

The Case for:
Increased Infrastructure Investment
In the Region of Niagara

Prepared for:

HEAVY CONSTRUCTION ASSOCIATION
OF REGIONAL NIAGARA

HCARN

"People Building Communities"

Prepared by:

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EXECUTIVE SUMMARY

1. Introduction

This report investigates the status of infrastructure in the Region of Niagara and the connection between investment in public infrastructure and resulting economic and user benefits. Its purpose is to build a business case that the Heavy Construction Association of Regional Niagara can use in support of promoting increased infrastructure investment. The report examines road infrastructure and sewer/water infrastructure.

2. Methodology

Information has been drawn from a number of Canadian associations and the municipalities in the Region of Niagara through infrastructure surveys completed by the Public Works departments. In addition, literature that investigated the benefits of infrastructure investment was reviewed.

Of the twelve municipalities and one Region, seven municipalities representing 84% of the population, responded to an infrastructure survey. A draft document was prepared and a review meeting was held with the Directors of Public Works (or equivalent) of Niagara Falls, St. Catharines and the Region.

3. Road Infrastructure Conclusions

3.1. Protecting Investment – there is a contingent liability of \$147.5 million to reconstruct the 590 km of 12-15 year old roads identified by the respondents. This contingent liability will become an actual liability if these roads are not rehabilitated in the next 1-3 years. The cost to rehabilitate these roads is \$47.2 million. In other words rehabilitating the roads saves \$100.3 million. There are a further 2,166 km of regional roads that are older than 15 years. The cost to rebuild these roads is \$541 million.

3.2. Attracting Investment – highway access is the #2 site selection factor (after labour cost). Without superior access Niagara will not be able to realize the full potential of the growing traffic transiting the peninsula.

3.3. User Benefits – such as reduced travel time and operating costs, and increased safety have a NPV in the range of \$634,000 per km.

4. Sewer & Water Infrastructure Conclusions

- 4.1. Protecting Investment – Based on National Research Council sewer/water maintenance and replacement guidelines (conservative estimates based on 3% and 2% of replacement value respectively) there has been a total budget shortfall of \$67.7 million in the respondents sewer/water budgets covering the period 1997 – 2000.
- 4.2. Attracting Investment – there is evidence of communities ceasing development due to the inability of the water system expand. Further, easy, cost efficient provision of water services can be a contributor to investment decisions.
- 4.3. User Benefits – no quantification of user benefits was found; however, Canadians, and in particular Hamilton/Niagara residents, rank the provision of clean water as the number one program that should be exempt from spending cuts. Clean water ranks ahead of public health, education and social assistance.

5. Common Conclusions

Research on the economic impact of infrastructure investment refers to either “highway capital stock”, “public capital stock” or “municipal projects”. There was no separate economic information on sewers/water mains; however, the public capital stock and municipal projects largely consist of highways and sewers/water mains. Further, the financial results of all three asset categories are similar. Hence for the purposes of this report the following conclusions regarding economic measures are common to both road and sewer/water investment.

- 5.1. Jobs – a \$1 million infrastructure project generates in the order of 29.3 local person years of employment.
- 5.2. Spending – a \$1 million infrastructure project generates a total benefit in the order of \$1,230,000 in Direct, Indirect and Induced local income.
- 5.3. Productivity – research on productivity impact shows there is a positive and strong correlation between investment and productivity in the order of: a 1% increase in public capital stock produces a 0.10% to 0.40% increase in productivity.
- 5.4. Costs – research on cost impact shows there is a positive and strong correlation between investment and reduction of manufacturing costs in the order of: a 1% increase in public capital stock produces a 0.11% to 0.22% decrease in manufacturing costs.

5.5. Return on investment – research on US investment impact shows that returns on infrastructure investment have dropped in the past 40 years from 40+% to 10%. This is due to diminishing benefits since the substantial completion of the US interstate highway system.

Returns in general are variable, based on the type of infrastructure investment, with investment in maintenance generating 35% returns and investment in new rural construction generating low (unspecified) returns.

6. General Conclusions

The economic impact (jobs, spending, productivity, costs, return on investment and user benefits) of infrastructure investment is positive and significant. The drawback to the evidence reviewed may be in transferring the conclusions based on large areas and long time frames, directly to Niagara.

However, any doubts about the appropriateness of increased infrastructure investment as a leading policy for economic development should be overridden by two strategic factors:

- Protecting Investment – there is a contingent liability of \$147.5 million in road reconstruction and a sewer/water budget shortfall of \$67.7 million in the past four years. The cost to replace failing infrastructure is far greater than the cost to maintain it on a regular basis.
- Attracting Investment – to attract investment and retain investment, Niagara needs to implement a program of road and sewer upgrades.

<p>Protecting Investment</p> <p>Roads: contingent liability of \$147,500,000</p> <p>Sewer/water: maintenance/replacement shortfall of \$67,700,000</p>
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It is clear from the need to protect and attract investment, and the research on the economic impact of infrastructure investment, that increased infrastructure investment is a valuable and potentially leading economic development tool for the Region of Niagara.

1. INTRODUCTION

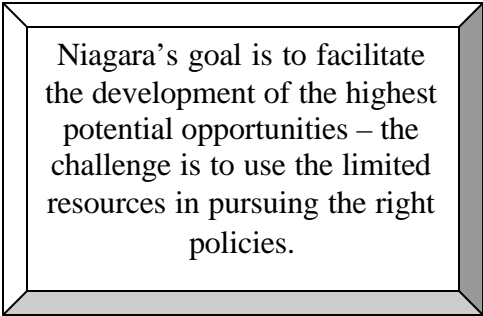
On February 15, 2000 the Heavy Construction Association of Regional Niagara (HCARN) hired BDO Dunwoody and Associates to examine the state of their industry. This work is being done in an effort to provide direction to the members of HCARN and highlight potential sources of new business.

