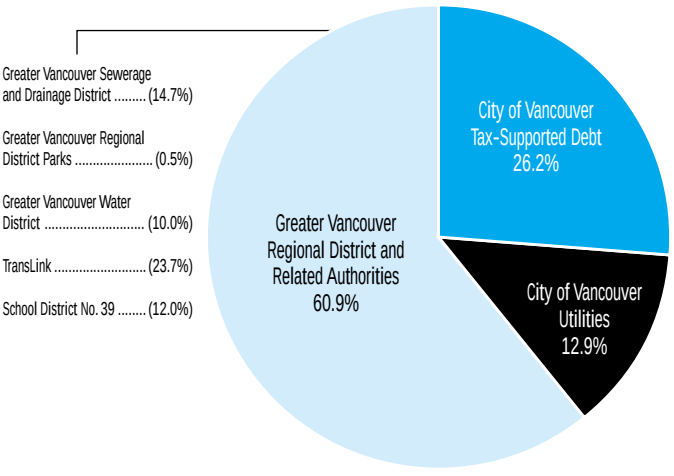
Vancouver stands out among western Canadian cities. Not only is it the West's largest city-region, but it is also the most fragmented. With a population of under 600,000, the City of Vancouver comprises only 27.5% of the 2 million people residing in the greater Vancouver area. This makes comparisons between Vancouver and the other large western cities difficult.

For example, the value of Vancouver's unfunded capital projects seems quite low when compared to the other cities. But this may be deceiving. The City of Vancouver is unique in that it is responsible for only a relatively small portion of the total infrastructure that sustains the larger Vancouver city-region. Most large capital expenditures are not undertaken by the City itself, but occur at the regional district level through separate legal entities, most of which operate under the Greater Vancouver Regional District (GVRD). In the Vancouver area, there are four separate organizations, aside from the City itself, that provide services to residents in Vancouver:

- *Greater Vancouver Water District:* A separate legal entity under the GVRD, the Water District was formed in 1926 to provide member municipalities with reliable potable water. The district develops and maintains supply, treatment, and delivery to the municipalities. Each municipality, however, is responsible for delivery to individual properties.
- *Greater Vancouver Sewerage and Drainage District:* This regional organization, also under the GVRD, manages all the sanitary trunk sewers, pumping stations, and treatment facilities. Municipalities are responsible for local collection only. The district also handles urban storm water run-off.
- *Greater Vancouver Regional District Parks:* This organization manages a regional parks system of over 28,000 acres that receives some 6.5 million visits annually.
- *TransLink:* Translink is the regional transportation authority which plans, delivers, and operates a regional transportation system, including bus and rail service.

The City of Vancouver is really a medium-sized city in a very large city-region, and while it is the largest municipality in that region, Vancouver does not directly provide many traditional municipal services. This has no small impact when making infrastructure comparisons. The services that are delivered regionally – whether transit, water, or sewer – are very capital intensive operations. A quick glance at Vancouver's debt profile *(Figure A)* tells the story. In 2001, Vancouver owed about $182 million in net tax-supported debt, and a further $90 million for its self-sustaining utility operations. But combined, that is less than 40% of the amount for which the City is contingently liable. Vancouver is also responsible for helping pay the debt-financed infrastructure for regionally delivered services.

FIGURE A: Net Debt of Vancouver and Overlapping Authorities
(End of Fiscal 2001)



SOURCE: Derived by Canada West Foundation from the Dominion Bond Rating Service.

THE 2010 OLYMPICS: Effects on Infrastructure

The recent success of the Vancouver-Whistler bid to host the 2010 Winter Olympics will have no small impact on the infrastructure investments taking place in and around Vancouver over the next five to seven years. The Olympics, with a combined price tag of over $2.6 billion, will result not only in the upgrading of existing sports facilities in both Vancouver and Whistler/Blackcomb, but the construction of new venues as well. One writer has succinctly summed up what the Olympics means for Vancouver: "The Olympics have become the biggest prize not only in sport, but in civic renovation. The Games bring the attention of the world and, if things go well, enormous prestige and spinoff economic benefits. And in the process of getting Games-ready, communities make important infrastructure improvements" (Deacon 2003).

For an event that lasts less than three weeks but draws the attention of the entire world (as many as two billion television viewers over the course of the event), the Olympics will entail a host of new provincial and municipal infrastructure projects totalling some $1.3 billion (Figure B). At the top of that list is a $600 million upgrading of Highway 99 (the Sea-to-Sky Highway) running from Vancouver to Whistler and the construction of a rapid transit link from the Vancouver Airport to the downtown. Another project that might be undertaken in conjunction with the Olympics is the upgrading of the Vancouver Trade and Convention Centre.

The infrastructure investments carry benefits that will last for years. For example, after the Games, the Olympic Village in Whistler could be converted into affordable housing for tourism employees living in a resort community where homes often have asking prices exceeding $1 million. With respect to the broader economy, the Organizing Committee of the Olympic Games (OCOG) estimates that the larger event could generate up to $10 billion in direct economic activity, creating 228,000 direct and indirect job years across the province, and resulting in as much as $2.5 billion in incremental tax revenues for governments. But like any large project, there are risks. Perhaps the biggest risk relates to the sheer scale and rapid pace of such an aggressive capital plan. Olympic organizers and governments will have to pay close attention if only to contain any potential cost overruns.

FIGURE B: Budget of the 2010 Vancouver Winter Olympics
(Budgeted Costs as of October 2002)

OPERATING COSTS: Organizing Committee of the Olympic Games	$1,354.8 million
CAPITAL COSTS: Municipal, Provincial, and Federal Governments	$1,109.8 million
Roads, and Railways	$599.9 million
Upgrading Sports Venues in Vancouver	$127.7 million
Upgrading Sports Venues in Whistler	$23.1 million
Constructing New Sports Venues in Vancouver	$44.0 million
Constructing New Sports Venues in Whistler	$157.0 million
Constructing of Vancouver Olympic Village	$30.0 million
Constructing of Whistler Olympic Village	$45.5 million
Constructing International Broadcast Centre	$15.0 million
Paralympics and Regional Facilities Grants	$67.6 million
CAPITAL COSTS: Third Parties and Private Sector	$199.8 million
Constructing New Sports Venues in Vancouver	$10.0 million
Constructing of Vancouver Olympic Village	$137.3 million
Constructing of Whistler Olympic Village	$52.5 million
TOTAL VANCOUVER OLYMPIC BUDGET	$2,664.4 million

SOURCE: Organizing Committee of the Olympic Games, Official Bid Book (www.winter2010.com)

EDMONTON

ALBERTA

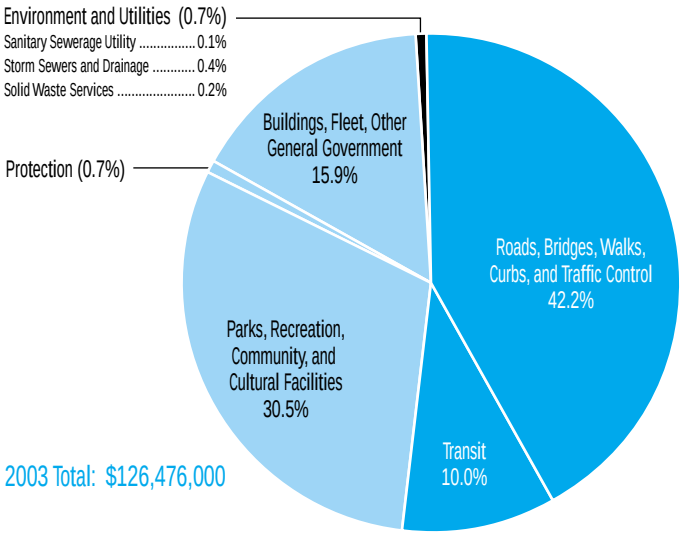
Estimated 2003 Capital Shortfall $126,476,000
Per Capita $187.31

1998-2002 Actual Capital Spending $1,318,237,000
Per Capita (Total of Annual Per Capita Amounts) $1,999.69

2003-2007 Five-Year Capital Plan $1,532,489,000
Per Capita (Using 2002 population) $2,269.58

THE 2003 CAPITAL SHORTFALL

(As Estimated by The City of Edmonton)



2003 Total: $126,476,000

QUALIFIERS AND KEY POINTS

- The 2003 unfunded capital needs speak only to the current fiscal year. Edmonton actually estimates a $3.2 billion shortfall in capital and infrastructure funding over the next ten years, of which $126.5 million will occur in 2003 and $1.424 billion may occur in years 2004-2007, for a total over the next five years of $1.551 billion ($310.2 million when annualized or $460 per capita annually until 2007).

- In 1998, an Infrastructure Strategy was developed, which was updated in 2002. The City's Office of Infrastructure is responsible for implementing this plan. According to the Office of Infrastructure, the replacement value of the city's assets is $18.05 billion. With an average life span of 50 years across all types of infrastructure, Edmonton should be replacing about 2% of the $18.05 billion annually, or about $360 million a year. Average rehabilitation and replacement spending over the next ten years is estimated at only $165 million, leaving an annual shortfall of at least $195 million for existing infrastructure, let alone expansion to accommodate new growth.

- Edmonton is pursuing several options to address the gap. In 2002, the city lifted a self-imposed moratorium on new tax-supported debt. Edmonton could borrow up to $250 million for tax-supported capital projects over the five-year plan. These borrowings would be in addition to any debt issued for self-financing utilities.

- The city has identified five challenges affecting its capital program: rapid population and economic growth, limited growth in funding sources, limited ability to secure partnership funding, keeping up with technological changes and advances, and the potential impact of the Kyoto Accord.

CAPITAL EXPENDITURE HISTORY

CAPITAL ITEM	1998-2002 (000s)	%
Roadways	$ 468,925	35.5%
Transit	110,112	8.4%
Police Protection	27,807	2.1%
Fire Protection	3,755	0.3%
Community Services	95,862	7.3%
General	183,866	13.9%
TOTAL GENERAL	890,327	67.5%
Sanitary Sewer	201,287	15.3%
Drainage and Waste	226,623	17.2%
TOTAL UTILITY	427,910	32.5%
TOTAL CAPITAL	1,318,237	100.0%
PER CAPITA	$ 1,999.69	100.0%

YEAR	Total (000s)	Per Capita
1988	$ 161,606	$ 278.61
1989	206,733	354.07
1990	193,564	319.66
1991	184,442	300.07
1992	170,537	275.86
1993	151,972	242.38
1994	171,665	274.01
1995	210,606	335.57
1996	165,484	268.51
1997	174,380	278.21
1998	196,765	308.68
1999	193,681	298.76
2000	239,770	364.87
2001	415,427	623.67
2002	272,594	403.71

2003-2007 CAPITAL PLAN

REVENUES	Budgeted (000s)	Per Capita (2002 Pop)	%
Current Revenues and Operations	$ 433,819	$ 642.47	28.3%
Reserves and Retained Earnings	268,378	397.46	17.5%
Federal and Provincial Capital Grants	446,703	661.56	29.1%
Development Fees and Contributions	67,537	100.02	4.4%
Debt Financing	281,298	416.60	18.4%
Other Revenues	34,754	51.47	2.3%
TOTAL CAPITAL REVENUES	$ 1,532,489	$ 2,269.58	100.0%

EXPENDITURES	Budgeted (000s)	Per Capita (2002 Pop)	%
Roads, Walks, Bridges, Traffic Control	$ 505,628	$ 748.83	33.0%
Transit Services	233,686	346.08	15.2%
TOTAL Transportation	739,314	1,094.91	48.2%
Police Protection	42,203	62.50	2.8%
Fire Protection	35,714	52.89	2.3%
TOTAL Protective Services	77,917	115.39	5.1%
Parks and Green Spaces	54,905	81.31	3.6%
Recreation, Culture, and Community	54,740	81.07	3.6%
TOTAL Community Services	109,645	162.38	7.2%
Civic Buildings and Facilities	21,000	31.10	1.4%
Municipal Fleet	83,135	123.12	5.4%
Other General and Government	62,743	92.92	4.1%
TOTAL General	166,878	247.14	10.9%
Land Purchases and Development	86,030	127.41	5.6%
Miscellaneous	14,312	21.19	0.9%
TOTAL Other	100,342	148.60	6.5%
Sanitary Sewerage Utility	244,175	361.62	15.9%
Drainage and Storm Sewers	57,399	85.01	3.8%
Solid Waste Services	36,819	54.53	2.4%
TOTAL Environment and Utility	338,393	501.16	22.1%
TOTAL CAPITAL EXPENDITURES	$ 1,532,489	$ 2,269.58	100.0%

EDMONTON'S CAPITAL SPENDING: Historical Review, 1960-2002

CHART 1: Real Per Capita Capital Expenditures

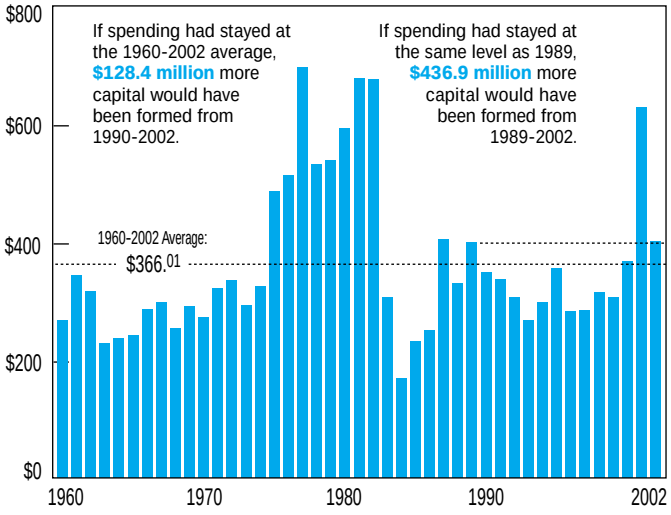


CHART 2: Capital Expenditures as a Percent of Tax Revenues

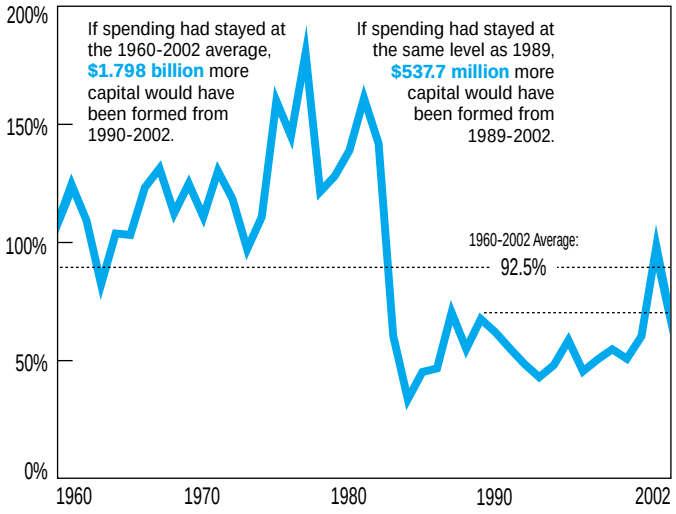


CHART 3: Capital Expenditures as a Percent of Incomes

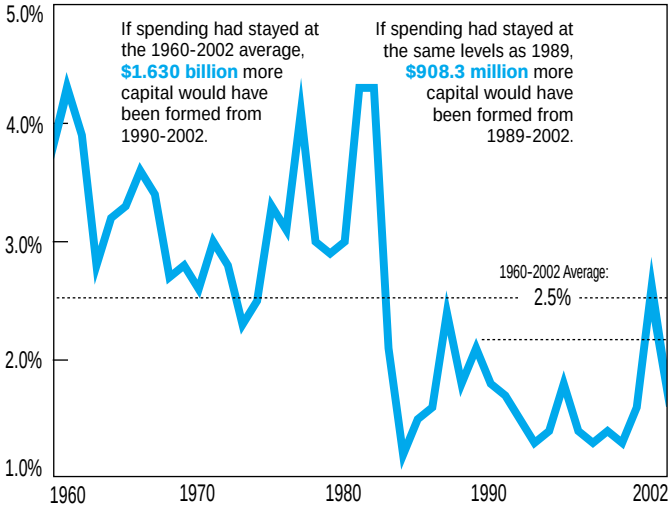


CHART 4: Percentage of Capital Expenditures Financed by Debt

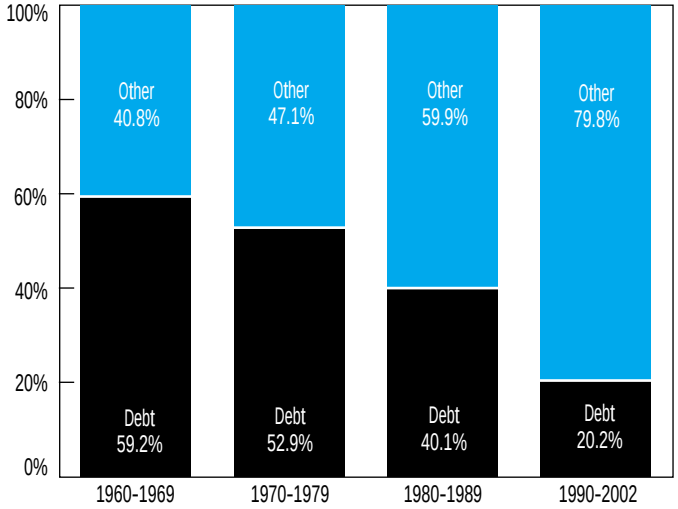
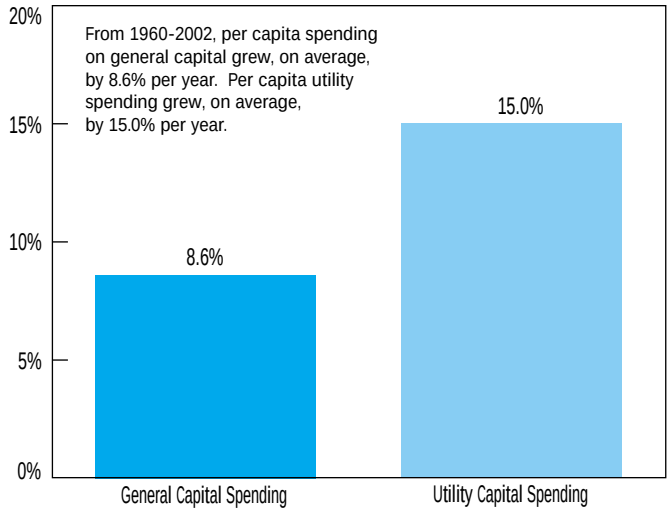


CHART 5: Average Annual Growth Rates of General and Utility Capital



SOURCES: The capital shortfall and future capital revenues and expenditures were derived from Edmonton's 2003-2007 Capital Plan. Additional information comes from the City's Office of Infrastructure in its *2002 Infrastructure Update.* Historical data for capital expenditures, tax revenues, debt financing, and population were derived by Canada West Foundation from the City's 1960-2002 Annual Financial Reports. Data for personal incomes in Edmonton were secured from Revenue Canada's *Tax Statistics on Individuals (1960-2000).* To produce Chart 1 (Real Per Capita Capital Expenditures), capital spending was controlled for inflation using the the Alberta Implicit Price Index for Government Gross Fixed Capital Formation for years 1981 to 2002, and the index for Canada for years 1960-1980 (the price index was re-based such that 2002 equalled 100.0).

NOTES: Capital for all years excludes the electrical utility, the municipal airport, the telephone system, and the water utility (all these operations were sold or discontinued). Sewer service remains the primary utility. Transit service is treated as a general (tax-supported) capital expenditure. Tax revenues include general property tax, the business tax (including BRZ levies), local improvement levies, and other special levies and taxes. Tax revenues exclude education taxes, utility franchise taxes, property taxes paid by EPCOR, taxes on municipal utilities before they were sold, and all revenue-in-lieu of tax. Income data for three years were interpolated or extrapolated due to lack of data, as was the 1960 year for the Implicit Price Index. Debt data excludes discontinued utility operations. Population data for some years were interpolated due to the lack of estimates. Three relatively small annexations were not controlled.

CALGARY

ALBERTA

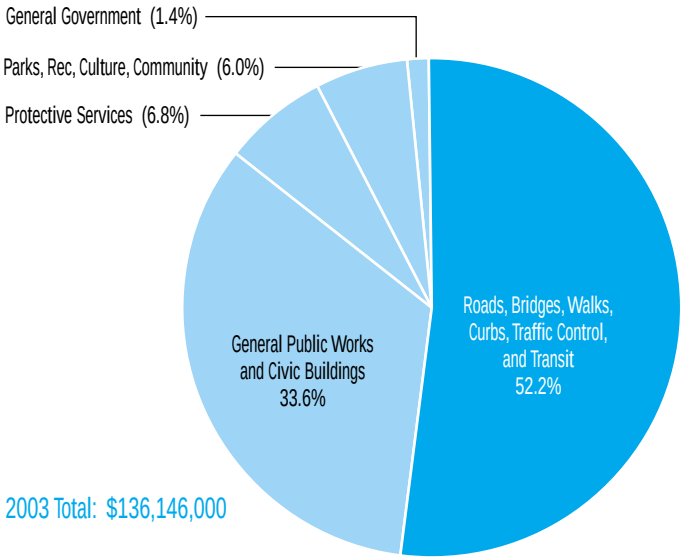
Estimated 2003 Capital Shortfall $136,146,000
Per Capita $150.44

1998-2002 Actual Capital Spending $2,062,815,000
Per Capita (Total of Annual Per Capita Amounts) $2,386.01

2003-2007 Five-Year Capital Plan $2,513,035,000
Per Capita (Using 2002 population) $2,776.87

THE 2003 CAPITAL SHORTFALL

(As Estimated by The City of Calgary)



2003 Total: $136,146,000

QUALIFIERS AND KEY POINTS

- Calgary's $136 million shortfall is the estimate for the 2003 year based on the preliminary capital budget. In all likelihood, the actual capital funding shortfall is higher. The $136 million speaks only to "high priority" unfunded projects for 2003. More important, the actual shortfall (both high priority and lower priority) is estimated on a going-forward basis in the final capital budget for 2003-2007 at $1.120 billion over the entire five-year period. This translates into $224.1 million when annualized, or about $250 per capita.

- Of the $1.120 billion, about 10% is for road construction, 25% is for transit, and the remainder is for other capital projects. About 60% of the total amount is directly related to fund growth projects, while 40% is for the maintenance and upgrading of existing capital assets.

- In the 1980s, the City of Calgary placed a moratorium on any tax-supported borrowing following significant capital investments earlier in the decade. But in 2002, the City agreed to issue up to $350 million in new tax-supported debt (in addition to utility-owned debt) over the 2003-2007 Capital Plan. Debt servicing costs incurred from any borrowing may not exceed 10% of the City's total tax-supported expenditures. The City will be using the savings on lower debt charges in the 1990s to support the additional borrowing.

- In 2002, the City passed a 4.5% property tax increase, of which 1.5% points have been earmarked to support future capital outlays. This amounts to an internally dedicated tax for capital purposes. Transportation services, particularly roads, bridges and interchanges, remain the largest infrastructure concern in Calgary.

CAPITAL EXPENDITURE HISTORY

CAPITAL ITEM	1998-2002 (000s)	%
Roadways	$ 517,237	25.1%
Transit	315,460	15.3%
Police Protection	41,592	2.0%
Fire Protection	27,347	1.3%
Community Services	213,845	10.4%
General	300,641	14.5%
Land Development	82,489	4.0%
TOTAL GENERAL	1,498,611	72.6%
Water Utility	317,121	15.4%
Sewer and Drainage	224,132	10.9%
Solid Waste	22,951	1.1%
TOTAL UTILITY	564,204	27.4%
TOTAL CAPITAL	2,062,815	100.0%
PER CAPITA	$ 2,386.01	100.0%

YEAR	Total (000s)	Per Capita
1988	$ 122,572	$ 184.04
1989	182,457	271.86
1990	191,176	275.91
1991	193,210	272.67
1992	201,920	281.57
1993	230,615	316.90
1994	183,311	248.33
1995	239,840	320.18
1996	219,844	286.61
1997	228,674	289.28
1998	287,091	350.40
1999	373,301	443.15
2000	436,300	506.88
2001	502,315	573.08
2002	463,808	512.50

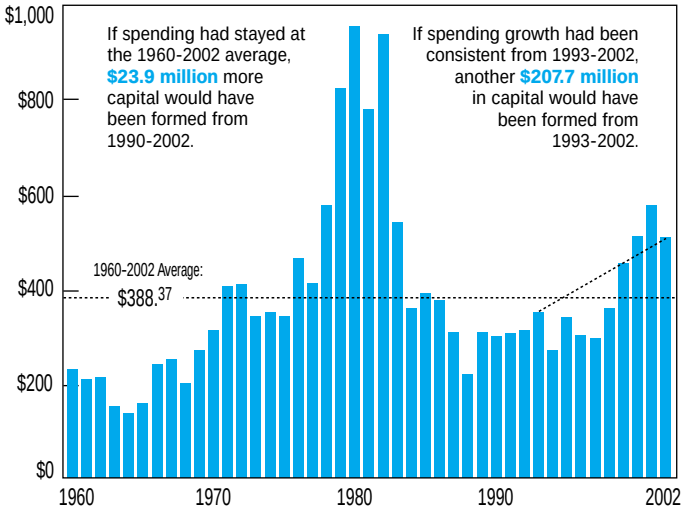
2003-2007 CAPITAL PLAN

REVENUES	Budgeted (000s)	Per Capita (2002 Pop)	%
Current Revenues and Operations	$ 355,771	$ 393.12	14.2%
Reserves and Retained Earnings	561,865	620.85	22.4%
Federal and Provincial Grants	493,659	545.49	19.6%
Development Fees and Contributions	91,410	101.01	3.6%
Debt Financing	1,010,330	1,116.40	40.2%
TOTAL CAPITAL REVENUES	$ 2,513,035	$ 2,776.87	100.0%

EXPENDITURES	Budgeted (000s)	Per Capita (2002 Pop)	%
Roads, Walks, Bridges, Traffic Control	$ 527,744	$ 583.15	21.0%
Transit Services	357,578	395.12	14.2%
TOTAL Transportation	885,322	978.27	35.2%
Police Protection	52,700	58.23	2.1%
Fire Protection	46,793	51.71	1.9%
TOTAL Protective Services	99,493	109.94	4.0%
Parks and Green Spaces	63,051	69.67	2.5%
Recreation, Culture, and Community	117,656	130.01	4.7%
TOTAL Community Services	180,707	199.68	7.2%
Civic Buildings and Facilities	105,947	117.07	4.2%
Municipal Fleet	107,710	119.02	4.3%
Other General and Government	106,748	117.95	4.2%
TOTAL General	320,405	354.04	12.7%
TOTAL Other (Land Purchases)	182,819	202.01	7.3%
Water Utility	432,538	477.95	17.2%
Sanitary Sewerage Utility	260,609	287.97	10.4%
Drainage and Storm Sewers	108,599	120.00	4.3%
Solid Waste Services	42,543	47.01	1.7%
TOTAL Environment and Utility	844,289	932.93	33.6%
TOTAL CAPITAL EXPENDITURES	$ 2,513,035	$ 2,776.87	100.0%

CALGARY'S CAPITAL SPENDING: Historical Review, 1960-2002

CHART 1: Real Per Capita Capital Expenditures



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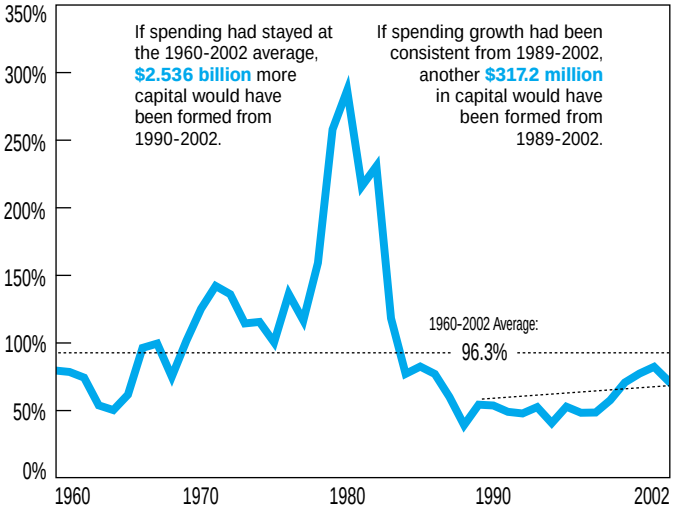


CHART 3: Capital Expenditures as a Percent of Incomes

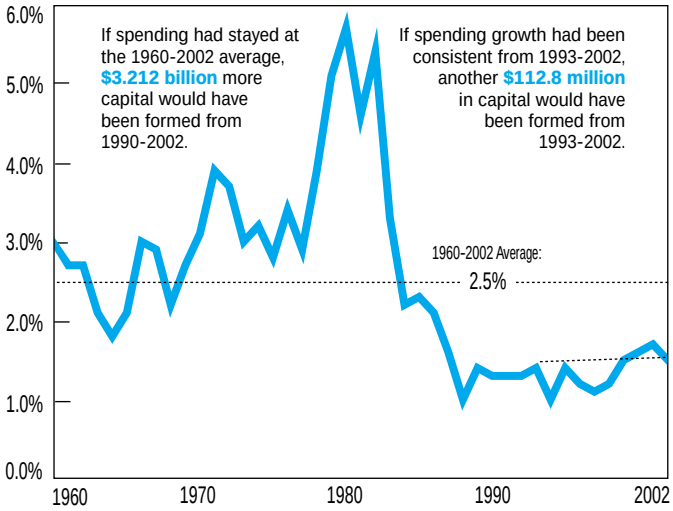


CHART 4: Percentage of Capital Expenditures Financed by Debt

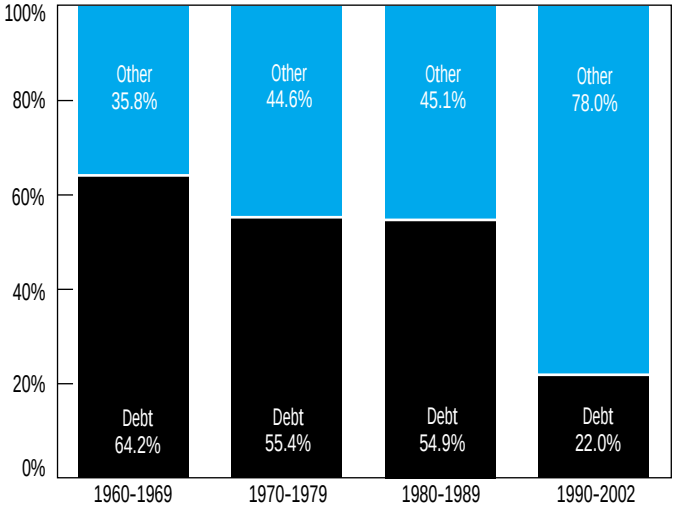
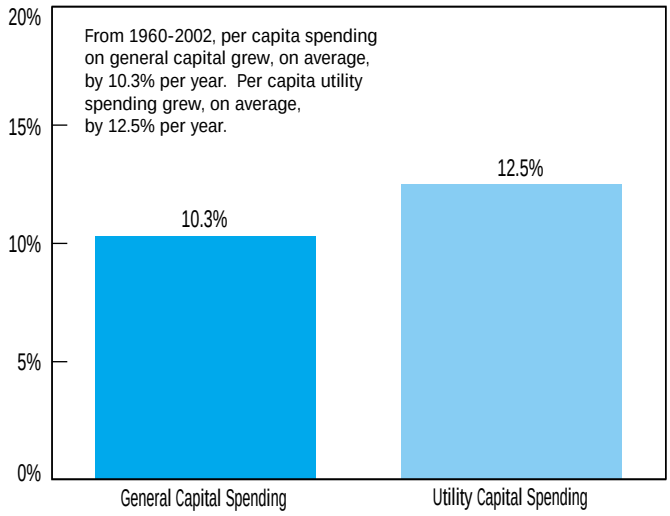


CHART 5: Average Annual Growth Rates of General and Utility Capital



SOURCES: The capital shortfall and future capital revenues and expenditures were derived from Calgary's 2003-2007 Preliminary Capital Plan and the report *Accommodating Growth* (June 2003). Historical data for capital expenditures, tax revenues, debt financing, and population were derived by Canada West Foundation from the City's 1960-2002 Annual Financial Reports. Data for personal incomes in Calgary were secured from Revenue Canada's *Tax Statistics on Individuals (1960-2000)*. To produce Chart 1 (Real Per Capita Capital Expenditures), capital spending was controlled for inflation using the the Alberta Implicit Price Index for Government Gross Fixed Capital Formation for years 1981 to 2002, and the index for Canada for years 1960-1980 (the price index was re-based such that 2002 equalled 100.0).

NOTES: Capital expenditures for all years exclude Calgary's municipal electrical utility, which was converted into a municipally-owned corporation in 1998 (ENMAX). All amounts for hospital and airport capital expenditures were also removed. Transit expenditures are treated as a general (tax-supported) capital expenditure. Tax revenues include general property tax, the business tax, and local improvement levies. General taxes also include amounts for library purposes. Tax revenues exclude franchise fees and taxes, as well as other utility-based taxes. Totals also exclude revenue-in-lieu of taxes. Income data for three years were interpolated or extrapolated due to lack of data, as was the 1960 year for the Implicit Price Index. Debt data excludes debt issued for educational, hospital, and electrical purposes.

SASKATOON

SASKATCHEWAN

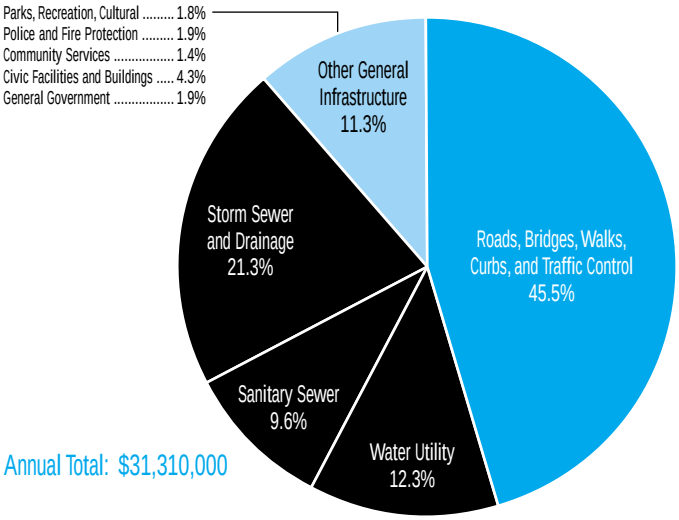
Estimated Annual Capital Shortfall $31,310,000
Per Capita $146.58

1998-2002 Actual Capital Spending $331,084,000
Per Capita (Total of Annual Per Capita Amounts) $1,573.62

2003-2007 Five-Year Capital Plan $430,007,000
Per Capita (Using 2002 population) $2,013.08

THE ANNUAL CAPITAL SHORTFALL

(As Estimated by The City of Saskatoon)



Annual Total: $31,310,000

QUALIFIERS AND KEY POINTS

- Saskatoon's first ten year Capital Discussion Paper was published in 1998 following substantial decreases in annual capital grants from the federal and provincial governments. In 2003, the city updated the 1998 report with a second Capital Discussion Paper. Since the 1998 report, the city has worked to build a funding base to lower its annual capital shortfall. The 1998 report estimated the annualized shortfall for general capital (excluding utilities) at $22.2 million. In the 2003 report, this has been reduced to $17.7 million.
- Over half of the additional funding base has come from savings on interest as a result of debt retirement. The rest has come from increases in the mill rate, special levies on utilities, and dedicating one-third of all revenues that accrue from growth in the annual property assessment.
- For many years, additions to Saskatoon's infrastructure were financed by direct levies or federal and provincial grants. The municipal tax base was the third source of revenue. Given that federal and provincial support for municipal infrastructure has decreased, the taxpayer has now become the primary source for capital replacement and expansion. Yet, taxpayers generally do not want to pay more in taxes or special capital levies.
- The 2003 Capital Discussion Paper notes that it is difficult to get a handle on the size of the capital shortfall in Saskatoon, which is likely higher than the estimates put forth. For example, total capital needs may not be quantified by individual departments and business units because they recognize there will be no funds to proceed with anyway. The report also recognizes that the infrastructure problem is one that has not appeared over the short-term. The implication is that ultimate solutions may lie in a long-term approach.