As part of the industry review, this report will examine relevant evidence and research in attempting to reach conclusions that are applicable to HCARN's situation. It will do this by summarizing the status of the Region of Niagara's infrastructure and reviewing numerous academic, industry and government papers on issues surrounding infrastructure investment.

To collect municipal infrastructure data, a survey was developed and delivered to each municipality and the Region. In recognition of bureaucratic workloads, the survey was designed to collect general data. The purpose of this report is not to identify specific projects, but to establish the magnitude of the infrastructure status. The analysis of infrastructure is very complex and time consuming. Each Public Works department will need to conduct asset reviews to specify priority projects.

It is important to note that little economic benefit research on an area the size of Niagara was found. We must therefore draw conclusions based on analysis of much larger geographic and economic areas. There are certain limitations (discussed further under 3.3.1 Methodology) associated with the productivity, investment return and cost research; however, when considered in concert with other strategic factors, they are not material.

It is generally understood that infrastructure investment has many benefits and that these benefits outweigh the costs. The other issues relate to protection of asset investment and the attraction of new investment. As it happens, the protection of existing assets is the most quantifiable factor. It is also the most controllable of all the issues examined.



Niagara's goal is to facilitate the development of the highest potential opportunities – the challenge is to use the limited resources in pursuing the right policies.

The Region of Niagara faces many challenges in a global environment that is changing at an unprecedented rate. The Region is faced with many opportunities, threats and limited resources. The goal is to facilitate the development of the highest potential opportunities – the challenge is to use the limited resources in pursuing the right policies.

1.1. TYPES OF INFRASTRUCTURE

The two major types of infrastructure are roads and sewer/water systems. The available information and completed research in the area of road infrastructure is far more detailed than information about sewer/water systems. We believe this is for a number of reasons:

- Some sewers/water mains have useful lives of up to 50+ years, making it harder to find useful data covering the full economic life of the systems;
- Sewers/water mains are out of sight out of mind, leading to a lack of data;
- When a road falls into disrepair, it has an immediate impact on users; when sewers/water mains fall into disrepair, they may go unnoticed for years;
- In the world where there is downward pressure on budgets and upward pressure on the amount of work to be done, public works employees probably have a better understanding and pay more attention to road issues.

We refer often to research into highway capital or public capital. Highway capital refers to the investment road infrastructure while public capital refers to the investment in general public infrastructure, the majority of which is roads and sewer/water systems.

The effect on jobs between pure roads and a mix of municipal projects is marginal, with the mix of municipal projects having a slightly higher level of local inputs and therefore having a more beneficial impact on local jobs, spending, etc. In any case the net effect between the two is minimal (Sonnen 1997).

Where we have information specific to sewer/water systems it is noted. In other cases we are comfortable that the references to “public capital” are applicable to sewer/water systems.

2. STRATEGIC ISSUES

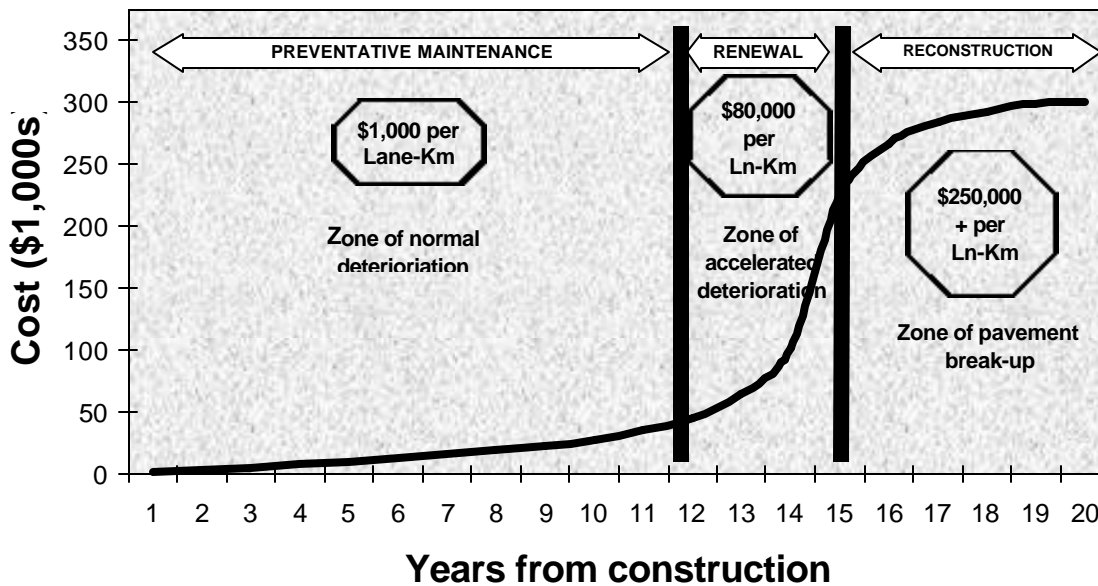
2.1. PROTECTING OUR INVESTMENT

2.1.1. Roads

The recent trend in Ontario highway infrastructure is alarming. According to the Ontario Auditor General the status of highway capital has worsened with now a full 60% of roads being substandard or poor. From our surveys in Niagara we know that 10.9% of respondent’s roads are between 12 and 15 years old. See the Exhibit A – Niagara Municipal Infrastructure Survey – Roads Summary.

The trend in funding has also been alarming. While trying to lower taxes and cut expenses, municipalities have been subject to downloading of services. Where infrastructure maintenance and capital has fallen victim to fiscal restraint, a potentially disastrous financial situation is developing.