CAPITAL EXPENDITURE HISTORY

CAPITAL ITEM	1998-2002 (000s)	%
Roads and Transit	$ 109,418	33.0%
Police and Fire	15,690	4.7%
Community Services	28,095	8.5%
General Government	10,506	3.2%
Land Development	43,878	13.3%
All Other	1,343	0.4%
TOTAL GENERAL	208,930	63.1%
Utility Services	67,162	20.3%
Environment Services	54,992	16.6%
TOTAL UTILITY	122,154	36.9%
TOTAL CAPITAL	331,084	100.0%
PER CAPITA	$ 1,573.62	100.0%

YEAR	Total (000s)	Per Capita
1988	$ 51,419	$ 280.23
1989	47,331	257.38
1990	47,127	256.71
1991	31,719	170.48
1992	39,839	210.97
1993	29,590	154.00
1994	38,855	198.65
1995	80,460	404.00
1996	45,972	224.61
1997	58,631	288.61
1998	63,691	307.61
1999	53,700	257.75
2000	69,755	332.75
2001	79,188	372.38
2002	64,750	303.13

2003-2007 CAPITAL PLAN

REVENUES	Budgeted (000s)	Per Capita (2002 Pop)	%
Current Revenues and Reserves	$ 343,303	$ 1,607.17	79.8%
Federal and Provincial Grants	19,725	92.34	4.6%
User Fees and Other Contributions	1,563	7.32	0.4%
Debt Financing	860	4.03	0.2%
Unfunded as of 2003	64,556	302.22	15.0%
TOTAL CAPITAL REVENUES	$ 430,007	$ 2,013.08	100.0%

EXPENDITURES	Budgeted (000s)	Per Capita (2002 Pop)	%
Roads, Walks, Bridges, Traffic Control	$ 111,717	$ 523.00	26.0%
Transit Services	14,075	65.89	3.3%
TOTAL Transportation	125,792	588.89	29.3%
Fire Protection	3,067	14.36	0.7%
Police Protection	5,598	26.21	1.3%
TOTAL Protective Services	8,665	40.57	2.0%
Parks and Green Spaces	19,128	89.55	4.4%
Recreation, Culture, and Community	21,804	102.07	5.1%
TOTAL Community Services	40,932	191.62	9.5%
Civic Buildings and Facilities	14,471	67.75	3.4%
Municipal Fleet	18,317	85.75	4.2%
Other General and Government	18,834	88.17	4.4%
TOTAL General	51,622	241.67	12.0%
TOTAL Other (Land Development)	18,056	84.53	4.2%
Water Utility	47,307	221.47	11.0%
Sanitary Sewerage Utility	71,664	335.50	16.6%
Drainage and Storm Sewers	21,408	100.22	5.0%
Solid Waste Services	6,827	31.96	1.6%
Electrical Utility	37,734	176.65	8.8%
TOTAL Environment and Utility	184,940	865.80	43.0%
TOTAL CAPITAL EXPENDITURES	$ 430,007	$ 2,013.08	100.0%

SASKATOON'S CAPITAL SPENDING: Historical Review, 1960-2002

CHART 1: Real Per Capita Capital Expenditures

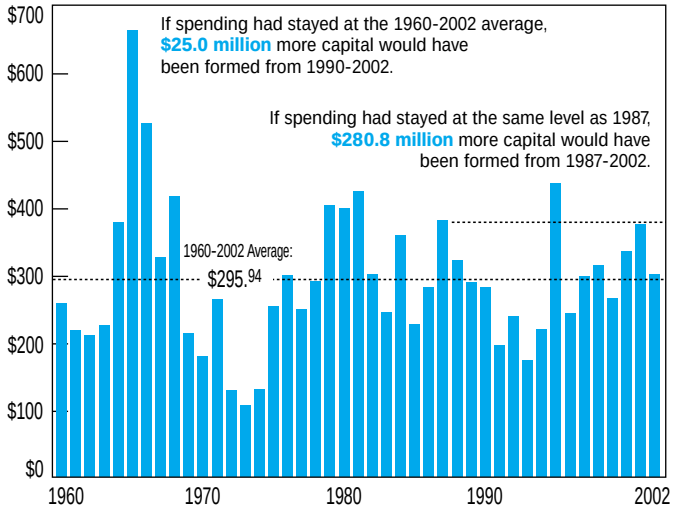


CHART 2: Capital Expenditures as a Percent of Tax Revenues

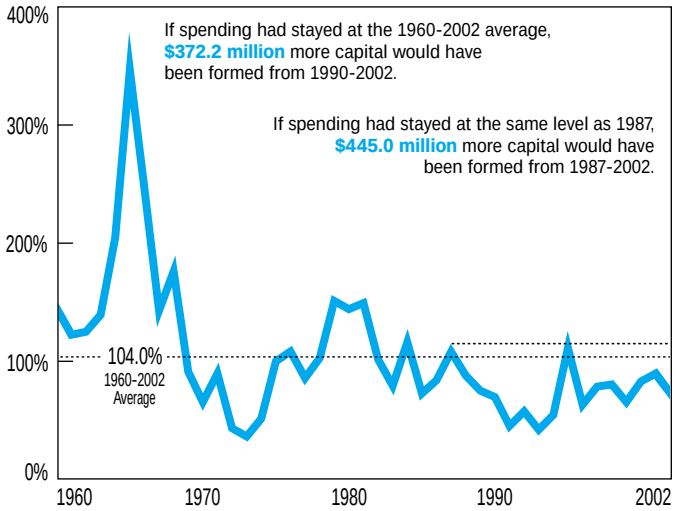


CHART 3: Capital Expenditures as a Percent of Incomes

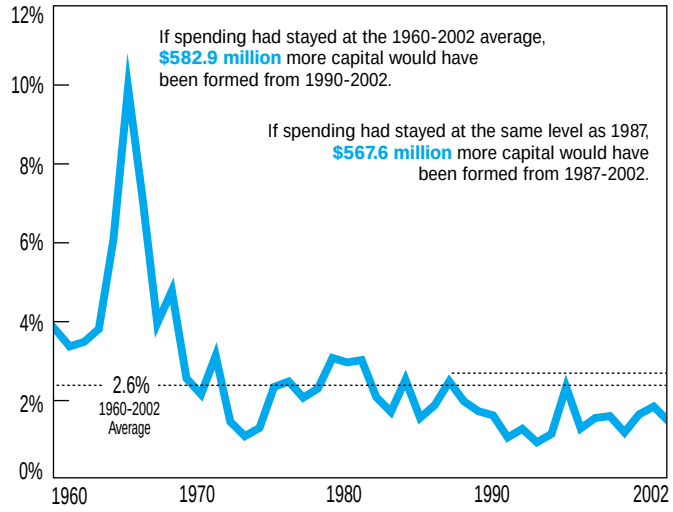


CHART 4: Percentage of Capital Expenditures Financed by Debt

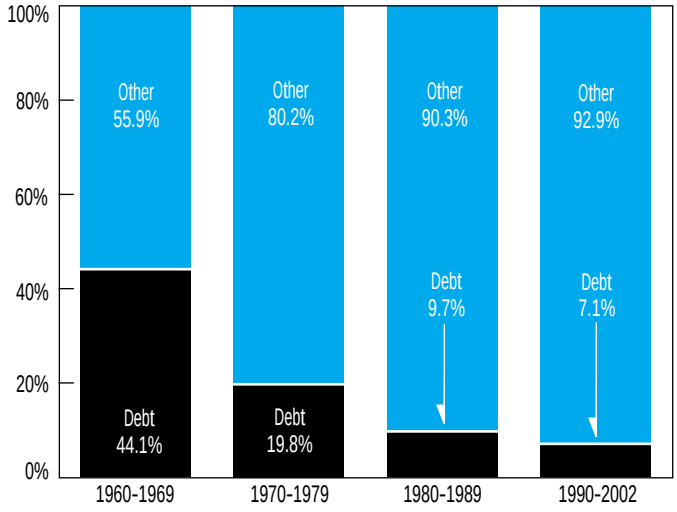
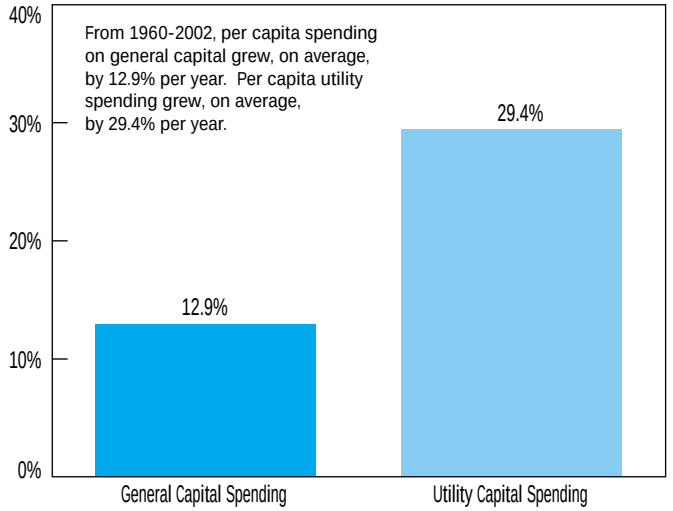


CHART 5: Average Annual Growth Rates of General and Utility Capital

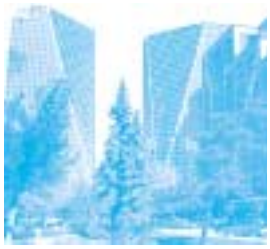


SOURCES: The capital shortfall comes from the City's *Ten-Year Capital Funding Discussion Paper (2003).* Future capital revenues and expenditures were derived from Saskatoon's Approved 2003 Capital Budget and 2004-2007 Capital Plan. Historical data for capital expenditures, tax revenues, debt financing, and population were derived by Canada West Foundation from the City's 1960-2002 Annual Financial Reports. Data for personal incomes in Saskatoon were secured from Revenue Canada's *Tax Statistics on Individuals (1960-2000).* To produce Chart 1 (Real Per Capita Capital Expenditures), capital spending was controlled for inflation using the Saskatchewan Implicit Price Index for Government Gross Fixed Capital Formation for years 1981 to 2002, and the index for Canada for years 1960-1980 (the price index was re-based such that 2002 equalled 100.0).

NOTES: Total capital spending from 1960-1982 includes additions to fixed assets, expenditures from the Property Realized and Property Development Reserves, the General Replacements Reserve, the Transit Reserve, plus the issuance of new debentures. Years 1960-1965 exclude amounts from some reserves due to lack of data. This may lower capital spending in these years relative to later years. Unlike other cities, transit capital is treated as a utility since expenditure break-outs after 1990 were unavailable. Total capital excludes any amounts for educational or hospital purposes. Tax revenues include general property tax, the business tax, the amusement tax, the library tax, the mobile home tax, local improvement levies, and infrastructure levies. Tax revenues exclude revenue-in-lieu of tax. Values for some taxes were interpolated due to lack of data. Income data for three years were interpolated or extrapolated due to data availability, as was the 1960 year for the Implicit Price Index. Population data were merged from three sources (years 1965 and 1999 were extrapolated due to large inconsistencies).

REGINA

SASKATCHEWAN



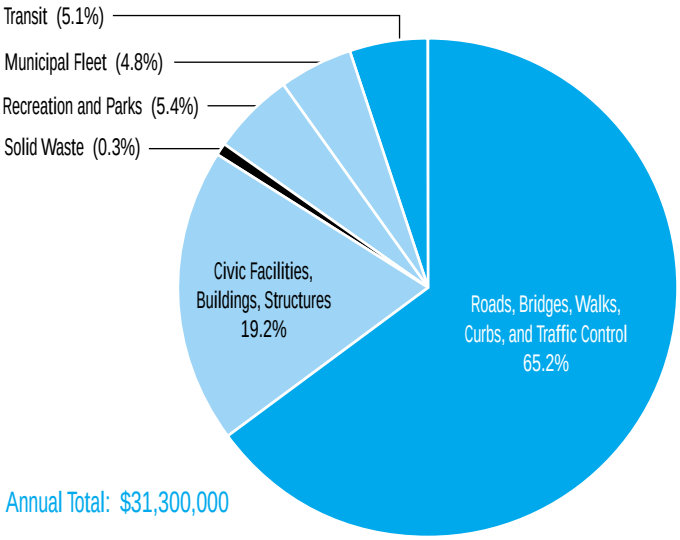
Estimated Annual Capital Shortfall $31,300,000
Per Capita $167.00

1998-2002 Actual Capital Spending $187,367,000
Per Capita (Total of Annual Per Capita Amounts) $992.79

2003-2007 Five-Year Capital Plan $261,187,000
Per Capita (Using 2002 population) $1,393.53

THE ANNUAL CAPITAL SHORTFALL

(As Estimated by The City of Regina)



Annual Total: $31,300,000

QUALIFIERS AND KEY POINTS

- Regina's annual capital shortfall is likely larger than estimated. The current figure does not speak to any potential deficiency in utility operations and the analysis was also conducted at a very macro level.
- Roadways are the largest concern. Of the city's 877 km of roads, 557 km (64%) have reached or exceeded their design life. Only 28% of the roads are labelled as being in good condition. The city can only complete about 21 km of roadway per year (4% of total needs).
- Approximately 40% of the city's vehicle fleet (excluding transit) is overdue for replacement, including 50% of the city's heavy truck and equipment fleet. An aging transit fleet sees 12% of all buses in the garage on a daily basis.
- The 2003-2007 capital plan calls for aggressive use of reserve funds. Reserves (excluding utilities) stand at $38.5 million, but could fall to $7.5 million by 2007. The General Reserve, Regina's main reserve, will fall from $19.3 million to $1.3 million, reducing the city's flexibility to address unseen events.
- In 1983, Regina stopped issuing any tax-supported debt. Since 1990, 75% of the interest savings has gone to capital projects, while 25% has been used to reduce property taxes. In 2001, this policy was revisited. The City may issue modest amounts of tax-supported debt, but only for non-recurring expenditures.
- From 1982-1986, provincial capital grants averaged about $10 million, falling to about $3 million from 1987-1991. Since 1992, provincial capital grants have not exceeded $2 million in any one year.

CAPITAL EXPENDITURE HISTORY

CAPITAL ITEM	1998-2002 (000s)	%
Roadways	$ 55,574	29.7%
Transit	6,432	3.4%
Police Protection	2,487	1.3%
Fire Protection	5,980	3.2%
Community	20,504	10.9%
General	26,176	14.0%
TOTAL GENERAL	117,153	62.5%
Water, Sewer, Drainage	65,561	35.0%
Solid Waste	4,653	2.5%
TOTAL UTILITY	70,214	37.5%
TOTAL CAPITAL	187,367	100.0%
PER CAPITA	$ 992.79	100.0%

YEAR	Total (000s)	Per Capita
1988	$ 37,775	$ 210.56
1989	49,444	277.23
1990	35,451	197.79
1991	26,591	148.40
1992	25,888	143.46
1993	26,006	143.13
1994	37,330	203.99
1995	33,386	181.15
1996	29,292	157.99
1997	36,883	197.95
1998	38,381	204.96
1999	31,573	167.77
2000	37,649	198.78
2001	38,741	202.41
2002	41,023	218.87

2003-2007 CAPITAL PLAN

REVENUES	Budgeted (000s)	Per Capita (2002 Pop)	%
Current Revenues and Operations	$ 110,500	$ 589.56	42.3%
Reserves and Retained Earnings	86,687	462.51	33.2%
Federal and Provincial Grants	9,024	48.15	3.5%
Development Fees and Contributions	6,382	34.05	2.4%
Debt Financing	48,000	256.10	18.4%
Other Revenues	594	3.16	0.2%
TOTAL CAPITAL REVENUES	$ 261,187	$ 1,393.53	100.0%

EXPENDITURES	Budgeted (000s)	Per Capita (2002 Pop)	%
Roads, Walks, Bridges, Traffic Control	$ 71,760	$ 382.86	27.5%
Transit Services	13,355	71.26	5.1%
TOTAL Transportation	85,115	454.12	32.6%
Police Protection	4,922	26.26	1.9%
Fire Protection	6,666	35.57	2.5%
TOTAL Protective Services	11,588	61.83	4.4%
Parks and Green Spaces	8,741	46.64	3.3%
Recreation, Culture, and Community	6,374	34.00	2.5%
TOTAL Community Services	15,115	80.64	5.8%
Civic Buildings and Facilities	3,117	16.63	1.2%
Municipal Fleet	33,938	181.07	13.0%
Other General and Government	7,885	42.07	3.0%
TOTAL General	44,940	239.77	17.2%
TOTAL Other	4,241	22.63	1.6%
Water Utility	34,188	182.41	13.1%
Sanitary Sewerage Utility	22,555	120.34	8.6%
Drainage and Storm Sewers	17,950	95.77	6.9%
Solid Waste Services	25,495	136.02	9.8%
TOTAL Environment and Utility	100,188	534.54	38.4%
TOTAL CAPITAL EXPENDITURES	$ 261,187	$ 1,393.53	100.0%

REGINA'S CAPITAL SPENDING: Historical Review, 1960-2002

CHART 1: Real Per Capita Capital Expenditures

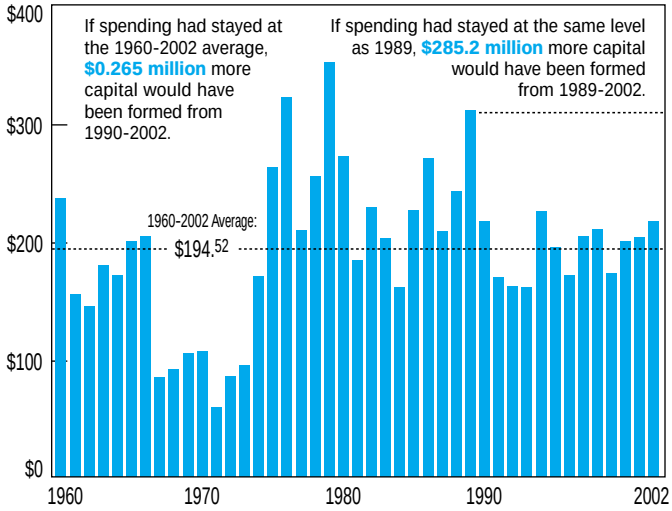


CHART 2: Capital Expenditures as a Percent of Tax Revenues

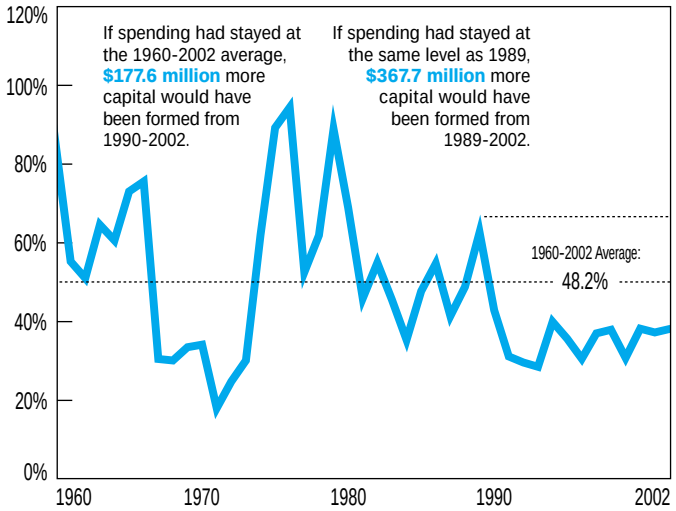


CHART 3: Capital Expenditures as a Percent of Incomes

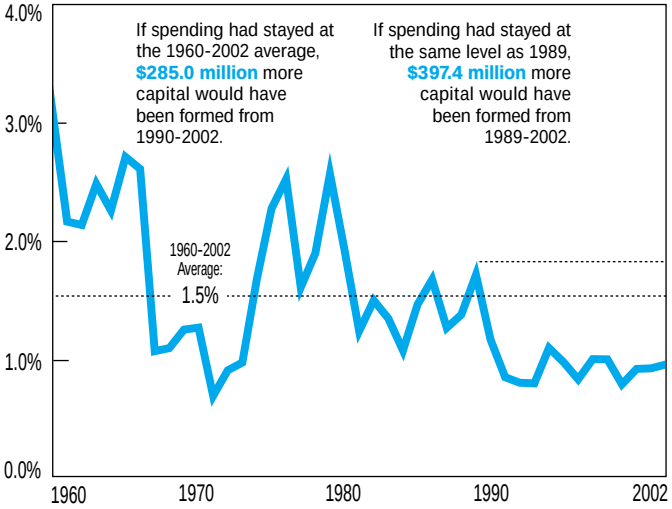


CHART 4: Percentage of Capital Expenditures Financed by Debt

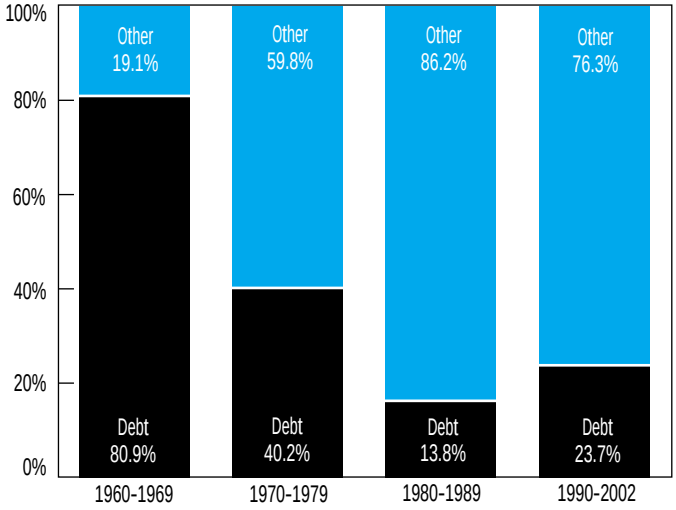
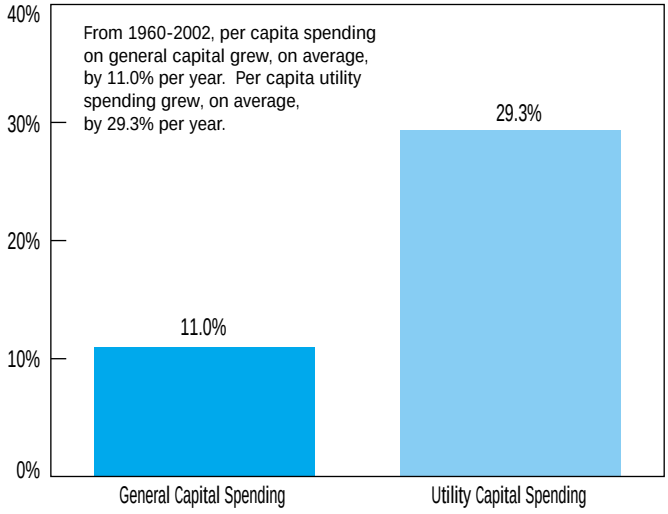


CHART 5: Average Annual Growth Rates of General and Utility Capital



SOURCES: The capital shortfall and future capital revenues and expenditures were derived from Regina's 2003 Budget (Volume Three: General Capital Program). Historical data for capital expenditures, tax revenues, debt financing, and population were derived by Canada West Foundation from the City's 1960-2002 Annual Financial Reports. Data for personal incomes in Regina were secured from Revenue Canada's *Tax Statistics on Individuals (1960-2000)*. To produce Chart 1 (Real Per Capita Capital Expenditures), capital spending was controlled for inflation using the the Saskatchewan Implicit Price Index for Government Gross Fixed Capital Formation for years 1981 to 2002, and the index for Canada for years 1960-1980 (the price index was re-based such that 2002 equalled 100.0).

NOTES: Capital expenditures exclude any amounts for education and hospitals. Amounts for discontinued operations (the airport and electrical utility) were also excluded. Amounts for 1964-1997 exclude library capital, but it is included in 1998-2002. This has the effect of increasing capital in the late 1990s relative to prior years. Tax revenues include general property taxes, special assessments, the amusement tax, library taxes, and supplemental business and municipal taxes. Taxes exclude education amounts, the levy for hospitals, revenue-in-lieu of tax, and a small group of other taxes and tax recoveries. Amounts also exclude all license and permit revenue, and franchise taxes on electrical and natural gas utilities. Local improvement and amusement tax totals for 2001 and 2002 are Canada West estimates due to lack of data. Income data for three years were interpolated or extrapolated due to data availability, as was the 1960 year for the Implicit Price Index. All debt data excludes amounts borrowed for educational, hospital, and electrical purposes.

WINNIPEG

MANITOBA

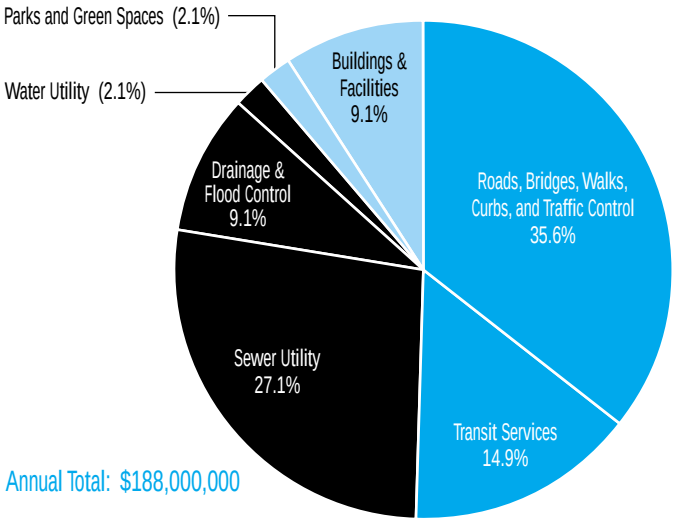
Estimated Annual Capital Shortfall $188,000,000
Per Capita $297.85

1998-2002 Actual Capital Spending $709,518,000
Per Capita (Total of Annual Per Capita Amounts) $1,127.41

2003-2007 Five-Year Capital Plan $868,271,000
Per Capita (Using 2002 population) $1,375.59

THE ANNUAL CAPITAL SHORTFALL

(As Estimated by The City of Winnipeg)



Annual Total: $188,000,000

QUALIFIERS AND KEY POINTS

- The $188 million annual infrastructure deficit was estimated by the City in September 2003. This is a significant increase over the previous estimate made in 1998 by the *Strategic Infrastructure Reinvestment Policy (SIRP) Report.* The previous annual infrastructure deficit estimate was $84 million (excluding amounts for Winnipeg Hydro which was subsequently sold to Manitoba Hydro in 2002).

- The $188 million is only the annual growth in the accumulated infrastructure debt. This debt was estimated in the SIRP report in 1998 to stand at $750 million. In addition, the City of Winnipeg estimates that infrastructure to meet changing regulations, accommodate growth, and provide flood control could cost an additional $1.4 billion over the next 10-20 years.

- The 1998 SIRP Report states that the infrastructure deficit facing Winnipeg can be attributed to a number of factors, including relatively old and aging infrastructure, severe climate and soil conditions, inadequate maintenance in the past, changing growth patterns and exurban development, financial restrictions, insufficient infrastructure analysis, and the absence of a sustainable investment policy.

- The City has placed a moratorium on new tax-supported debt. As the City's debt is paid down, the savings on debt servicing will be redirected to capital investment. The City has also decided that the emphasis should be on rehabilitating existing infrastructure as opposed to constructing new infrastructure.

CAPITAL EXPENDITURE HISTORY

CAPITAL ITEM	1998-2002 (000s)	%
Roadways	$ 203,873	28.7%
Transit	56,563	8.0%
Protection	15,532	2.2%
Community	25,782	3.6%
General	64,086	9.0%
Special Projects	123,210	17.4%
Other	7,481	1.1%
TOTAL GENERAL	496,527	70.0%
Water	84,843	11.9%
Sanitary Sewer	28,884	4.1%
Drainage	96,646	13.6%
Solid Waste	2,618	0.4%
TOTAL UTILITY	212,991	30.0%
TOTAL CAPITAL	709,518	100.0%
PER CAPITA	$ 1,127.41	100.0%

YEAR	Total (000s)	Per Capita
1988	$ 145,469	$ 233.75
1989	152,807	246.38
1990	159,093	254.88
1991	143,907	230.18
1992	173,864	276.99
1993	126,341	200.51
1994	132,480	210.12
1995	200,821	318.46
1996	141,138	224.14
1997	114,686	182.71
1998	135,614	216.32
1999	155,652	247.89
2000	110,743	175.87
2001	142,035	225.17
2002	165,474	262.16

2003-2007 CAPITAL PLAN

REVENUES	Budgeted (000s)	Per Capita (2002 Pop)	%
Current Revenues and Operations	$ 141,379	$ 223.98	16.3%
Reserves and Retained Earnings	490,800	777.56	56.5%
Federal and Provincial Grants	125,000	198.04	14.4%
Development Fees and Contributions	5,987	9.49	0.7%
Debt Financing	102,000	161.60	11.7%
Other Revenues	3,105	4.92	0.4%
TOTAL CAPITAL REVENUES	$ 868,271	$ 1,375.59	100.0%

EXPENDITURES	Budgeted (000s)	Per Capita (2002 Pop)	%
Roads, Walks, Bridges, Traffic Control	$ 205,121	$ 324.97	23.6%
Transit Services	96,007	152.10	11.1%
TOTAL Transportation	301,128	477.07	34.7%
Police Protection	1,285	2.03	0.1%
Fire Protection	5,761	9.13	0.7%
TOTAL Protective Services	7,046	11.16	0.8%
Parks and Green Spaces	18,400	29.15	2.1%
Recreation, Culture, and Community	40,079	63.50	4.6%
TOTAL Community Services	58,479	92.65	6.7%
Civic Buildings and Facilities	19,029	30.15	2.2%
Other General and Government	46,078	73.00	5.3%
TOTAL General	65,107	103.15	7.5%
Local Improvements	3,405	5.39	0.4%
Capital Grants to Third Parties	6,965	11.04	0.8%
TOTAL Other	10,370	16.43	1.2%
Water Utility	226,068	358.16	26.1%
Sanitary Sewerage Utility	75,610	119.79	8.7%
Storm Drainage and Flood Control	124,463	197.18	14.3%
TOTAL Environment and Utility	426,141	675.13	49.1%
TOTAL CAPITAL EXPENDITURES	$ 868,271	$ 1,375.59	100.0%

WINNIPEG'S CAPITAL SPENDING: Historical Review, 1960-2002

CHART 1: Real Per Capita Capital Expenditures

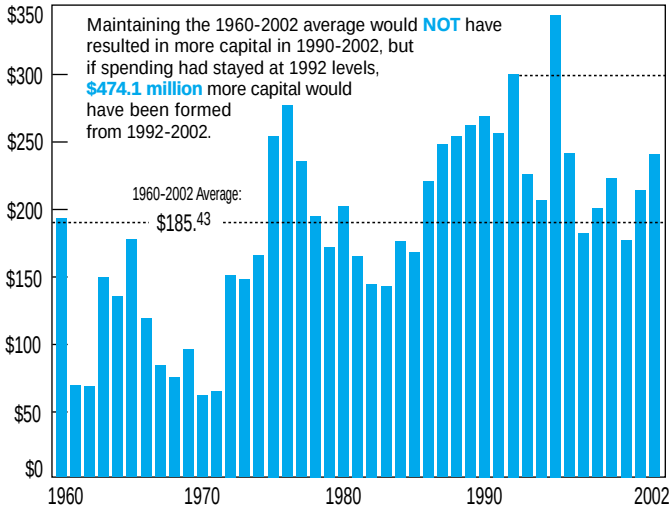


CHART 2: Capital Expenditures as a Percent of Tax Revenues

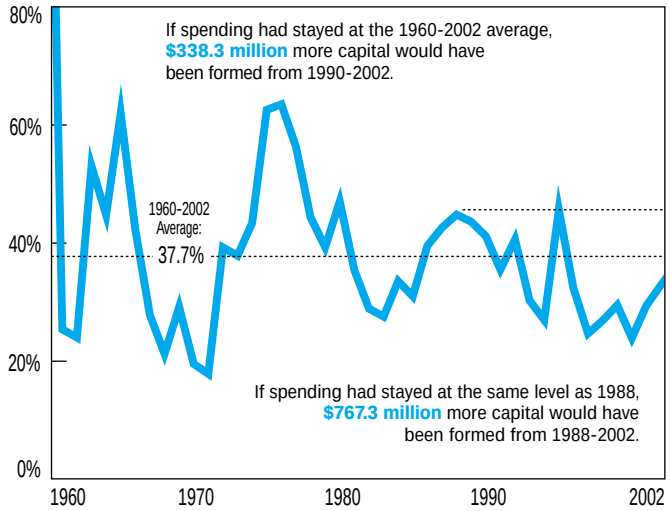


CHART 3: Capital Expenditures as a Percent of Incomes

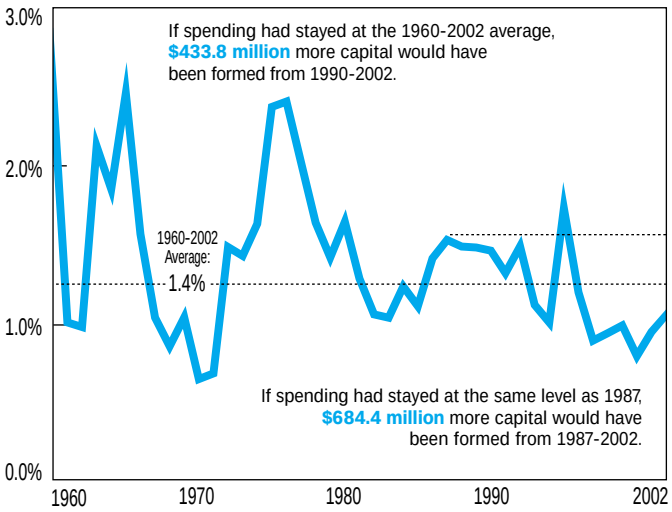


CHART 4: Percentage of Capital Expenditures Financed by Debt

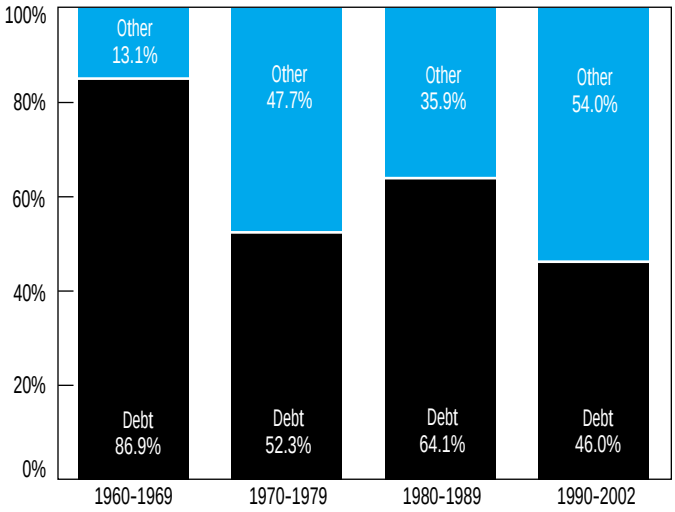
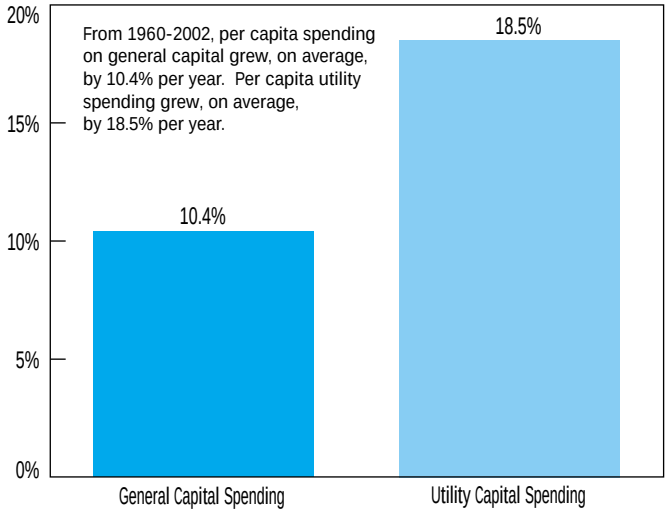


CHART 5: Average Annual Growth Rates of General and Utility Capital



SOURCES: The capital shortfall was detailed by the City in September 2003. Future capital expenditure and revenue was derived by Canada West from the Adopted 2003 Capital Budget and the 2004-2007 Capital Plan (outlined in the 2002 Budget). Additional information was secured from the 1998 *Strategic Infrastructure Review Policy (SIRP) Report.* Historical data for capital expenditures, tax revenues, debt financing, and population were derived by Canada West Foundation from the City's 1960-2002 Annual Financial Reports. Data for personal incomes in Winnipeg were secured from Revenue Canada's *Tax Statistics on Individuals (1960-2000).* To produce Chart 1 (Real Per Capita Capital Expenditures), capital spending was controlled for inflation using the the Manitoba Implicit Price Index for Government Gross Fixed Capital Formation for years 1981 to 2002, and the index for Canada for years 1960-1980 (the price index was re-based such that 2002 equalled 100.0).

NOTES: Data were not completely controlled for 1971's amalgamation. All capital data on the first page includes transit as a general capital expenditure. Capital on page two excludes transit expenditures completely due to data problems (the debt analysis does include transit). Capital excludes all educational and hospital amounts, the electrical utility (sold in 2002), and the steam heating utility. Tax revenues include general property tax, the business tax, local improvement levies, utility sales taxes, amusement taxes, and transfers from the tax reserve account. Educational taxes, revenue-in-lieu of taxes, mobile home taxes, and steam heating taxes are excluded. Income data for three years were interpolated or extrapolated due to data availability. Incomes from 1960-1970 were estimated based on Winnipeg's share of the CMA (the original data treated Winnipeg as a consolidated entity). Debt data excludes debentures issued for educational and hospital purposes, and the electrical and steam heating utilities. The 1960 value for the Implicit Price Index for Government Gross Fixed Capital Formation was extrapolated. Populations for several years were interpolated because of data inconsistencies.

More important, these estimates represent infrastructure deficits – the annual shortfall in capital funding – not the infrastructure debt. Only Winnipeg has undertaken an in-depth analysis of what its infrastructure debt looks like. In the 1998 *Strategic Infrastructure Review Policy (SIRP)* report, the City estimated a backlog of maintenance, rehabilitation, and replacement worth $750 million. In 1998, this amount was said to be growing by $84 million annually (now $188 million) yielding a total backlog by 2002 of $1.1 billion.

But other methods of estimating infrastructure deficits can also be considered. For example, Calgary and Edmonton have taken a forward-looking approach to their capital planning because of rapid population growth. Like most western cities, Calgary has developed a 5-year capital plan, while Edmonton has developed both a 5-year and a 10-year capital plan. Calgary's plan shows unfunded capital projects totalling $1.12 billion over the period on a go-forward basis. Edmonton's 5-year plan lists unfunded capital projects at $1.55 billion, while the 10-year plan estimates $3.2 billion over the next 10 years. When these amounts are annualized ($224 million for Calgary and $310 million for Edmonton), it is clear that they are higher than the 2003 estimates. This means that infrastructure deficits in these two cities will rise in the future.

Winnipeg has also estimated future needs. New infrastructure to meet changing federal and provincial regulations, accommodate growth, facilitate economic opportunities, and provide enhanced flood control could cost an additional $1.4 billion over the next 10-20 years (Manitoba Heavy Construction Association 1998b.) This raises Winnipeg's infrastructure needs to $2.5 billion, an amount rivaling that of Calgary and Edmonton.

Another method of estimating infrastructure needs comes from Edmonton and Winnipeg, both of which have engaged in asset life cycle analysis *(see Appendix 1)*. Both cities have developed an inventory of assets, their approximate capital replacement value (CRV), and their condition. The total CRV of Edmonton's assets is estimated at $18 billion. The City's Office of Infrastructure states that 2% to 4% of this amount should be spent annually on rehabilitation and replacement. Using the conservative 2% level, Edmonton should be spending $360 million to update existing infrastructure each year, but expects to spend only about $165 million annually over the next ten years. This leaves a $195 million annual shortfall (City of Edmonton 2002). Applying the same approach to Winnipeg's $13.2 billion in assets (1998 estimate) yields a cost of $264 million annually, but the City has only been budgeting about $177 million. This leaves an annual $87 million shortfall as of 1998.