Chart 1 - Road Cost Over Time



The life-cycle costs of maintaining roads need examining. For the first 12 years of a road’s life, the costs of maintenance are quite low – approximately

\$1,000 per lane/km. Between years 12 and 15, the road enters a phase of accelerated deterioration and the cost of renewal rises to \$80,000 per lane/km. By delaying the “renewal” of the road between years 12 and 15, the infrastructure begins to break-up, at which point the road can not be renewed, but must be reconstructed. The cost of reconstruction jumps by a factor of 3 to \$250,000 per lane/km. In other words delaying major maintenance by 1-3 years triples the cost to \$¼ million per lane/km. See Chart 1 – Road Cost Over Time.

Applying these ratios to roads represented in the Municipal survey, has surprising but powerful results. The respondents have a total of 590 km of roads between the ages of 12–15 years. These roads represent a contingent liability of \$147.5 million to reconstruct them if they are not rehabilitated in the next 1-3 years. The cost to rehabilitate them is \$47.2 million. Rehabilitation avoids \$100.3 million in unnecessary costs.

The cost of safe roads triple between years 12-15. Niagara has a contingent liability of between \$147.5 million if \$47.2 million is not spent to rehabilitate those 12-15 year old roads.

We can also conduct a life cycle cost analysis – see Exhibit B - Road Life Cycle Costs. Based on these figures, the net present value of life cycle costs per lane-km is 62% more expensive if roads are reconstructed in year 16 than if they are regularly rehabilitated. Even if reconstruction is delayed until year 20, resulting in the potential for unsafe roads, the NPV of life cycle costs per lane-km is still 31% more expensive than regular rehabilitation. Maintaining roads less expensive (and safer) than letting roads begin to break-up and then reconstructing them. Delaying investment is false economy.

Life cycle costs under regular rehabilitation are 62% and 31% lower than reconstruction at 16 years and 20 years respectively.

2.1.2. Sewer/Water Systems

Similar models for sewer/water systems comparing required investment based on age and integrity of the infrastructure do not exist. Determining the status of underground infrastructure is very difficult. Age is not the only determining factor when evaluating a system's condition (Strategic Alternatives, et al, 1999). For example, the occurrence of water main breaks is associated with:

- Small pipe diameter (less than 300 mm);
- Unlined cast-iron pipes;
- Climate – freeze/thaw cycles;
- Pipes in contact with other underground structures;
- Maintenance practices;
- Subsurface soil conditions (1 year in a corrosive clay soil may be worse than 30-40 years in a non-corrosive sandy soil);
- Systems demands;
- Original construction methods;
- Ground water infiltration or blockage.

Instead of a life cycle cost model we can compare annual maintenance and replacement requirements for average systems. The National Research Council of Canada suggests that maintenance and repair expenditures be at least 2-4% of the capital replacement value per year. A bare minimum of 4% is recommended for sewage treatment plants. Further, a municipality should be setting aside 2% of replacement value per year based on an average 50 year life span.

Based on NRC figures, the municipalities that responded to our inventory survey should be investing annually \$27.5 million on maintenance and repair and a further \$18.3 million for replacement. The total budget should be \$45.8 million for the respondents. See Exhibit C – Summary of Sewer/Water Budget Shortfall 1997-2000.

For the years from 1997 – 2000, the sewer/water maintenance and replacement budgets were \$67.7 million below NRC guidelines. This is the equivalent of an annual 37% budget shortfall. In other words, 37% of the sewer/water systems are not being maintained or replaced at acceptable levels.

Typical failure of sewer/water systems involve infiltration and leakage respectively. Industry averages for these types of failure indicate that infiltration can represent 25% of wastewater and leakage can waste 30% of

drinking water. In both cases extra water needs to be treated, leading to increased chemical, electrical and labour costs. As these three items are the main expenses of water and wastewater treatment faulty water distribution and collection systems can be the source of unnecessary expense.

Respondents' sewer/water systems have been under funded to the amount of \$67.7 million in the past 4 years.

2.2. THE ROLE OF LOGISTICS

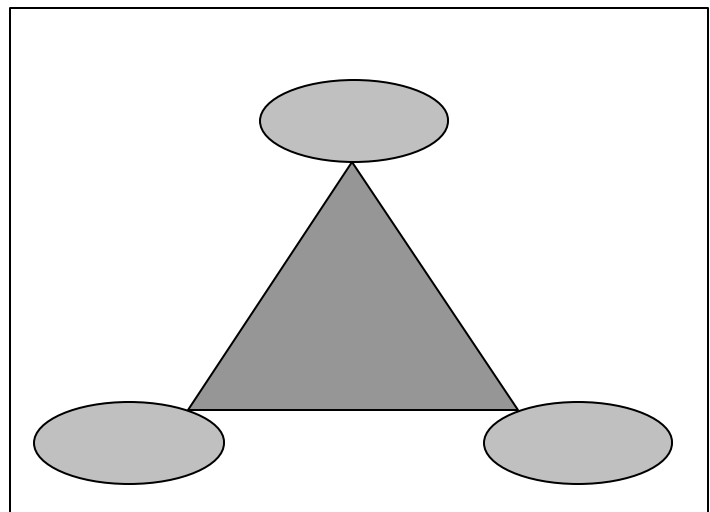
Infrastructure investment plays an important role in improved logistics and therefore is a powerful lever in reducing costs and increasing productivity. It is worth examining how infrastructure drives logistics and the impact logistics can have on local economies.

Reducing Costs - New or improved highways can: reduce the costs of acquiring raw materials and delivering goods to markets by reducing travel time, vehicle operating costs and improving safety; improve coordination of supplies, driving implementation of Just-In-Time inventory systems leading to reduced inventories, time, carrying costs, theft, breakage, etc. It is important to note that JIT systems do not just rely on quick delivery – they depend on time definite delivery i.e. arriving at 1 p.m. not before 1 p.m. Congestion leads to unreliability which makes time definite delivery impossible.

Securing Inputs - Better highways allow access to a wider market of inputs such as labour and materials. The wider market means there is a greater selection of cost, ability, quality and availability. This drives down costs, while increasing quality and productivity.