However, all of this may be conservative. Some analysts suggest that the 2% to 4% range should apply only to maintenance and rehabilitation. Another 2% should be set aside for replacement assuming a 50 year average life span across all asset types (Vanier 2000b; BDO 2001). If an average of 3% is needed for maintenance and rehabilitation (even higher if there is a substantial backlog of deferred maintenance) and a further 2% is needed for replacement, then Edmonton and Winnipeg's infrastructure deficit could be even higher.

Finally, not all deficits have the same impact – some are more difficult to deal with than others. Here, we are concerned with two issues: the building of new infrastructure and the preservation and maintenance of existing assets. A substantial part of the unfunded capital needs in Vancouver, Edmonton, and Calgary is the result of growth pressures, which can be partially offset by a growing tax base, growth in property assessments, and development levies. This stands in contrast to Saskatoon, Regina, and Winnipeg, where growth rates are more modest, the focus remains on preserving the capital stock, and the funds required must come from the current property tax base. Winnipeg faces a particularly daunting challenge. As western Canada's oldest city, Winnipeg has some of the oldest infrastructure. Maintaining older infrastructure costs more than maintaining new. But this should provide little comfort to other big western cities if only because today's new infrastructure eventually becomes tomorrow's old.

PUTTING THE ESTIMATES IN CONTEXT

Charts 1 to 3 in the dataset (pages 15 to 24) track over 40 years of capital spending in Edmonton, Calgary, Saskatoon, Regina, and Winnipeg. Capital spending is measured in real per capita terms, as a percent of property taxes, and as a percent of personal incomes earned in the city. Scanning across the three measures, it is clear that capital spending has fallen in every city. The current value (in 2002 $) of this reduced spending is summarized in *Figure 6.* In the figure, the spending reduction for each city across each measure was converted into per capita dollars using 2002 population figures. This figure was then divided by the number of years under review to produce an *annual average per capita* reduction in capital spending. This number is more comparable between cities, more comparable to the various annual infrastructure deficit estimates, and provides a control for the different starting points of the reduced spending. Each *annual average per capita* reduction in capital spending for the three measures can be averaged again to produce a "bottom-line" number for reduced capital investment.

Again, the data can be viewed from a short-term and a long-term perspective. The short-term takes the high point of any measure in the 1987 to 1993 period, and calculates the value of failing to maintain that level of capital spending up to 2002. In the short-term, spending appears to have fallen the most in Regina, which records an annual average drop of $144 per capita across the three short-term measures. This is followed by Saskatoon at $135 per capita. Both amounts are higher than Winnipeg ($78), Edmonton ($72), and Calgary ($22). But, there are reasons. First, capital spending at the city level is volatile. Both Regina and Saskatoon experienced a sharp one-year spike in spending in the late 1980s, after which spending was relaxed. Maintaining such a high level of spending was never in the cards. Second, Calgary's lower drop in the short-term is due to significant increases in capital spending since 1997 to accommodate growth. But prior to 1997, spending in that city had still fallen considerably.

As such, the long-term perspective is more instructive. This view compares spending from 1990-2002 to the average seen over the entire 1960-2002 period, and calculates the difference between the two. Calgary saw the largest drop in spending (annual average of $163 per capita across the three measures) followed by Edmonton ($135), Saskatoon ($117), Regina ($63), and Winnipeg ($47). Again, the picture is not perfect. First, spending spiked in Edmonton and Calgary in the 1980s, which increases the 1960-2002 average. Such spending could likely not be sustained. Second, one of the measures sets spending against tax revenue, not total revenue. This may understate or overstate the drop for some cities relative to the others because all cities are not equally dependent on property taxes (e.g., Calgary and Edmonton receive some provincial fuel tax revenue). The smaller drop for Winnipeg and Regina reflects a lower level of capital investment by both cities over the entire 1960-2002 period.

FIGURE 6: The Value of Reduced Capital Spending Among Western Canada's Six Big Cities
(All Amounts in Actual and Per Capita 2002 $)

SHORT-TERM: Reduced Capital Spending Based on a Recent High Point		EDMONTON	CALGARY	SASKATOON	REGINA	WINNIPEG
REDUCED REAL PER CAPITA CAPITAL SPENDING	Total Actual Spending Reduction:	**$436.9 million**	**$207.7 million**	**$280.8 million**	**$285.2 million**	**$474.1 million**
	Spending Reduction Per Capita:	$647.04	$229.47	$1,314.35	$1,521.76	$751.08
	Average Annual Reduction Per Capita:	$49.77	$25.50	$87.62	$117.06	$75.11
REDUCED CAPITAL SPENDING AS A % OF TAXES	Total Actual Spending Reduction:	**$537.7 million**	**$317.2 million**	**$445.0 million**	**$367.7 million**	**$767.3 million**
	Spending Reduction Per Capita:	$796.31	$350.49	$2,083.49	$1,961.79	$1,215.60
	Average Annual Reduction Per Capita:	$61.25	$26.96	$138.90	$150.91	$86.83
REDUCED CAPITAL SPENDING AS A % OF INCOMES	Total Actual Spending Reduction:	**$908.3 million**	**$112.8 million**	**$567.6 million**	**$397.4 million**	**$684.4 million**
	Spending Reduction Per Capita:	$1,345.21	$124.62	$2,657.02	$2,120.31	$1,084.24
	Average Annual Reduction Per Capita:	$103.48	$13.85	$177.13	$163.10	$72.28
AVERAGE OF THE THREE DIFFERENT MEASURES	Total Actual Spending Reduction:	**$627.6 million**	**$212.6 million**	**$431.1 million**	**$350.1 million**	**$641.9 million**
	Spending Reduction Per Capita:	$929.52	$234.86	$2,018.29	$1,867.95	$1,016.97
	Average Annual Reduction Per Capita:	$71.50	$22.10	$134.55	$143.69	$78.07

LONG-TERM: Reduced Capital Spending Based on 1960-2002 Averages		EDMONTON	CALGARY	SASKATOON	REGINA	WINNIPEG
REDUCED REAL PER CAPITA CAPITAL SPENDING	Total Actual Spending Reduction:	**$128.4 million**	**$23.9 million**	**$25.0 million**	**$0.265 million**	**Not Applicable**
	Spending Reduction Per Capita:	$190.14	$26.43	$117.19	$1.41	
	Average Annual Reduction Per Capita:	$14.63	$2.03	$9.01	$0.11	
REDUCED CAPITAL SPENDING AS A % OF TAXES	Total Actual Spending Reduction:	**$1.798 billion**	**$2.536 billion**	**$372.2 million**	**$177.6 million**	**$338.3 million**
	Spending Reduction Per Capita:	$2,663.08	$2,802.52	$1,742.57	$947.75	$535.96
	Average Annual Reduction Per Capita:	$204.85	$215.58	$134.04	$72.90	$41.22
REDUCED CAPITAL SPENDING AS A % OF INCOMES	Total Actual Spending Reduction:	**$1.630 billion**	**$3.212 billion**	**$582.9 million**	**$285.0 million**	**$433.8 million**
	Spending Reduction Per Capita:	$2,413.96	$3,548.75	$2,728.66	$1,520.37	$687.25
	Average Annual Reduction Per Capita:	$185.69	$272.98	$209.90	$116.95	$52.86
AVERAGE OF THE THREE DIFFERENT MEASURES	Total Actual Spending Reduction:	**$1.185 billion**	**$1.924 billion**	**$326.7 million**	**$154.3 million**	**$386.1 million**
	Spending Reduction Per Capita:	$1,755.73	$2,125.90	$1,529.47	$823.18	$611.61
	Average Annual Reduction Per Capita:	$135.06	$163.53	$117.65	$63.32	$47.04

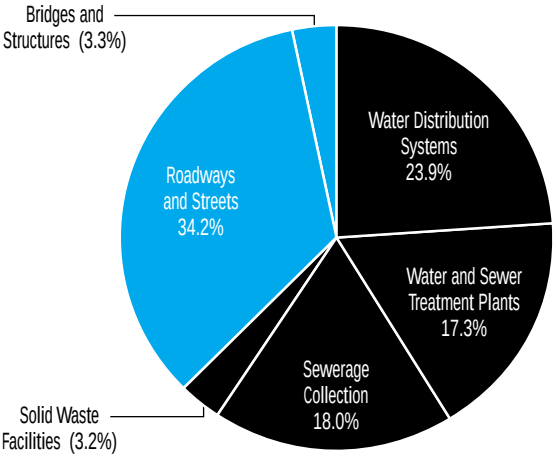
SOURCE: Derived by CWF from the comprehensive sourcing information and relevant notes on pages 13 to 24.

SUMMARY: Capital spending has fallen in each city, and the value of this reduction does not differ drastically from the size of the infrastructure deficits being reported. For example, Calgary estimates a deficit of $150 per capita, which is slightly lower than the average annual spending reduction across the three long-term measures ($163 per capita). Saskatoon's deficit of $147 per capita is only slightly higher than the average annual per capita reduction over the three short-term measures ($134 per capita). Thus, the infrastructure deficit estimates made by western Canada's big cities do appear reasonable, and indicate that capital spending needs to move back to levels before the budget crises of the early 1990s and even up to the average level of the past 40 years. Winnipeg appears to be an outlier – its deficit of $298 per capita is much larger than any measure of reduced capital spending. But this may be illusory. First, the drop in Winnipeg's capital spending may be larger than what can be accurately measured because data from 1960 to 1970 excludes the surrounding municipalities that comprise the amalgamated City of Winnipeg. Second, Winnipeg has generally had a lower rate of capital spending than other cities. Over the last five years, capital spending in Winnipeg averaged $225 per capita compared to $477 in Calgary and $400 in Edmonton. Winnipeg's deficit may appear larger than our measures of reduced spending simply because it has invested less in the past.

WHERE IS THE INFRASTRUCTURE DEBT?

Little data exist on the areas where Canada's investment in infrastructure maintenance, rehabilitation, and replacement is falling short. Most of the aggregate data speak only to the municipal context in Canada, and come from the survey-based estimates produced by the FCM and other organizations.

FIGURE 7: Where the Municipal Infrastructure Debt Lies
(Canada-Wide Data, 1996)

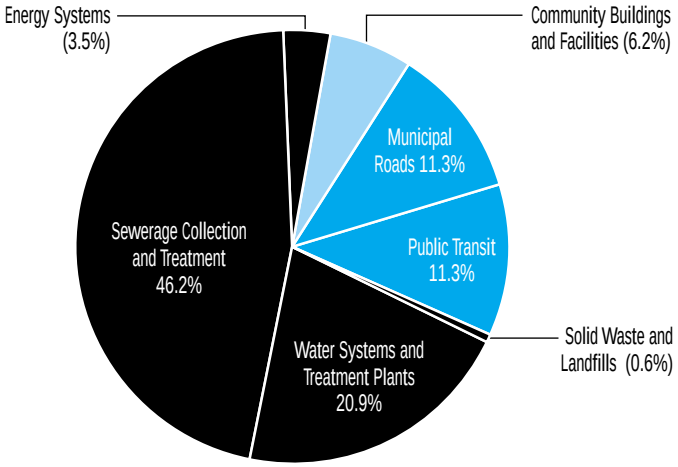


SOURCE: Civil Engineering Department at McGill University, *Report on the State of Municipal Infrastructure in Canada,* 1996.

Figure 7 provides a break-out of the Federation of Canadian Municipalities' 1995 estimate of the infrastructure debt for all municipalities across Canada. (The size of the estimated infrastructure debt in 1996 was $44 billion.) Assuming that the proportions have not changed appreciably since then, just under two-thirds of the estimated funds required to bring Canada's local government infrastructure up to acceptable standards lie in municipal environmental services or utilities. About 25% of the total estimated amount is needed for water distribution systems alone, while 20% of the total is required for sanitary sewerage collection. Much of the remainder, just over 20% of the total amount, is needed for water purification and sewer treatment and solid waste facilities.

However, the single largest area is urban transportation, which includes transit, roadways, and other related infrastructure such as bridges, interchanges, and public transit. Taken together, a backlog of maintenance, rehabilitation, and infrastructure replacement in transportation infrastructure comprises over one-third of the estimated municipal infrastructure debt.

FIGURE 8: FCM Investment Priorities
(1999 Pre-Budget Submission)



SOURCE: *Quality of Life Infrastructure Program Proposal: Federal Budget Submission to Finance Minister Paul Martin,* Federation of Canadian Municipalities, 1999.

In 1999, FCM also delivered a pre-budget presentation to the federal government, calling for a renewed investment in municipal infrastructure and highlighting certain investment priorities *(Figure 8)*. Again, water distribution and purification, and sewer collection and treatment, comprised about two-thirds of the amount (investments in social housing were removed from this illustration to keep the focus on traditional municipal infrastructure). Transportation needs (e.g., roads and transit) comprised 25% of the requested investment, with the remainder going to community buildings, municipal energy systems and solid waste and landfill facilities.

The experience of most big western cities is different. For example, neither Vancouver and Calgary report an infrastructure deficit in their environmental or utility services, and Edmonton's shortfall is minimal (see the dataset on pages 13 to 24). While Saskatoon and Winnipeg do report shortfalls in certain environmental areas, as a percentage of the total deficit it is much lower than the total municipal sector (43% of the annual deficit in Saskatoon and 38% in Winnipeg). Quite simply, the great need in the West's big cities is transportation. In each city except Vancouver, roads, bridges, interchanges, sidewalks, and public transit form at least half – but often much more – of the annual infrastructure deficit. Transportation forms 46% of the deficit in Saskatoon, 51% in Winnipeg, 52% in both Edmonton and Calgary, and almost 70% in Regina. While Vancouver appears to be the outlier, its lower amount reflects the fact that transit services are regionalized and much of the road network in the city-region is maintained by other municipalities.

The next largest unfunded area in the six cities differs, but is usually found in either community buildings, facilities, public works, and other general infrastructure (Vancouver, Calgary, Saskatoon, Regina, and Winnipeg), or in parks, recreation, and cultural and community services (Vancouver and Edmonton). Typically, few infrastructure deficits are recorded in police and fire protection, although these services do account for just over 10% of the infrastructure deficit in Vancouver.

The findings raise an important question: why are western cities reporting so little infrastructure funding problems in their utilities and environmental services, and is there a reason why transportation needs comprise such a high portion of the infrastructure funding shortfall? The answers are not readily apparent, but any explanation would likely touch on several factors. First, differing service levels do play a part. For example, Edmonton provides very few utility services (e.g., water is provided by EPCOR), and Regina did not include utilities in its infrastructure deficit analysis. While this can increase the impact of the transportation shortfall, it takes us only so far – even full service cities report significant transportation deficits.

One could point to substandard situations with regards to water and sewerage in cities outside the West. For example, several coastal cities in Canada do not treat their sewerage, but release it raw into adjacent ocean water. This is not recognized as a problem for most western cities, which typically treat sewerage before disposal. But again, many of the estimates of the infrastructure debt across the total local sector do not include substandard situations. Thus, the answer must lie elsewhere.

First, a large part of the difference could be explained by noting that the national municipal data includes rural municipalities and smaller cities and towns. While it is far from proven, it may well be that smaller centres have more difficulty in maintaining these systems.

Second, western Canada's cities are younger than the average central and eastern Canadian city. Of all municipal infrastructure, water and sewer pipes have the longest lifespan, sometimes in excess of 100 years. As such, it is likely that water and sewerage is more of an issue outside western Canada simply because that infrastructure is much closer to the end of its life cycle, and in need of more costly rehabilitation and replacement as opposed to regular and ongoing maintenance. This could also explain why Winnipeg, as western Canada's oldest city, is reporting a deficit in these systems (new provincial standards are also playing a role).

Third, transportation may constitute such a large part of the infrastructure funding shortfall in western cities simply because most environmental services such as water and sanitary sewerage are self-financing through user fees. In some cities, this also applies to solid waste and storm water drainage. This is no small consideration. Simply put, it is much easier to finance infrastructure improvements for municipal utilities as opposed to general infrastructure that relies on the tax base. Citizens understand that user fees are related to usage, and are intended to recover the operating and maintenance costs of the system as well as future infrastructure needs. If utility infrastructure does run into a problem, there is generally less opposition to the solution – increasing user fees or issuing self-sustaining debt. Transportation, particularly roadways and its related infrastructure, is funded from general tax revenue. This entails across-the-board tax increases or the issuing of tax-supported debt, which merely defers those higher taxes to some point further down the road.

Fourth, water management has always been important to the West, particularly on the prairies. A generally dry climate and more than a few periodic battles with drought have led to a focus on quality water and its management, both in the rural and the the urban context. In addition, water and sewer services are the subject of more intense provincial regulations and standards, which tend to mitigate against foregoing maintenance on these systems. City managers are also keenly aware of the high value citizens place on water and sewer services. After all, it is one thing to suffer through potholes in the roads, and another thing altogether to have both unreliable and unsafe drinking water coupled with regular sewer back-ups.

SUMMARY: The funding of utility infrastructure as compared to tax-supported or general infrastructure is brought into sharp relief by *Chart 5* in the dataset (pages 15-24). This chart tracks the average annual percentage change in the capital spending of each city's various utilities (e.g., water, sanitary sewerage, storm drainage, solid waste) as compared to the average annual percentage change in general or tax-supported capital spending (e.g., roads, parks, recreation and community facilities). Over the 1960-2002 period, average annual year-over-year increases in per capita utility capital spending are much higher for every city than year-over-year increases in general or tax-supported capital spending. This does not imply that utility capital spending is larger than general capital spending (which it is not), but simply that capital spending on utility infrastructure has a much easier time of growing. Thus, much of the infrastructure challenge in the West's big cities revolves around the financing of tax-supported infrastructure.

Chart 4 in the datasets shows what has happened to a traditional source of such funding, namely debenture debt. In the 1960s debentures were the most common way of financing capital expenditures. For most cities, at least 50% of all capital expenditures were financed by debentures, with some recording ratios as high as 85% over the decade. Since then, the use of debentures has fallen steadily for every city. In the 1990 to 2002 period, most cities were using debt for about 20% of all capital spending, although the amount for Saskatoon was much lower at 7% and Winnipeg's was higher at 46%. In turning to each city's capital plan, however, we find that this is again changing.

WHAT ARE WESTERN CITIES PLANNING TO DO?

A review of the capital plans for the six big western cities reveals a mix of good news and bad. On the positive side, most cities plan to spend more on capital in the future than in the past. Capital spending in the next five years (2003-2007) as opposed to the last five years (1998-2002) could grow by 39% in Regina, 30% in Saskatoon, 22% in Calgary and Winnipeg, and 16% in Edmonton. To be sure, a lot of this capital spending still needs final approval and some expenditures remain unfunded. For example, 15% of planned capital expenditures in Saskatoon remain unfunded and depend on incremental funding increases or additional decisions on issuing more debt. While Vancouver seems to be an outlier (the City expects a slight reduction in spending for the next 3-year budget cycle), actual expenditures may not be presented on the same basis as budgeted expenditures, which affects comparisons. For example, the budget excludes $20 million that may be borrowed for certain projects if other funding partners can be found.

Second, most cities are returning to a more reasonable position on the use of debt financing. In approving the latest Vancouver capital plan, voters gave the nod to $97 million in borrowing for tax-supported capital projects. Combined with borrowing for self-financing utilities, debt will fund about 60% of the total Vancouver capital plan. The City of Edmonton recently approved $50 million in tax-supported borrowing for 2003, with the option of approving another $200 million over the 2004-2007 period. Calgary has approved $350 million in potential borrowing over the 2003-2007 period. Combined with the debt planned for self-financing utilities, borrowing could constitute up to 20% of the total capital plan in Edmonton and over 40% in Calgary.

Even Saskatoon and Regina, both of which took a very cautious approach to debt throughout the 1990s, are borrowing again. In 2002, Regina borrowed $40 million for its utilities and Saskatoon issued $17 million in debt. Debt will fund about 20% of Regina's total capital spending over the next five years. The amount of debt financing in Saskatoon very small, but 15% of that city's capital plan is still unfunded. To complete the plan, a portion of that 15% may come from debt financing. Winnipeg remains the outlier. Due to historically high levels of tax-supported debt, the City has put a halt on any future borrowing for non-utility purposes. In Winnipeg, debt constitutes only 12% of the funding needed for the total capital plan over the next five years.

The bad news comes on two fronts. First, the expenditure profile of many cities makes it evident that not enough resources are being funnelled into those areas where the infrastructure deficits appear largest. For example, transportation needs represent 52% of Calgary's infrastructure deficit for 2003, but will only consume 35% of all capital spending for the next five years. Almost 57% of Saskatoon's annual infrastructure shortfall is in transportation, but only 29% of capital expenditures will take place in this area. In Winnipeg, 51% of the infrastructure deficit is in roads and transit, yet only 35% of all capital is going to this particular area. In Regina, transportation accounts for 70% of the annual infrastructure deficit but only 53% of capital will be spent in this area (excluding utilities which were not considered as part of the infrastructure deficit analysis). Only in Edmonton and Vancouver will planned capital spending reflect the proportionate shortfall in transportation. Transportation accounts for 52% of the 2003 infrastructure deficit in Edmonton and 24% in Vancouver. In Edmonton, 48% of planned capital spending will go to transportation, while Vancouver will spend 32% in this area. Yet despite the larger investment, a significant infrastructure deficit will remain in transportation.

All of this is not meant to suggest that some cities are ignoring the critical areas that need investment. Scanning across the expenditure profiles, it is clear that self-financing utility operations tend to be the single largest expenditure category. This is not surprising given the way they are financed and their importance to the health and safety of citizens. But transportation also commands significant resources. For most cities, it is the second single largest expenditure category. The fact is, if cities did commit a larger share to transportation, the deficit would simply widen in other areas, whether that be water and sewer services, protection, parks and recreation, or cultural and community services. The problem is clearly one of balancing a wide range of needs against limited fiscal resources.

A second piece of bad news, although it affects some cities more than others, is the level of grants expected from federal and provincial governments. In this case, the cities of Saskatoon and Regina clearly stand out. Grants will contribute only 5% of total capital revenues in the 2003-2007 period in Saskatoon, and less than 4% in Regina. As such, these cities are the most dependent on their own revenues and reserves. In Saskatoon, these sources will carry almost 80% of the future capital budget. In Regina, the amount is 76%. While current revenues and reserves will contribute 73% of Winnipeg's planned expenditures, granting levels are much higher at about 14% of total expenditures. Moving westward, the situation improves. About 20% of Calgary's expenditures will come in the form of grants and fuel tax-sharing with the province. In Edmonton, about 29% of future expenditures will come from these sources. Vancouver expects about 22% to come from federal and provincial grants. In Calgary and Edmonton alone, grants will total more than $900 million over the next five years, largely driven by the fuel tax-sharing agreement with the province of Alberta. Clearly, this is a unique situation among the West's cities. Unlike their counterparts in Saskatchewan and Manitoba, Alberta's two big cities are not as pressed to raise taxes, commit current revenues, or raid reserves to pay for badly needed infrastructure.

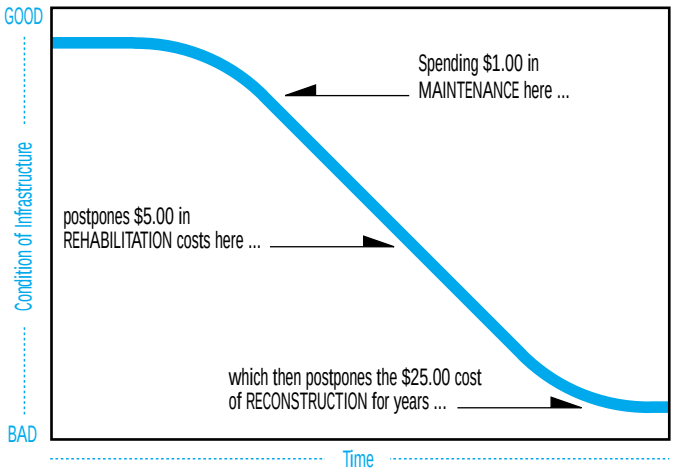
WHAT ARE THE COSTS OF FAILING TO ACT?

When government expenditures start to exceed revenues, the first thing to go is capital spending (Parsons 1992). The reason is straightforward – deferring the maintenance, rehabilitation and replacement of infrastructure has a strong political upside and very few short-term downsides. Cutting capital provides immediate fiscal relief and few citizens are likely to complain. But deferring infrastructure maintenance provides only temporary relief. There are some very significant long-term costs that can accrue from failing to invest in infrastructure.

1. Higher Capital Costs in the Future

All infrastructure has a specified lifespan. At certain points in the life of an infrastructure asset, maintenance is needed. At other points, rehabilitation is required. At the end of its useful life, replacement must occur. When maintenance of existing infrastructure is deferred, its lifespan is shortened. This means that rehabilitation and replacement costs arrive much sooner. To make matters worse, rehabilitation and replacement are much more expensive than regular and ongoing maintenance. *Figure 9* is an adaptation of what is known as *De Sitter's Law of Fives* – if required maintenance of an infrastructure asset is not performed, then rehabilitation equalling five times the maintenance costs will be required. If the rehabilitation is not effected, then replacement expenses can reach five times the rehabilitation costs. Thus, deferring maintenance today saves money, but only the initial up front costs of the maintenance. In the future, those savings evaporate quickly because they are offset by exponentially higher costs in the form of rehabilitation and replacement.

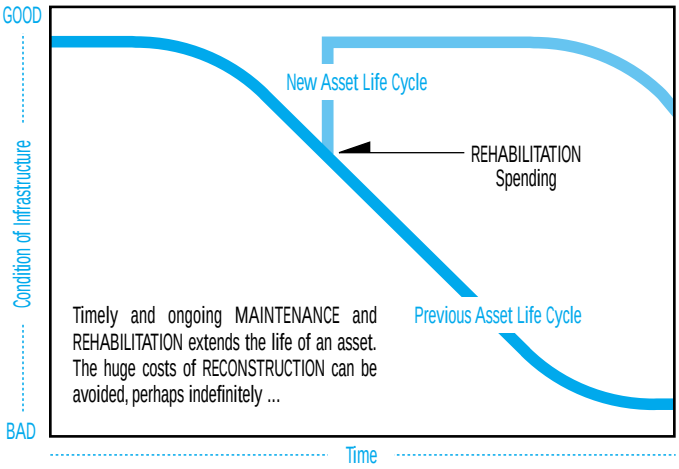
FIGURE 9: De Sitter's Law of Fives
(Relationship of Maintenance to Rehabilitation and Reconstruction)



SOURCE: Derived by CWF from *Financing Infrastructure Preservation: Challenges and Opportunities*, City of Winnipeg Public Works Department, April 24, 2001, and Vanier 2000a.

Figure 10 (page 31) shows how maintenance and rehabilitation can preserve existing infrastructure and also extend its life. When maintenance and rehabilitation are conducted at the right stage in the asset life cycle, a new asset life cycle can be formed. By undertaking the expenditure now, the huge costs of replacing an asset can be postponed. Some argue that replacement can even be avoided.

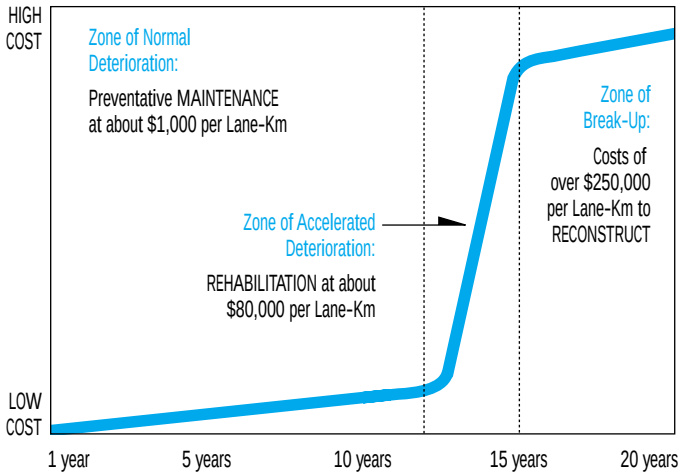
FIGURE 10: Extending the Life of an Asset
(Impact of Rehabilitation Spending)



SOURCE: Derived by CWF from *Financing Infrastructure Preservation: Challenges and Opportunities*, City of Winnipeg Public Works Department, April 24, 2001.

Undertaking investments in maintenance and rehabilitation at the right time is particularly critical with respect to paved roadways, which tend to have a short lifespan – about 20 years depending on levels of usage. For the first 12 years of a road's life, preventative maintenance can be undertaken at a cost of about $1,000 per lane kilometre *(Figure 11)*. If that is postponed, the road enters a zone of accelerated deterioration in years 12 to 15. Costs rise both rapidly and dramatically, reaching up to $80,000 per lane kilometre. If this too is deferred, the road enters a zone of break-up where complete reconstruction is needed. Costs can rise up to $250,000 per lane kilometre.

FIGURE 11: Pavement Life Cycle

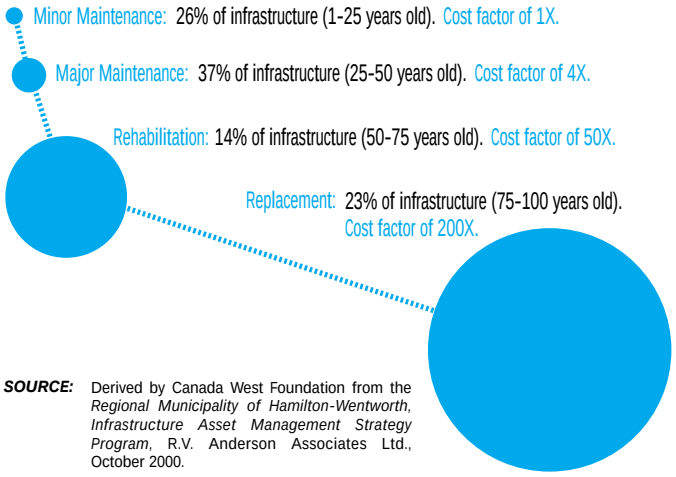


SOURCE: Reproduced by Canada West Foundation from *The Case for Increased Infrastructure Investment in the Region of Niagara* by the Heavy Construction Association of Regional Niagara and BDO Dunwoody and Associates, January, 2001.

All of this hits directly on the discussion of infrastructure deficits in the big western cities, the municipal sector as a whole, and all public infrastructure right across Canada. First, roads form a large share of big city infrastructure deficits in the West. To be sure, this is a combination of maintenance for existing roads as well as new infrastructure. But that does not change the essential point – even the smallest amounts of deferred maintenance lead to large costs in the future. Second, a good portion of Canada's total municipal infrastructure debt exists in water and wastewater systems. The same mathematical principles apply. Studies on municipal water and wastewater systems show that if minor maintenance on these systems cost $1,000, then major maintenance costs $4,000. Rehabilitation costs reach $50,000 and replacement costs reach $200,000 (City of Hamilton 2001).

A final point is made in *Figure 12*. The Regional Municipality of Hamilton-Wentworth, Ontario, states that much of its water and wastewater infrastructure (about 40%) is ready to move from the major maintenance stage to the more expensive rehabilitation stage.

FIGURE 12: Water and Sewer Infrastructure in Hamilton
(Percentage of Infrastructure in Various Stages of its Life Cycle)



SOURCE: Derived by Canada West Foundation from the *Regional Municipality of Hamilton-Wentworth, Infrastructure Asset Management Strategy Program*, R.V. Anderson Associates Ltd., October 2000.

This bubble of "baby boomer" infrastructure – built between 1945 and 1970 – likely reflects a good deal of public infrastructure right across the country. Failing to meet the current rehabilitation challenge of this infrastructure means that replacement will come much sooner, and with a price tag that far exceeds the rehabilitation costs. If the replacement cannot be funded, then the infrastructure will simply crumble.

2. Higher Operating Costs

Deferred infrastructure spending also results in higher operating costs for governments, businesses, and individuals. One recent study estimated that 25% to 30% of drinking water in Canada is lost through water distribution systems, increasing operating costs by $650 million a year. Reducing leakage from 25% to 10%

would save municipal water utilities more than $350 million per year (Félio and Mareschal 1998). Implementing the $17.4 billion in upgrades to the national highway system could save from 73-97 million hours in travel time annually. The value of these savings over a 25 year period has been estimated at $17.8 to $26.5 billion (Council of Ministers Responsible for Transportation and Highway Safety 1997). The same upgrades could also save between $1.4 and $4.4 billion over the same timeframe in reduced vehicle operating costs. The American Automobile Association (AAA) estimates that operating costs of a medium-sized passenger car can increase by 11% when travel occurs on roads in mediocre condition and 29% on roads in poor condition (Connecticut Conference on Municipalities 2002).

3. Environmental Costs

Higher operating costs imply a set of higher environmental costs as well. For example, traffic congestion in urban centres amounts to more than frustration for the commuter and lost time for the business owner – motor vehicles are fuel efficient only when operating at constant speeds. Just upgrading the national highway system alone could save between 114 and 236 million litres of fuel over the 1998-2022 period (Council of Ministers Responsible for Transportation and Highway Safety 1997).

4. Health and Safety

Much of the nation's infrastructure is directly related to promoting and maintaining the health and safety of Canadians. For example, an upgrading of national highways could prevent up to 247 fatal accidents per year, and up to 16,000 injury and 17,000 non-injury accidents (Council of Ministers Responsible for Transportation and Highway Safety 1997). However, the provision of clean drinking water and basic sanitation is even more important. Compromising these systems would carry significant costs. Improvements in basic sanitation have gone a long way in promoting the health of average Canadians, arguably more than the billions spent on acute medical care. Basic sanitation is a form of preventative health care, and if that system fails, even more pressure will come to bear on fiscally strapped provincial health budgets.

5. Economic Costs

Many argue that failing to adequately invest in public infrastructure carries an economic cost in terms of low productivity growth and lost opportunities for increases in economic output or GDP. For example, many commentators point to the multiplier effects of government capital investment. One study estimated that a $1 million infrastructure project generates 29.3 local person years of employment and $1.23 million in direct, indirect, and induced local income (based on a multiplier of 2.0 where 61% of the income earned stays in the local economy).

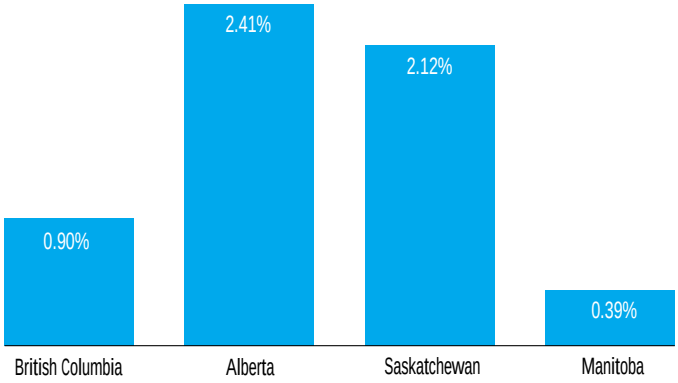
Others point to the reduced costs that accrue to business from increased public infrastructure investment. Research shows that a 1% increase in the public capital stock can produce a 0.11% to 0.22% decrease in manufacturing costs. Still others point to the positive economic development potential that comes with infrastructure investment. As global competition increases, companies looking to relocate will be attracted by good quality infrastructure from which they can draw a benefit in the form of increased profits. One 1997 study found that the second most important location factor, after the cost of labour, was highway accessibility.

Some who argue for more public capital investment point to research on the productivity impacts, where a 1% increase in the public capital stock results in a 0.1% to 0.4% increase in productivity. Investment in infrastructure maintenance has also been found to generate up to 35% returns on investment (all examples from BDO Dunwoody and Associates 2001).

MUNICIPAL INFRASTRUCTURE IMPACTS ON WESTERN GDP

The perceived economic importance of investing in municipal public infrastructure raises an important question. Would an increase in municipal capital investment lead to higher GDP in the West? To answer the question, one can estimate the percentage change in provincial GDP that results from a 1% increase in the provincial municipal capital stock in the form of a modified Cobb-Douglas production function model. (This model captures economic output or GDP as a function of two inputs – capital and labour. Capital is broadly defined as machinery and equipment, non-residential building construction, and engineering construction for all sectors of the economy. Labour is defined as the labour force.) The model assumes that an optimal level of output is attained through a combination of both capital and labour. The results of the experiment appear in *Figure 13.*

FIGURE 13: The Municipal Capital Stock's Impact on GDP
(Increase in GDP as a result of a 1% Increase in Municipal Capital Stock)



SOURCE: Derived by Canada West Foundation based on a modified Cobb-Douglas production function. Capital stock data are from CANSIM II Table 310002, Series V1078474. GDP data for 1961-1980 are from Statistics Canada Cat. No. 13-213S, and data for 1981-2002 are from CANSIM II Table No. 3800056, Series V3860248. Labour force estimates were derived from CANSIM II Table No. 2790002. Criteria used for evaluating significance are based on normally distributed standardized T-tests, within 90% confidence intervals. This modified Cobb-Douglas production function employs time series data, and is based on an ordinary least squares regression model. Dickie-Fuller tests for stationarity were performed, the results of which (although ultimately inconclusive), are indicative of the model being non-stationary (integrated of order one). These values must be interpreted with caution. The national average return to GDP of municipal capital is approximately 0.5%. There are various significance and specification tests that would have to be performed before conclusive evidence can be drawn from these results. As well, it would be useful to develop and include an error correction variable to restore the long-run predictability of the model. Such procedures are beyond the scope of this report.

Increases in the municipal capital stock were positively related to GDP in all four provinces. In British Columbia, a 1% increase in the municipal capital stock would increase provincial GDP in the short-run by 0.9%. In Alberta, it would yield a 2.4% short-run increase. In Saskatchewan and Manitoba, it would yield a 2.1% and 0.4% increase in GDP respectively. All of this is noteworthy for two reasons. First, the results include rural as well as urban municipalities (the two could not be separated given the available input data). Because municipal infrastructure is often characterized by economies of scale, the returns to infrastructure in areas of low population density are often less than in urban areas. In other words, the inclusion of the rural municipal capital stock likely understates the returns to the urban capital stock, especially considering the high rural component within some western provinces. Second, and more importantly, other model forms were estimated where the focus was shifted to the contribution made by the provincial and federal capital stocks. Although these models also indicate a positive correlation to provincial GDP, the municipal capital stock had the *greatest* influence over GDP in all provinces with the exception of Manitoba.