Reaching Markets - Improved highways facilitate access to wider output markets. Reducing time to transport expands range that goods can be transported in a given timeframe (crucial for perishable goods, but important for non-perishables). Reduced costs boost productivity. Better quality access means less in-transit damage to goods, and lower operating costs.

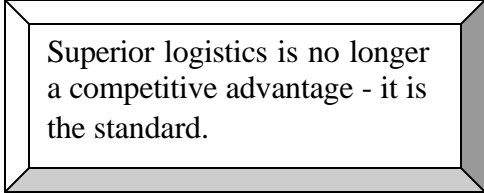
Business Decisions - Better highways can fundamentally change the way business is structured and operates. Added flexibility – allowing manufacturers greater options for customizing acquisition of suppliers and marketing of products such as more frequent, smaller deliveries which help to reduce customer inventories.



Greater Corporate Specialization – superior transportation (including connection to air transport), creates opportunities to strategically align business locations and take advantage of tax, labour, property and trade conditions as appropriate. Without easy access, the company would not be able to communicate (distribution of knowledge or product) between locations or monitor efficiently.

Summary

Without superior infrastructure, the use of logistics as a powerful driver of productivity is not an option. Any community can develop the infrastructure needed for logistics based productivity improvements. What was once a competitive advantage is now becoming standard operating procedure for successful communities.



Superior logistics is no longer a competitive advantage - it is the standard.

2.3. INVESTMENT LOCATION DECISIONS

2.3.1. Roads

Consider the ongoing changes in the business environment. The free movement of people, capital, ideas, enabling systems such as JIT and the internet and outsourcing of non core competencies has led to truly global competition – global competition for local companies not just with our nationals and multinationals.

If the idea that Welland is competing with Singapore is not immediate enough, then think about the activities of our neighbours – Hamilton, Toronto, Boston. Boston is a day's trucking away and could either feed southern Ontario or be fed by southern Ontario. Boston is well into the "BIG DIG", a US \$10.8 billion (an amount almost equal to the entire Canadian National Highway System upgrade requirement) transportation project with the goal of burying a major highway to relieve congestion. Completion is scheduled for 2004.

With global competition and global logistics systems, companies looking to make major investments (jobs, taxes, expanding skill base) in our communities will conduct a lot of analysis. Top of their list is to decide if we are "on-the-map" or not. In fact a 1997 Site Selection Survey found that the second most important location factor, after the cost of labour (Area Development 1997) was highway accessibility.

Selection of Location Factors

- 1) Cost of labour
- 2) Highway accessibility**
- 5) Telecommunications
- 18) Airport accessibility
- 22) Rail accessibility
- 23) Water accessibility

2.3.2. Sewer/Water Systems

There is evidence of communities (i.e. Niagara-on-the-Lake in the 1980s) that are forced to cease or delay development due to the inability of the sewer/water system to expand. Such situations are seldom planned, showing that lack of knowledge about the system can lead to unforeseen major capital outlays. On the other hand, easy, cost efficient provision of water services can be a contributor to investment decisions. In particular, many industries require

a reliable, quantity of water and the ability of the sewer and treatment system to accommodate its effluent.

Of particular interest to Niagara should be the impact on potential investors of outstanding legal liability, such as the \$30 million class-action suit by Fort Erie ratepayers against the Region and town. This was caused by discoloured and contaminated drinking water supplied by 134 km of cast iron mains. The cost to supply and install the entire 134 km is in the order of \$19.4 million to \$33.5 million depending on the size of water main¹. Regular maintenance and proper condition of the pipe would avert the legal liability and the major capital cost to replace the system.

¹ Greater Toronto Sewer and Water main Construction Association, 1999

2.4. SUPPORT FOR EXISTING INDUSTRY

Just as superior infrastructure can position a community to attract external development, highway and water capital is important to existing industry. All the logistics, productivity and cost evidence is equally applicable to existing firms, and in some cases more important because these firms are the current tax base.

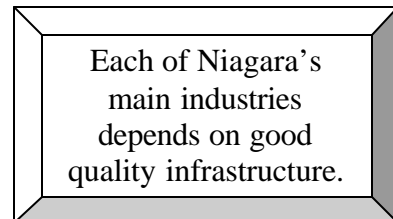
Each established and growing industry relies on infrastructure access:

Tourism – good quality infrastructure is essential for establishing professional tourism experience and encouraging repeat visits and referrals; links from main highways into communities are required for development of any tourism site – it is the nature of tourism that the customer gets delivered to the good, not vice versa.

Wineries – the obvious connection is with reduced costs of product delivery; many wineries are also providing tourism experiences (tours, restaurants, education) and need good access.

Agriculture and Horticulture – Niagara has two-thirds of Ontario's fruit orchards and 22% of Ontario's greenhouse space. The greenhouse industry is growing by 5-10% annually. The benefits of superior access covered in the section on logistics are all applicable, both for flexible, delivery of product and better access to labour markets.

Manufacturing – 35.6% of the industrial base is in transportation/machinery². Clearly this major sector would benefit by immediately leveraging the improved access into cost savings and better market access.



Each of Niagara's
main industries
depends on good
quality infrastructure.

Call Centres and Telecommunications – A cluster of supporting factors have developed in Niagara to support these industries, including, available bilingual labour, operator training and management training at area education institutions, telecommunications infrastructure (fibre-optic corridor and "smart" buildings) and access to major Canadian and US markets. This is one of the fastest growing sectors, meaning Niagara will need to continue to provide easy labour market access.

² Business Directory 2000.

Commuters – while not an industry, 40% of Niagara residents commute between the municipalities for employment. Better access would generate real benefits in terms of more personal time, lower fuel and running costs, fewer accidents, etc.