The value of the municipal variable for the province of Manitoba is positive, but not significant (9 times out of 10). While the reasons for this result are not entirely clear, one possible explanation likely revolves around the fact that Manitoba has the highest ratio of municipal stock to private stock of all provinces in the West. Thus, the analysis may be showing the effects of decreasing returns to scale within the provincial economy.

To be sure, no economic model is perfect. This one is no exception. The model is limited by inconsistencies in the input data and it lacks long-run predictability. In other words, the model cannot demonstrate whether an increase in municipal public capital would generate a permanent increase in GDP. But the model is still helpful if only because it underscores a consistent theme in the debate about public infrastructure and its linkages to the economy – there are deep divisions among economists on the merits of any across-the-board increase in public capital investment (Gillen 2001).

For example, the multiplier effects mentioned above, just like this model, are transitory in nature. They boost output and incomes in the short-run, but they do not necessarily contribute to long-term economic growth. Further, economic studies showing a strong correlation between higher levels of public capital investment and increases in GDP, productivity, and incomes have been hotly contested. In short, the relationship between public infrastructure and the health of the economy is not well understood (Eggelton 1995). To be sure, investment certainly remains the primary driver of economic growth and productivity, and quality infrastructure certainly attracts business and skilled talent to the local economy. But these economic spin-offs must be measured against other policy choices that may yield even more economic benefits – lower taxes, lower levels of public debt, or increased investments made by the private sector.

NEXT STEPS: Addressing the Research Deficit

Another deficit that hits directly on the ability of Canadians to sort through the infrastructure issue is a shortage of comprehensive research on infrastructure – the research deficit. There are four separate aspects to this deficit, and addressing it would advance Canada's journey towards an eventual solution.

First, there is the obvious need for solid, comparable, and more useful data to facilitate comparisons and better measure the infrastructure issue empirically. Capital investment, as currently defined and presented in the public and national accounts, does not always reflect infrastructure spending proper. Capital excludes certain infrastructure-related expenditures such as maintenance, but includes certain non-infrastructure assets such as land. Governments also need to take inventory of their assets, which would allow researchers to expand the work with asset management approaches. Winnipeg's SIRP report and the work of Edmonton's Office of Infrastructure are two examples of a step in the right direction. All of this spills over onto national

and provincial statistical agencies, which need to increase their focus on collecting and developing data that will provide relevant and useful feedstock for policy researchers.

Second, much more research is needed to deal with the highly subjective nature of infrastructure deficits and debt, particularly those questions dealing with definitional issues, data interpretation, and especially the quantifying of infrastructure needs. For example, the size and scope of any infrastructure debt is dependent on government policy. If rapidly growing cities are unable to contain sprawl, then the infrastructure needed to accommodate future population increases will by matter of course be high. However, if cities are able to dedicate themselves to more dense forms of growth through a mixture of new land use policies, tax reform, and user pay systems, then infrastructure needs will change. The prospect of innovative and new technologies could also lower the costs of replacing existing infrastructure or extending its life through better and more effective maintenance, even if those technologies have yet to be developed. Infrastructure demand management strategies and setting accurate prices that reflect the full costs of using certain services could also reduce infrastructure needs. Making a substantial investment in public transit may carry higher up front costs, but it offers the potential of lower infrastructure costs down the road by limiting the need for pavement, which has a notoriously short lifespan. In other words, more research on the way we build and operate our cities is vital to quantifying infrastructure needs. It is also part of the potential solution.

Third, more research is needed to fully understand the costs of failing to address the infrastructure issue. While there is a plethora of evidence showing increased costs in the future of deferring maintenance now, the jury is still out on the question of infrastructure's impact on the economy. Many of the other costs are highly anecdotal in nature and have not been adequately quantified. To better understand the trade-offs involved, Canadians need a better understanding of how these costs relate to increased infrastructure investment.

Finally, much more research is needed on the alternatives and options available to address the issue. Given the potential size of the municipal infrastructure debt, the options cannot be limited to infusions of federal and provincial dollars alone. Research must now go beyond estimating a number for the size of the infrastructure debt and move toward sharing concepts, developing solid and comparable data, and providing a better overall understanding of the issue.

CONCLUSIONS

A number of conclusions emerge from the six questions posed at the beginning of this study. First, there is no "right" way to estimate or measure an infrastructure deficit or debt. Whether estimates are retrospective or anticipative, whether they emerge from surveys, engineering needs assessments or notions of optimal investment, each method has its own strengths and weaknesses. With that said, all estimates do share one similarity – the numbers are invariably large.

Second, there are limited objective data to place these estimates in context. A review of past capital spending is one of the only approaches currently open. Our review of capital spending trends over the last forty years shows that investment in the public capital stock has fallen dramatically. While the value of this reduced spending fluctuates depending on the measure considered, the essential point is that the size of most current infrastructure debt estimates are not outside the realm of plausibility. If the various infrastructure debt estimates are to be addressed, investment in our public infrastructure has to move back to the levels existing prior to the fiscal belt-tightening of the early 1990s. The size of some estimates are large enough to suggest that government investment in the public capital stock has to move closer to the historical averages seen over the entire 1960-2002 period.

Third, unlike the municipal sector as a whole, much of the infrastructure challenge in the West's big cities revolves around the financing of tax-supported infrastructure – civic buildings, parks, recreation facilities, and especially roads and transit. In the past, a good portion of this infrastructure was funded through debenture borrowing. This is not the case today. Thus, it is hard to avoid the conclusion that cities have suffered as a result of the recent public backlash against federal and provincial deficits and debt. But unlike federal and provincial governments, which borrowed heavily in the 1970s and 1980s to cover day-to-day operations, cities borrow for infrastructure, something that has long-lasting value and whose costs should rightly be spread out between the generation doing the building and future generations who also stand to benefit. Too much debt is fiscally crippling, but too little debt is also far from ideal.

Of course, this also means that at least part of the infrastructure debt at the municipal level may have been self-imposed. To be sure, capital grants for most cities were severely scaled back in the 1990s and some cities are still receiving very little provincial

support. But many cities themselves also implemented policies that severely restricted their ability to debt finance tax-supported capital. For some cities, that policy may have made sense due to an inordinately high debt load in the 1980s. But some cities today have virtually no tax-supported debt (Vander Ploeg 2001). For purely political rather than economic reasons, many elected civic officials have also campaigned on the promises of zero tax increases, which in many cases is an unreasonable standard given that small incremental changes in property tax rates are sometimes necessary to ensure that tax revenues grow alongside inflation, and more important, the incomes being generated in the city.

However, things are changing. Our review of the capital plans for the various cities shows that capital spending in the next five years will increase. Cities are also coming to grips with the thorny question of what constitutes an acceptable level of debt. For most big western cities, borrowing will form a significant source of capital financing in the future (assuming that the next few years within the capital plans are eventually approved).

Finally, there are costs to not addressing the issue. The most tangible cost is higher capital expenses in the future. Deferred maintenance now means that the more costly rehabilitation and replacement expenses arrive sooner. Other hard costs include increased operating expenditures and foregone economic growth. Soft costs include negative environmental effects and threats to public health and safety. At the same time, the jury is still out on some of these costs. More research is needed to uncover whether the costs incurred to finance increased infrastructure investment produce at least a proportionate cost-savings somewhere else. In fact, the subjective nature of an infrastructure deficit itself raises important questions that need to be better explored.

The purpose of this report was to present a detailed overview of infrastructure in Canada and how the six big western Canadian cities fit into the larger picture. However, first impressions may have left the more lasting imprint on the author. Developing the capital spending database for the six western cities entailed a thorough review of the annual financial reports published by each city from 1960 to 2002. In the 1960s and early 1970s, one of the first financial schedules to appear in every city's annual report was a detailed accounting of the capital budget. What was spent? Where did the funds come from? Which projects moved ahead? Which ones did not? Why not? The significance of this should not be understated. In the 1960s and 1970s, civic leaders wanted to draw attention to the fact that they were actively building their cities. By the 1980s, however, these schedules had either disappeared from the annual financial reports or were overshadowed by details on program spending and the state of operating budgets. Not until the late 1990s and the looming threat of an infrastructure crisis did the capital budget regain its prominence.

All of this leads to another question – has public capital investment been squeezed out by continual demands for more government program spending, whether that be locally-provided community and social services, provincially-provided health care and education, or federally-funded regional development plans and business subsidies? Are Canadians, whether acting by themselves or through their governments, simply too focused on consuming the national wealth today rather than investing it to protect and even increase potential consumption in the future?

This may indeed be the case. In 1960 for example, total government investment in fixed capital formation was about 20% of total government spending on programs. By 2002, it had fallen to less than 10%. Municipal governments, which have traditionally been the builders of the government sector, were not immune either. Local government expenditures on public fixed capital formation fell from 37% of program spending in 1960 to about 19% in 2002 (Statistics Canada NIEA data).

There is also international evidence that Canadians may be consuming too much of the national wealth. In recent years, much has been said about the new economy and the need for infrastructure to keep Canada competitive. If that is the case, then the Organisation of Economic Cooperation and Development may be sounding the clearest warning yet (OECD 2002). In 2000, total public and private investment in Canada was only 14.4% of GDP. This was well behind Japan (23.8%), Australia (17.5%), France (15.5%), Germany (15.2%), and Italy (14.5%). Canada's rate of public and private investment was only a hair above that of the United Kingdom (14.2%) and the United States (14.0%). On the other hand, Canada's total government consumption was one of the highest at 21.4% of GDP. This was only slightly below France (23.4%), but well ahead of the U.K. (19.5%), Germany (19.4%), Italy (18.9%), Australia (18.6%), the United States (15.6%), and Japan (14.7%). If the lighthouse is indeed warning of a reef just under the surface, then this ship has to turn around. Negotiating that turn and preventing the ship from being dashed against the rocks will form the basis of the next Canada West infrastructure study. ■

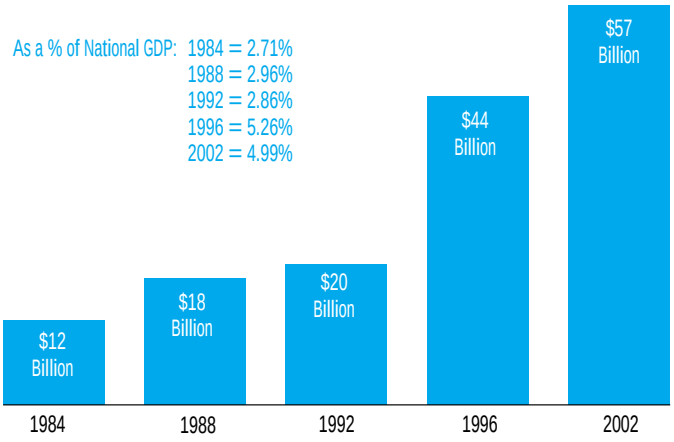
APPENDIX 1: ESTIMATING THE INFRASTRUCTURE "DEFICIT"

Since the early to mid-1980s, a number of individuals and organizations have come forward with a series of estimates regarding the unfunded infrastructure needs of various governments or selected public service sectors in Canada. While both the numbers and the methodologies differ, they typically share two similarities – the numbers are invariably large, and each method has its own set of unique problems and weaknesses.

1. Infrastructure Surveys

The most common form of infrastructure needs estimate, and the one that tends to receive the greatest media coverage, is the survey approach. With this method, researchers draw a sample of various sized municipalities, and then interview managers and engineering departments about the state of their existing infrastructure. The Federation of Canadian Municipalities (FCM) conducted the first such survey in 1984, and has since updated that original in conjunction with other organizations such as the Canadian Society for Civil Engineering and the Civil Engineering Department at McGill University. The question in the original 1984 survey was "Of your existing capital stock, how much is in need of renovation?" After conducting the interviews and tallying the results, an estimate is reached and then extrapolated for the entire population to reach a number for all municipalities in Canada. Results of these surveys are shown in *Figure 1.*

FIGURE 1: Municipal Infrastructure "Deficit" Estimates
(Commonly Cited Estimates in Billions of Nominal $)



SOURCE: Federation of Canadian Municipalities (FCM) for years 1984, 1988, and 1992; FCM and McGill University Department of Civil Engineering for 1996; and the Canadian Society for Civil Engineering for 2002.

While many of the surveys refer to the final estimate as the infrastructure deficit, it is more properly labeled the infrastructure debt. The approach is retrospective – it looks backward. It speaks to the backlog of deferred maintenance, rehabilitation, or replacement and the amount by which spending needs to be increased above baseline levels to restore existing infrastructure to acceptable levels. The estimates are not anticipative. They do not capture the investment needed to accommodate population growth or the costs of building new infrastructure to correct substandard situations such as the lack of proper wastewater treatment (Poisson 2002).

A range of other estimates, anywhere from $50 to $100 billion and higher, have also been extrapolated:

- *Estimates of the infrastructure debt for all Canadian governments:* Estimates of the backlog of maintenance on existing assets for all public infrastructure in Canada could be as high as $125 billion (Mirza 2003).

- *Estimates of how the debt will grow if no action is taken:* As seen in *Figure 1,* survey-based municipal infrastructure debt estimates have grown from $12 billion in 1984 to almost $60 billion in 2002. Some estimates peg the growth of the municipal infrastructure debt to $110 billion by 2027 if remedial action is not forthcoming (Canadian Society for Civil Engineering 2002). Others have estimated future infrastructure debt amounts for all governments in the order of $200-$300 billion and even up to $400 billion by 2015-2020 (Mirza 2003; Comeau 2001).

All of these estimates have been subjected to criticism. While one should not place too much emphasis on the ad hominem argument, some have argued that such surveys appear to be self-serving (Swimmer 1993) if only because many of them are conducted by advocacy groups with a vested interest in the issue. A more pressing concern, however, is at least one author's admission that the surveys tend to produce significant amounts of qualitative data, but little quantitative data (Mirza 2003). Finally, the biggest problem revolves around the fact that the surveys are likely measuring perceived needs as opposed to objective data. The 1992 FCM estimate, for example, was based on members filling out a "Green Card" questionnaire at the 1992 Annual FCM Conference. Measuring needs in this fashion may produce results, but may not constructively inform public policy.

A final complicating factor emerges from a set of other estimates whose methodologies are less clear:

- *A $20 billion infrastructure debt in 1985:* This estimate, put forward by the Canadian Society for Civil Engineering, estimated that the municipal infrastructure debt in 1985 was $8 billion (66%) higher than FCM's original 1984 estimate of $12 billion (Canadian Society for Civil Engineering 2002).

- *Between $12.3 billion to $25.1 billion infrastructure debt in 1989:* The Canada Housing and Mortgage Corporation (CMHC) estimated that funds needed to bring municipal infrastructure up to acceptable standards in 1989 were about $12.3 billion or 40% less than FCM's 1992 estimate of $20 billion. In 1989, an opposition task force of the federal Liberal Party estimated that $25.1 billion was needed, or 26% more than the 1992 FCM estimate (Swimmer 1993; IBI Group and Urban Development Institute 2000).

Obviously, there are significant differences among these estimates. Whether the divergent estimates accrue from different definitions or methodologies, the result is no small degree of confusion.

2. Sector Specific Studies

Several studies in Canada have offered estimates of the infrastructure debt facing specific public service sectors. The methodologies employed by these studies have differed:

- *An $88.5 billion infrastructure debt for water and sewer:* The CMHC sponsored a study by the Canadian Water and Wastewater Association (CWWA) that estimated a $28.0 billion infrastructure need for municipal water systems and a $60.4 billion debt for wastewater systems from 1997-2012 ($5.9 billion annually). The estimates were derived by taking statistics on the size of the industry, the populations served, and the level of service provided. The estimates are retrospective and anticipative – estimates were formulated based on both current and future needs. For example, the estimates reflect the amount needed to clear any backlog of maintenance on existing systems, expanding the system for Canadians who do not currently receive complete services, improving the infrastructure in other places to provide enhanced services, and accommodating future population growth (Canadian Water and Wastewater Association 1997).

- *A $17.4 billion infrastructure debt for Canada's highways:* In 1988 the Council of Ministers Responsible for Transportation and Highway Safety forged a consensus on the essential elements of a new National Highway Transportation Policy, establishing which roads should form part of the network and the minimum standards needed for design, construction, operation, and maintenance of a new system. The Council determined that the funding needed to correct deficiencies in this system was $13 billion. In 1997, the Council updated the estimate and determined that the costs had risen by one-third to $17.4 billion (Council of Ministers Responsible for Transportation and Highway Safety 1997).

- *An $83.1 billion infrastructure debt across several sectors:* A 2002 report from the Public Policy Forum pulled together several estimates from various sectors, including FCM's 1995 estimate of $44 billion for municipalities (now $57 billion), $17.4 billion for highways, and a further $3 billion for airports, $4 billion for colleges and universities, and $1.7 billion for defence infrastructure (Poisson 2002).

In all likelihood, most sector specific estimates are more methodologically sound than the survey estimates as they clearly establish the standards of service required and then use existing data to identify the funding needed to bring those standards into play. The sector specific estimates are not comparable to the survey estimates for several reasons, one of the most important being that most are retrospective as well as anticipative – they look at investment needs to maintain, rehabilitate, and replace existing infrastructure, as well as acquiring new infrastructure in the future.

3. Benchmarking From Other Studies

For comparative purposes, some researchers have referred to the estimates of various other organizations and included them as benchmarks for their own estimates. For example, the earlier CWWA study referred to several estimates made by FCM and other national roundtables regarding investment needs for municipal water and wastewater systems. Compared to the $5.9 billion annual need estimated by CWWA, FCM estimated $1.4 billion annually and other national roundtables estimated between $4.7 to $6.0 billion annually. A 1996 study by the National Roundtable on Environment and the Economy (NRTEE) estimated total unmet needs for such systems at $38 to $49 billion (McFarlane 2003).

A second set of benchmarks is extrapolated from work conducted in the United States. Some examples include:

- *A 1989 American Study:* In 1989 a Joint Committee of Congress estimated the costs of repairing America's infrastructure at about $1 trillion U.S from 1990 to 2005. If Canada's needs are about one-tenth of U.S. needs (Canada's population is 10% that of the U.S.) then that would indicate a Canadian infrastructure debt of about $100 billion (Mirza 2003).

- *A 1992 U.S. Infrastructure Review:* In 1992, an Infrastructure Review in the U.S. corroborated the $1 trillion infrastructure need of the earlier 1989 study (Mirza 2003).

- *A 1998 American Study:* In 1998, the American Society of Civil Engineers (ASCE) estimated the amount to repair existing U.S. infrastructure at $1.3 trillion, indicating a $130 billion infrastructure need in Canada (Mirza 2003; Comeau 2001).

If the total public infrastructure debt in Canada is indeed around $125 billion (Mirza 2003), then there appears to be some consistency between current U.S. and Canadian estimates. Despite the similarity, however, the obvious problem is whether the U.S. situation can be directly applied to Canada. First, many researchers, even those who are making the U.S.-Canada connection, admit that U.S. infrastructure is generally in worse condition than Canada's (Mirza 2003), which implies that Canada's infrastructure debt is smaller than the U.S. Second, there are also the considerations of currency exchange and purchasing power parities. Third, there are obvious structural differences between the two economies that mitigate against a direct comparison.