2.5. DEVELOPMENT OF NEWER INDUSTRIES

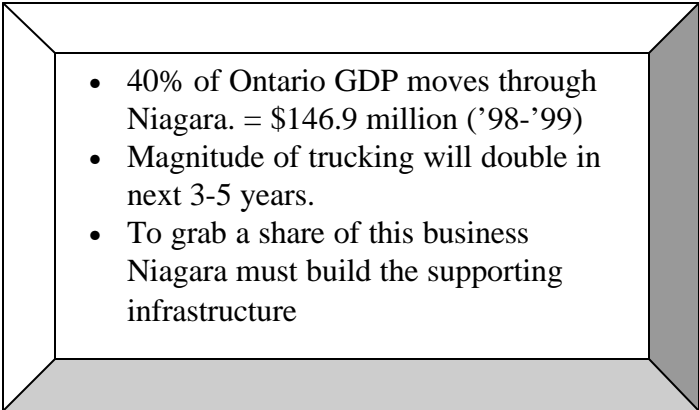
An accurate analysis of potential businesses for Niagara to attract is beyond the scope of this report. However, there is one clear opportunity based on Niagara's competitive advantage. That advantage is location, and such location advantage is very difficult for competitors to erode.

Consider that 75% of Canadian freight shipments by value travel by road. Future passenger traffic growth will be modest due to market saturation, higher costs and demographic shifts. On the other hand trucking will continue to gain market share particularly in trans border markets (Blanchard 1996).

This is largely being driven by the North American Free Trade Agreement (NAFTA), but also has to do with the rising potential of logistics and the use of the internet. Blanchard goes on to state that "Canada will specialize in higher value-added industries whose movement relies on highway transportation".

The magnitude of this trade between the U.S. and Canada according to David Bradley, head of the Ontario Trucking Association will double over the next three to five years. Further, more than 40 per cent of Ontario's gross domestic product³ moves by truck through the Niagara border-crossing area and that's a key reason both nations want a second Peace Bridge span over the Niagara River. Says Bradley "we simply don't have the infrastructure on the Canadian side to support that kind of growth" (Bradley, 2000).

While the traffic transits Niagara, its destination is the Greater Toronto Area (GTA). By failing to create an attractive business environment (lower cost structure, lower taxes, simpler regulation, etc) and failing to create the road infrastructure that allows Niagara to capture the truck traffic, Niagara's greatest competitive advantage will be wasted and its greatest opportunity lost.

- 
- 40% of Ontario GDP moves through Niagara. = \$146.9 million ('98-'99)
 - Magnitude of trucking will double in next 3-5 years.
 - To grab a share of this business Niagara must build the supporting infrastructure

³ Ontario GDP for 1998-1999 = \$367,190,000,000 at market prices, Table D6, 1999 Ontario Economic Outlook and Fiscal Review.

The role of sewer/water infrastructure is less obvious but just as crucial. New development will require increased sewer capacity to ensure future supply of good quality, abundant water to all users. To meet these needs, existing deficiencies need to be dealt with now.

3. ECONOMIC IMPACT – THE HARD NUMBERS

3.1. PROFILE OF THE CONSTRUCTION INDUSTRY

In Canada

- 94% of construction firms are Canadian owned
- 90% of firms have less than 20 employees
- 75% firms have less than \$250,000 annual revenue
- Industrial and Heavy Construction industry provides 11th best wage in Canada

Industry	Weekly Wage	Rank
Other financial intermediaries	\$1,296.21	1
Tobacco products	\$1,292.33	2
Refined petroleum and coal products	\$1,100.14	3
Paper and allied products	\$961.64	4
Primary metals	\$958.48	5
Computer and related services	\$938.05	6
Insurance (excluding agencies)	\$910.79	7
Transportation equipment	\$905.93	8
Chemical and chemical products	\$889.30	9
Beverages	\$889.01	10
Industrial and heavy (engineering) construction	\$886.56	11

Source: Statistics Canada, CANSIM, Matrix 4288.

Construction firms are almost exclusively Canadian owned small sized enterprises. This sector of the economy is a strong generator of jobs and keeps profits in Canada.

In Ontario (1998)

- \$30 billion in sales of which approximately 50% is non-residential.
- Employs 292,000 people.
- Approximately \$9 billion in wages and \$4 billion in taxes.

The construction industry is Ontario's second largest employer in the goods producing sector after manufacturing, and the eighth largest in all of Ontario.

In Niagara

- Average income in Niagara is \$36,460⁴; average industrial and heavy construction income is \$44,328 (22% higher). Average annual HCARN⁵ employee income:

Wages	Total	Average/firm	Average Wage
1999	\$22,830,894	\$ 951,287	\$ 48,166
1998	\$25,979,027	\$1,082,459	\$ 53,173
1997	\$22,041,162	\$ 918,382	\$ 47,503

HCARN employees earn an income substantially above (32%) the average for Niagara and above (9%) the average for the construction sector.

- HCARN members have 1999 annual sales of \$79.0 million, with an average of \$3.3 million/firm.
- HCARN members accounted for 68% of the 1997-98 municipal infrastructure budgets, and only 49% of the 1999 municipal infrastructure budgets.

Conclusions

HCARN and other Niagara construction workers earn an above average wage. HCARN's participation in the annual infrastructure investment has dropped dramatically, indicating that the full benefits of infrastructure spending are not accruing to communities in the Region.

3.2. JOBS AND SPENDING

There are a number of estimates regarding the creation of jobs and resulting spending based on infrastructure projects. The general consensus closely matches a model for the Niagara region developed by Cirello (1996), which is reproduced here with some modification⁶.

Person Years of Employment Based on \$1 million infrastructure project

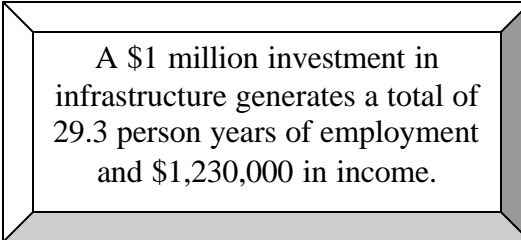
Direct	Indirect	Induced	Total
11.9	6.2	11.2	29.3

⁴ FP Markets Canadian Demographics 2000.

⁵ HCARN information from the HCARN Member Survey Results report, BDO Dunwoody, 2000.

⁶ The induced component was deemed optimistic and has been reduced in line with other estimates.

The local income from a \$1 million investment and based on a multiplier of 2.0 (Canadian average is usually about 2.1, and ranges from 1.5 to 2.5) is a total of \$1.23 million. It is important to understand that the construction sector has a high component of local labour and material, and therefore there is little income or benefit that leaks outside the Region. In this example it is estimated that 61% of the initial \$1 million investment is kept within the region. Investments that are used to purchase materials or labour from outside the Niagara region are less efficient at generating wealth within the region.



A \$1 million investment in infrastructure generates a total of 29.3 person years of employment and \$1,230,000 in income.

3.3. PRODUCTIVITY AND COSTS

Since the late 1980s there has been a large amount of research conducted on the impact of infrastructure investment on national productivity. This flurry of interest was sparked by Aschauer (1989) who reported a correlation between the drop in US annual output growth rate and the drop in infrastructure investment. The conclusion was that increasing such investment would boost productivity.

3.3.1. Methodology

Subsequent research papers found evidence both to support and criticize the original hypothesis. Further, the supportive evidence has not always been consistent. This is due to a wide range of factors:

- Long time frame – studies cover many decades;
- Variety of methodologies;
- Different definitions of public capital stock i.e. public schools have an impact on productivity but it is very long term;
- Complex relationships;
- Lack of easily comparable test populations – i.e. US is different from Canada, 1940s-1960s different from 1960s-1980s, etc.;
- Different or combined industrial sectors used in studies.

Notwithstanding these factors, there is sufficient evidence to suggest the impact of infrastructure investment is positive on an aggregated basis i.e.

across the US. For the purposes of this report we are interested in a much smaller region than is usually represented. Most studies use a macro approach which assesses the impact of many completed projects over a large geographic area covering many years. Ideally we would require a micro approach that produces a cost – benefit analysis on a case by case basis.

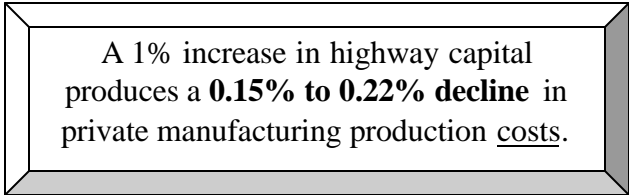
It is not within the scope of this project to conduct such an analysis; however, there is sufficient quantitative and qualitative evidence to draw conclusions that are applicable to Niagara.

3.3.2. US Evidence

There is general consensus that the US interstate highway system is largely complete and that there are fewer opportunities for the large productivity gains experienced during the past 50 years when the system was being built – the “network⁷” benefits are largely exhausted.

Such large returns as those created by the building of the highway network may well be experienced through similar investment in other “networks” such as airports (close to its peak), telecommunications, and the internet.

With this as a background, we can report that estimates of the public impact of infrastructure investment range from highly positive to marginally negative with most studies indicating a positive relationship.



A 1% increase in highway capital produces a **0.15% to 0.22% decline** in private manufacturing production costs.

A range of studies indicates that a 1% increase in highway capital can provide increases in private sector productivity in the range of 0.4% to 0.6%. This is a remarkable result and is generally attributed to the high returns generated from the 1950s when the US interstate system was being built.

A well regarded study suggests that the average cost elasticity of total highway capital for the private manufacturing sector was between –0.15 to –0.22 versus -0.04 for the national economy (Nadiri and Mamuneas 1996).

⁷ Network benefits refer to the growing value of a system to each user as the system increases in size, incorporating more users, locations, etc.

This means that for a 1% increase in highway capital, there was a 0.15% to 0.22% decline in costs for the private manufacturing sector. This would equate to a similar increase in productivity.

The following table shows cost elasticities by industry based upon increases in infrastructure and research and development. The results show that for a 1% increase in either infrastructure or R&D, there is a corresponding decline in costs for the specified industry.

Cost elasticities by industry (Nadiri & Mamuneas 1994)

	Infrastructure	R&D
Paper and allied products	-0.14	-0.02
Chemicals and allied products	-0.15	-0.03
Petroleum refining/related industries	-0.21	-0.01
Rubber products	-0.14	-0.03
Stone, clay and glass products	-0.15	-0.03
Primary metals	-0.12	-0.04
Fabricated metals products	-0.13	-0.03
Machinery	-0.12	-0.03
Electrical equipment	-0.14	-0.05
Transportation	-0.11	-0.06
Scientific instruments	-0.17	-0.04

According to this study the beneficial impact on costs is approximately 4 times greater for infrastructure than for R&D. These figures are in line with the Nadiri and Mamuneas results for highway capital stock.

In other words, to reduce costs and boost competitiveness in the above listed industries, there is more leverage to be gained from government investment in infrastructure than in R&D.

3.3.3. Canadian Experience

There is a significant body of US and international research, and fewer Canadian studies. In addition to issues raised under 3.3.1, one argument against drawing conclusions from the US evidence for use in Canadian situations relates to climate – due to greater maintenance costs, development effects may be less than average. Alternatively, given our harsher climate and geographic dispersion, highways could be more important and have a more significant impact on development than in the US.

For our purposes, Niagara with its moderate climate, is not appreciably different from the typical US area.

The following table summarizes prominent Canadian studies.