Another concern in comparing the American and Canadian experiences is that most Canadian survey estimates are retrospective, while a number of the U.S. figures appear to be looking forward over time. This may be less problematic, however, considering yet another FCM estimate in 1999. In that year, FCM prepared a pre-budget submission to the federal government. The submission stated that "an investment of approximately $13 billion annually for 10 years [$130 billion] is required to address the deficit [debt] in Canada's environmental, social, and transportation infrastructure" (FCM 1999).

4. Asset Management Approaches

Other efforts to measure infrastructure debt and deficits use an asset management approach that depends on life cycle analysis or life cycle costing. This method requires the production of specific data that can be employed to more accurately measure infrastructure needs. The approach is suited to existing infrastructure only, not to accommodating new growth.

In its pure form, the process follows six steps. First, an inventory of all infrastructure assets is conducted (what do we own?). Second, the replacement value of the infrastructure is then determined using current construction costs (what would it cost to rebuild?). Third, the age of the infrastructure or its place in the life cycle needs to be determined (how old or in what condition is the infrastructure?). Based on the above, the fourth step is to assess what types of spending are required based on the condition of the infrastructure (is it minor or major maintenance, rehabilitation, or replacement?). Fifth, a timeline is developed as to when expenditures need to be made (when do we spend?). Finally, an assessment of the annual costs to service the existing infrastructure is conducted, and then compared to the amounts spent in the past (is there an infrastructure debt?) and what funding is available in the future (is there a potential for infrastructure deficits?).

While some cities such as Edmonton and Hamilton have undertaken this type of analysis, the data requirements are so intense that it cannot be readily applied across all government sectors. However, it is still helpful. For example, the value of all municipal, provincial, and federal government infrastructure assets is estimated at some $1.6 trillion (Canadian Society for Civil Engineering 2002). Organizations that have focused on asset management, such as the National Research Council and the American Public Works Association, recommend spending between 2% and 4% of the capital replacement value (CRV) annually on minor and major maintenance and rehabilitation (City of Edmonton 2002). Others have added that another 2% of the CRV should be set aside annually to replace the infrastructure, assuming a 50 year average lifespan (Vanier 2000b; BDO Dunwoody and Associates 2001).

If these assumptions are accurate, then spending at all levels of government to maintain current infrastructure should be $80 billion annually ($48 billion for maintenance and rehabilitation at an average of 3% per year and another $32 billion for replacements at 2%). This would leave a $50 billion infrastructure deficit for the year considering that all governments in Canada spent $30 billion on fixed capital formation in 2002 (Statistics Canada 2003a).

In another study by the National Research Council, the total value of all public and private assets in Canada was estimated at $5.5 trillion (Vanier 2000b). Maintenance and repair costs for this infrastructure (at the more conservative 2% annually) would be $110.0 billion and replacements were calculated at some $86.5 billion for a total of $196.5 billion.

While the figures are interesting, they too have problems. First, it is assumed that the average lifespan for all infrastructure is 50 years, but some infrastructure, such as roads, have very short

lifespans while water and sewer pipes have lifespans in excess of 100 years. To reach an accurate estimate of what should be spent requires a detailed inventory of the assets. Second, the $30 billion spent on fixed capital formation by governments in 2002 excludes certain maintenance. As such, governments are likely spending more than $30 billion. On the other hand, the $30 billion includes the acquisition of new capital for growth purposes, which has no relation to existing infrastructure assets and should not form part of the calculation. Only if the two effectively cancel each other out will the number be accurate. Finally, while the numbers may overstate the situation, they could also be inherently conservative. Most experts agree that 2% to 4% for maintenance is insufficient if there exists a considerable infrastructure debt or backlog of maintenance (Vanier 2000b).

5. Optimizing Infrastructure

Another method of estimating whether an infrastructure debt exists, and its potential magnitude, comes from the efforts of economists seeking to understand the optimal level of public capital investment in an economy. Since the late 1980s, there have been four basic approaches to the question:

- *Aggregate Production Function Approach:* Focusing on the potential increases in GDP that accrue from increasing the stock of public capital.

- *Variable Cost Function Approach:* Measuring the degree by which production costs in the economy are lowered as a result of increasing public infrastructure investment.

- *Cost-Benefits Analysis:* Measuring the economic benefits of selected infrastructure projects against costs incurred and foregone opportunities elsewhere in the economy.

- *Growth Theory Approaches:* Isolating the effects of particular variables, such as the stock of public capital, on productivity growth in the economy or growth in per capita incomes.

All of the economic models are intended to operationalize a specific definition of infrastructure debt, that is "the gap between what we invest, as compared to what we ought to invest in our nation's infrastructure to optimize long run national wealth, productive capacity and economic efficiency" (Manitoba Heavy Construction Association 1998a). The assumption is that there exists an optimal level of public capital infrastructure investment that will maximize economic growth, incomes, or productivity growth, and any level of infrastructure below the optimizing level would indicate the presence of an infrastructure deficit or debt. The efforts of economists in this area concern themselves with the question of whether governments should be investing more in public infrastructure, and the answer depends on the linkages between infrastructure investment, productivity, and economic growth (Gillen 2001).

Most studies of this nature have been conducted in the U.S., with only a handful of Canadian studies. All the models are similar in that they are very complex, but different in that they produce widely divergent results. For example, some studies have found that public investments in infrastructure have an impact on productivity that is equal to that of private capital investment, while others have found it has no impact at all. Estimates on the returns to public infrastructure investment have been as high as 100% and as low as zero (Swimmer 1993; Swimmer 2001; Gillen 2001).

The aggregate production function approach tends to show the strongest linkages. In several reports written in the late 1980s, David Aschauer reported a high correlation between low U.S. productivity growth in the 1970s and 1980s and a lack of infrastructure spending. He found that most of the lack of growth in productivity was due to an under investment in public infrastructure. His findings also showed that returns to public capital investment frequently exceeded that to private capital (Gillen 2001). Aschauer modified his approach in a 1990 study, but still found that returns to core infrastructure spending (e.g., roads, water, sewer, and other basic tangible infrastructure) were 20 times that of private investment. Further, those results showed annual returns in the order 21% to 29% for a 1% increase in the stock of public capital, and 146% for core infrastructure investment.

What all of this implies is an underutilization of investment in public infrastructure. If public infrastructure were indeed optimal, the marginal productivities of private capital and public infrastructure investments would not have such large differences. However, while most economists do believe that public infrastructure is important to productivity, Aschauer's findings have been severely criticized. To equalize the differences between the productivities of public infrastructure and private investment that he uncovered, one economist determined that the public core infrastructure stock in the U.S. would have to increase by a factor five (Swimmer 1993).

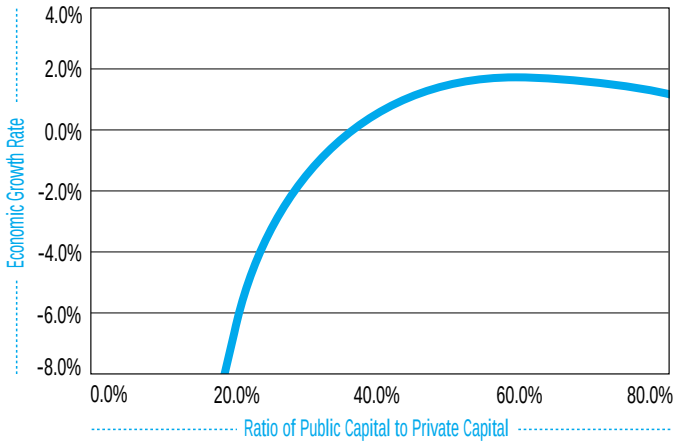
On average, variable cost function approaches have tended to uncover similar findings, but the effect of public infrastructure is smaller than the production function analyses suggest. Two studies in 1992 calculated the return to public capital based on a user cost approach, and found that public capital infrastructure investment in the U.S. was indeed too low. On the other hand, a 1996 study found that more public capital investment would be unwarranted (Gillen 2001).

Proponents of the cost-benefit approach argue that links between infrastructure investment and productivity can only be settled by moving from the aggregate to the specific by examining individual projects, selected industries, or smaller geographical areas. Results have shown that there is over investment in some areas and under investment in others. Cost-benefit analyses have found that carefully chosen investments could yield economic rates of return that are indeed higher than the average return on private capital investment, but there is little evidence that substantial across the board increases in infrastructure would be more productive, on average, than private investment (Swimmer 1993).

Endogenous growth theory models are a relatively new addition to the debate, but have yielded interesting results. This type of model typically finds that an increase in the savings rate in public capital increases the growth rate of per capita permanent income in the economy in much the same way as production function approaches. Analysts conclude that if the formation of public capital is too low relative to that of private capital, the potential returns to shifting the economy's savings toward public capital can be substantial. If the models find lasting support, the policy significance could be fundamental (Gillen 2001).

The meaning of all of this for Canada is not entirely clear since most of these studies have not quantified the value of an infrastructure debt in terms of hard dollars. There is, however, one exception. In the late 1990s, David Aschauer modified yet again his earlier attempts with a set of new studies (Aschauer 1997a; 1997b; 1997c; 1998a; 1998b). In a policy brief outlining this work (Aschauer 1998c), he states unequivocally that in the U.S., the optimum public capital stock (defined as the ratio of public capital to private capital that maximizes output or GDP growth) is between 59.7% and 63.9%, with an average of 61.0%. Public investments under that amount do not maximize GDP, and neither do investments higher than that amount *(Figure 2)*.

FIGURE 2: Public Capital Stock and Economic Growth
(One Measure of the Optimal Public Capital Ratio)



SOURCE: Reproduced by Canada West Foundation from David A. Aschauer, *How Big Should the Public Capital Stock Be?* Public Policy Brief No. 43A. September 1998. Jerome Levy Economics Institute (at www.levy.org/docs/hili/43a.html). Accessed on April 17, 2003.

This is extraordinarily high. If U.S. federal investment in the nation's stock of assets had kept pace with overall investment, the public capital stock would be some $3 trillion higher (Aschauer 1998c). If the same ratio is applied to Canada (and there is no evidence that it can or should be) the amounts are equally incredible. In 2002, the total stock of private capital (geometrically depreciated and in 2002 dollars) was some $1.928 trillion (Statistics Canada 2003b). This would mean that the stock of public capital to maximize GDP growth should be about $1.176 trillion. Since the public capital stock (including health and education) is only $607 billion, that leaves an infrastructure debt of a whopping $570 billion. Since annual spending or flows of capital (less depreciation) comprise the outstanding stocks, we can also look at this data. In 2002, private investment in non-residential fixed capital was $131.5 billion. If public investment in infrastructure were to be at the 61% range, that would imply an investment by governments of $81.4 billion for the year. Since $30.4 billion was spent on government fixed capital in 2002, that leaves a $51 billion infrastructure deficit for the year. More telling yet is the fact that Canada has never optimized in the 1960 to 2002 period – the highest ratio of public capital investment to private investment in Canada was 43.0% in 1972 (31.5% in 2002).

It is difficult to make sense out of these numbers, if only because they are so massive. To be sure, the $570 billion could be overstated due to differences in the measurement of American and Canadian public and private capital stock data. Yet despite many critics, Aschauer remains unrepentant. The core of his argument is that public expenditures on consumption activities have squeezed out the public investment role, and economies are

suffering as a result. In other words, governments need to shift from tax and spend activities that are oriented to consumption (e.g., income transfers) and start investing in infrastructure (Aschauer 1998c).

To be sure, all of the economic modelling approaches suffer from methodological flaws. The production function and variable cost function approaches are retrospective, analyzing the gains in productivity of the past, which may be completely unrelated to the productivity enhancing needs of the future, especially given the rapid pace of technological change (Swimmer 1993). The cost-benefits approach is limited to specific projects and cannot inform the infrastructure needs of the broader economy, and the method fails to account for the positive externalities or spillovers that such investments create.

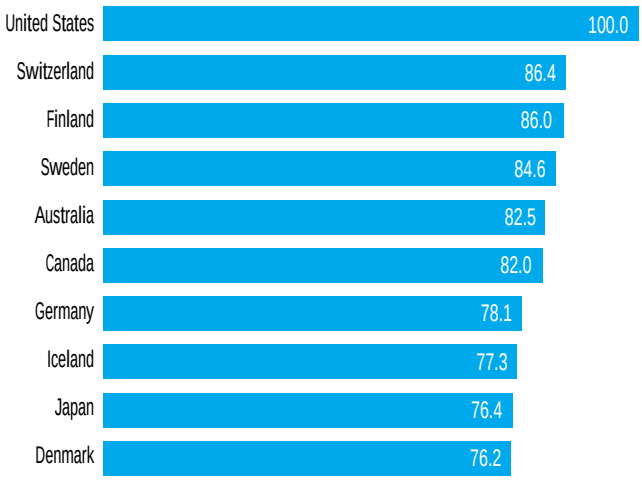
At the end of the day, there are only three firm conclusions. First, no economist disagrees that public infrastructure is a necessary and vital prerequisite to private production. Second, even the strongest proponents of increased investments in public infrastructure agree that it is subject to the law of diminishing returns – each incremental addition yields less and less additions to GDP growth until at some point, subsequent additions actually reduce growth *(Figure 2).* Third, a majority of the studies do indicate an under-investment in public capital, but there is precious little agreement as to the magnitude of that under-investment (Gillen 2001).

6. Anecdotal and Implied Deficits

Finally, there are some who imply the presence of an infrastructure debt by pointing to anecdotal examples of a potential problem, but who seldom quantify its size:

- *IMD World Competitiveness Report:* Canada's international ranking in infrastructure according to the International Institute for Management Development in Switzerland has been used to demonstrate different aspects of an infrastructure debt. For example, Canada did not have a top ranking in any of the 22 infrastructure factors included in the 1999 report. Further, Canada was not even in the top ten countries in seven of the twelve "basic" infrastructure measures. Canada ranked 45th in roads, 43rd in railways, 35th in energy, and 28th in telecommunications. Regarding maintenance and development of infrastructure, Canada ranked 15th among its competitors (Swimmer 2001). As shown in *Figure 3,* Canada is behind a number of its competitors in the 2003 report as well.

FIGURE 3: Canada's International Infrastructure Ranking
(Top Ten Countries as of 2003, 100=Top Country)



SOURCE: World Competitiveness Report, International Institute for Management Development (IMD).

Again, some cautions are in order. First, the infrastructure being measured is typically of the tangible and hard variety. It is unclear how measures of softer infrastructure (e.g., amenities, health and education facilities) are considered. Second, Canada does well in the rankings for high technology infrastructure. In the 1999 report, Canada ranked 7th in overall computing power, 6th in the usage of new information technology, and 5th in the Internet category. Thus, there are two ways to interpret such data. On the one hand, much of the report is based on subjective surveys and Canada appears to be doing comparatively well with regards to high technology infrastructure (Swimmer 2001). To be sure, this represents an important competitive edge in today's information economy. But the results could also be interpreted in the opposite direction, particularly considering that much of Canada's high technology infrastructure (e.g., cell phone towers, Internet connections, personal computers) is the result of private, rather than public, investment.

- *International Comparisons of Capital Spending:* Various authors have shown that Canada's spending on municipal infrastructure is well behind that of other industrialized nations. For example, in 1996 the average municipal infrastructure spending in Europe (average of 43 countries) was $3,150 per capita (Brittain 2002). In the United States, spending was $2,480. In Canada, the amount was $1,180 (all amounts in 1996 Canadian dollars). Others have pointed to the massive investments now taking place in the United States under the *Transportation Equity Act for the 21st Century (TEA-21),* which will total some $216.3 billion from 1998-2003 (Poisson 2002). Still others refer to the European Community's *European Regional Development Fund (ERDF),* whose 2000-

2006 budget of $175 billion (U.S) accounts for one-third of the entire EU budget and is spent based on matching funds from within the member country receiving the grants (FCM 2001). The implication is that Canada, despite several multi-billion dollar national infrastructure programs, is simply not doing enough to maintain and develop public infrastructure.

- *A Significant Reduction in Capital Spending:* Finally, it is well known that total government spending relative to GDP has steadily increased since the 1960s. But as some economists and financial analysts point out, this growth had nothing to do with increased spending on public capital. In the 1970s, the growth was driven by massive increases in spending on social programs and income transfers, and in the 1980s by sharp growth in interest payments on the public debt (Grant 1999). In fact, provincial and local government spending on fixed capital relative to private capital spending fell steadily from a high of 24% in the mid-1960s to less than 10% by 1990. While provincial and local capital spending constituted 3.6% of GDP in the mid-1960s, it had dropped to 2.0% by the early 1990s (Ip 1991).

The typical endpoint of such analyses is the implication of an infrastructure debt accumulating from years of infrastructure deficits, but the amount is not quantified. As one author states:

> *"The period of the mid-1960s to the present has been a sharp contrast. By and large, provincial and local governments have not engaged in continuous, intensive infrastructure replacement or expansion. By 1989, the ratio of [public] to private capital investment had fallen to 10%, the lowest level in 40 years... Provincial and local governments need to work together on long-term plans for such investment and to make a commitment to keep them."* (Ip 1991)

Again, however, there is the odd exception. In the early 1990s, a joint working group of federal and provincial officials concluded that there were increasing demands for better public infrastructure, which had aged and deteriorated since the mid-1970s. The group estimated that to restore the public capital-to-GDP-ratio that prevailed in 1975 would require an investment of $219.2 billion over ten years (McCracken and Sonnen 1993).

Focusing on falling levels of capital spending in the past to imply an infrastructure debt today is not without its problems if only because past trends are not always indicative of today's needs. First, during the 1950s and 1960s, Canada was experiencing the baby boom and a massive influx of immigration. Coupled with efforts to build a post-war industrial economy, the need for massive investments in public infrastructure was evident. This is especially the case for the manufacturing sector, which is more dependent on public infrastructure than other sectors of the economy. With the bulk of Canada's infrastructure in place by the 1970s, the need for more capital spending simply fell.

Second, it is clear that a driving force behind current GDP growth is the impact of technology. Technologically-driven economic growth does not necessarily imply that public infrastructure investment should, or even could, keep pace. Further, new technological industries are changing the structure and needs of the Canadian economy. It could well be that today's economy relies less on traditional and tangible public infrastructure.

Third, the 1950s and 1960s were a time when Canadian governments could afford massive investments in infrastructure. For better or worse, infrastructure today competes with a vast array of public services that were unavailable in the 1950s and 1960s. While the debate over whether Canada should have enriched its social programs, introduced public health care or engaged in expensive regional development schemes is best left for another day, it is obvious that government budgets in 2003 do not compare to budgets in the 1960s.

Finally, data on public fixed capital formation represents new additions and replacements of existing infrastructure, but do not always include regular maintenance and repair costs, which often appear as part of government operating budgets. This may overstate the drop in capital spending.

But neither is this is the end of the argument. With regards to infrastructure, the past can indeed predict the future. Once an infrastructure system has been constructed, the time will come when that system needs to be replaced. All infrastructure has a defined life. A significant portion of Canada's infrastructure was put in place in the 1945 to 1970 period, and is now reaching the end of its lifespan. If public infrastructure investments were proceeding at a normal pace across the entire government sector, one would expect significant increases at some point to reflect the replacements of the original infrastructure. But this is not borne out by the data. Perhaps more important are several recent trends, such as growing urbanization, environmental concerns, and competitive pressures from freer trade, which suggest that the public sector should be investing substantially more in fixed capital today than in past decades (Ip 1991).

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