Author	Basis	Result
Informetrica (1989)	1% increase in the ratio of government engineering to private capital stock	a 0.53% increase in the productivity of private capital
Khanam (1996)	1% increase in public highway capital stock	0.11% to 0.60% (National time series) 0.08% to 0.36% (Provincial pooled Data) in productivity of goods producing industries
Wylie (1996)	1% increase in public capital stock	0.308% increase in output of direct goods sector capital stock per person-hour worked
Khanam (unpublished)	1% increase in public highway capital stock	-0.07% to -0.22% reduction in private sector production costs

In short, the Canadian experience is similar to the US evidence. Public infrastructure has a strong and positive role to play in our national economic growth and productivity. Specifically a 1% increase in public capital stock

generates economic benefits in the range of a 0.10% to 0.40% increase in productivity or a 0.11% to 0.22% decrease in costs.

Canadian results – a 1% increase in public capital generates a productivity increase in the magnitude of 0.10% to 0.40%.

3.3.4. RETURN ON INVESTMENT

On an aggregate basis annual returns from infrastructure investment are in the 10% to 40% range. This is quite high, and as mentioned earlier probably due to the high returns and network benefits produced during the early part of the study period. A more acceptable estimate comes from Nadiri and Mamuneas (1996) who calculate the average social return in the US from 1950-1989 as 28%, falling to 10% in the 1980s.

Also applicable to our situation, are the estimated returns for different types of infrastructure investment. For example as projects move from main highways

to rural roads, the expected return drops. Further, as the type of work shifts from highway maintenance to upgrading above minimum standards the returns drop. The following rates show a range of returns based on what type of highway investment is made (Gramlich 1994):

Road maintenance generates returns of up to 35%.

Real Rates of return on Highway investment

Type of Investment	Real Return
Maintenance	35%
New urban construction	15%
Upgrading sections not meeting minimum standards	5%
New rural construction	Low
Upgrading sections above minimum standards	Negative

3.3.5. SUMMARY

The lack of Canadian research on small geographic areas makes it impossible to draw conclusions with high confidence. However, there is a body of research that gives us reasonable assurance that public infrastructure (road and sewer/water) investment:

1. Has a positive and significant impact on productivity in the range of 0.10% to 0.40% increase for a 1% increase in public infrastructure capital;
2. Has a positive and significant impact on costs in the range of 0.11% to 0.22% decline for a 1% increase in public infrastructure capital;
3. Has a rate of return in the range of 10% to 35% with rural projects lower and maintenance projects higher within the range.

4. BENEFITS – THE SOFT ISSUES

There are a number of infrastructure investment benefits, sometimes referred to as quality of life benefits, that accrue to users of infrastructure. These benefits have not been captured in the academic studies discussed in the previous section but are important real benefits and are usually felt more quickly than the economic indicators.

4.1. HIGHWAY BENEFITS:

Reduction in travel time – increased personal time; reduced cost to transport due to fewer congestion and poor surface delays.

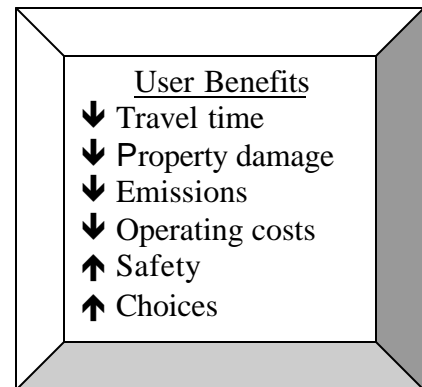
Reduced property damage – to vehicles, transported property, physical property and infrastructure.

Reduced emissions – less congestion would reduce emissions per vehicle; of course subsequent vehicular traffic growth could result in increased total emissions.

Reduced operating costs – reduced congestion and smoother roads, reduce fuel, maintenance and repair costs while prolonging the life of vehicles.

Increased safety – less congestion, smoother roads, better signage and less road rage leads to fewer fatal and non-fatal accidents.

Increased choices – improved mobility and accessibility contribute to the quality of life by expanding the choice of work and leisure opportunities; also improves access to health care and education, generating long-term social benefits.



From the National Highway System report (Council of Ministers Responsible for Transportation and Highway Safety 1997), we can estimate the economic benefit of such changes. According to the report, Canada's national highway infrastructure requires a \$17.4 billion investment to bring the entire system up to standard. If that investment was made at "once", benefits to users would be:

Benefit	Annual Benefit (range)	Average benefit/km ⁸
Travel time	Saves 73-97 million hours	3,483 hours
Fuel consumption	Saves 114-236 million litres	7,172 litres
Fatal accidents	Avoids (52)-247 accidents	0.004 accidents
Injury accidents	Avoids 3,413-16,012 accidents	0.398 accidents
Property damage accidents	Avoids 4,280-17,489 accidents	0.446 accidents
Hydrocarbon emissions	Avoids 2.0-(0.6) million tonnes	28.687 tonnes

Annual benefit calculations are at an 80% confidence interval

The report also calculates the dollar value of these savings⁹ on a present value basis over a 25 year period.

Benefit	Present Value 1997 dollars		Average PV/km ¹⁰
	Low	High	
Reduced travel time	\$17,833,000	\$26,493,000	\$908,000
Reduced vehicle costs	\$1,384,000	\$4,417,000	\$119,000
Greater safety	\$514,000	\$15,285,000	\$324,000
Reduced emissions	(\$2,248,000)	(\$226,000)	(\$51,000)
Highway maintenance	(\$163,000)	(\$381,000)	(411,000)

Total user benefits	\$17,102,000	\$45,806,000	\$1,289,000
Network benefits	\$759,000	\$2,035,000	\$57,000
Total Benefits	\$17,861,000	\$47,841,000	\$1,346,000

Total Investment	\$17,370,000	\$17,370,000	\$712,000
Net Present Value	\$491,000	\$30,471,000	\$634,000

Present value calculations are at an 80% confidence interval

⁸ National Highway System plant consists of 24,401 km of road.

⁹ This includes only costs of correcting the existing system and does not include cost of maintenance or further capital over the 25 year period. Estimated Present Value of extra maintenance = \$163-\$381 million.

¹⁰ These figures simply average the low and high PV values.

4.2. SEWER/WATER BENEFITS:

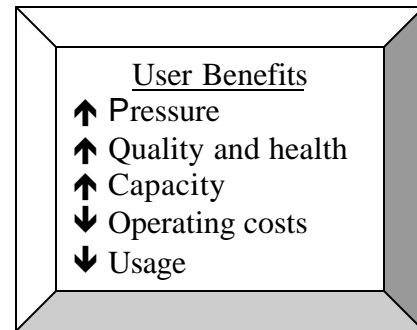
Increased water pressure – cleaning pipes reduces tuberculation (internal build up of material), resulting in better home pressure, better pressure for fire fighting, etc.

Cleaner water – systems in Ontario are overstressed due to development demand (residential and industrial), with some plants venting untreated sewage when excess storm flow exceeds treatment capacity. Fewer leaks reduce infiltration (of plants and ground liquids) and cleaner pipes reduce mineral, bacterial and chemical build-up and contamination.

Increased Capacity – better pressure, higher flow and reduced leakage means greater capacity to accommodate new development with existing systems, resulting in lower capital and operating costs per unit.

Reduced operating costs – cleaner pipes, better pressure results in lower joint leakage and breaks; also smaller pumping stations are required, resulting in lower capital requirements and running costs (electricity, chemicals, labour).

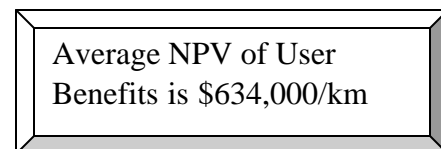
Reduced usage – fixing the unseen leaks will conserve our most precious resource.



4.3. SUMMARY

4.3.1. Roads

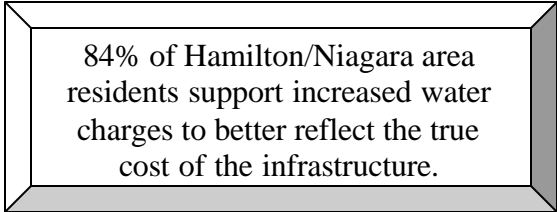
Quality of life effects are quite significant, with a positive net present value over a 25 year period. On a per kilometre basis, the average NPV of user benefits is \$634,000/km. Further, benefits such as increased safety and personal time, reduced operating costs and property damage will be felt immediately by local users. The figure of \$634,000 per km is based on the entire National Highway System which has a higher percentage of



multilane highway than the Region of Niagara. While the figure is not directly applicable, it does provide a idea of the magnitude of the value of such investment.

4.3.2. Sewer/Water Systems

User benefits were not quantified; however, a 1996 survey found that Canadians rank the provision of clean water as the number one program that should be exempt from spending cuts, ahead of public health, education and social assistance. Further, this survey reported that 79% of Hamilton/Niagara residents supported the government increasing the charges they pay to better reflect the true cost of water infrastructure. When told that untreated sewage is vented into lakes and rivers during storms where treatment plan capacity is exceeded, the figure increased to 84% (EnviroNics 1996).



84% of Hamilton/Niagara area residents support increased water charges to better reflect the true cost of the infrastructure.

5. FUNDING

In general it appears that there is good understanding of the importance of infrastructure investment. There also appears to be a disconnect between understanding and implementation. The common refrain from Ontario municipalities is “yes, road and sewers are important but we have no funds”.

The important point here is that municipalities must find the funding. Failure to do so will result in enormous funding shortfalls in the near future. There is no excuse for postponing this investment because postponement dramatically increases the liability.

We also know that it is possible the Niagara municipalities to find the funding. Both the City of St. Catharines and City of Port Colborne have been proactive about underground infrastructure replacement. They will not have the huge burden of replacing simultaneously failing systems because they have systematically upgraded their assets.

Road and water infrastructure are funded by very different taxation methods. Road funding comes from general taxes and hence is not easily identified by end users¹¹. On the other hand sewer and water is funded partially from general taxes¹² but also from user charges. The degree to which users will resist increased user charges depends on the perceived need for underground investment.

It is not the purpose of this report to solve funding problems. In resolving the issue, municipalities will have to consider all revenue sources, some of which may require provincial authority or collection. In all cases the key will be to secure sustainable funding. There is no quick, 1-time fix for these problems. A few funding options:

- Special realty tax/user rate surcharges to build a pool of infrastructure funds
- A municipal gasoline tax to be added on top of the provincial gasoline tax
- A municipal income tax
- Increased development charges
- Subsidy paid from provincially approved toll roads to maintain municipal feeder system
- Superbuild Fund
- Public Private Partnerships

¹¹ Gasoline taxes are not allocated to road infrastructure and are viewed by users as a general tax.

¹² While users pay for water, municipal systems still tend to be subsidized through general taxes.

6. CONCLUSIONS

Research of the Region of Niagara municipalities produced clear evidence that the issue of infrastructure investment is current and is of substantial financial magnitude such that councils should make it a prime priority. There is existing urgency as well as long term sustainability that need to be resolved.

6.1. Road Infrastructure Conclusions

6.1.1. Protecting Investment – there is a contingent liability of \$147.5 million to reconstruct the 590 km of 12-15 year old roads identified by the respondents. This contingent liability will become an actual liability if these roads are not rehabilitated in the next 1-3 years. The cost to rehabilitate these roads is \$47.2 million. In other words rehabilitating the roads saves \$100.3 million. There are a further 2,166 km of regional roads that are older than 15 years. The cost to rebuild these roads is \$541 million.

6.1.2. Attracting Investment – highway access is the #2 site selection factor (after labour cost). Without superior access Niagara will not be able to realize the full potential of the growing traffic transiting the peninsula.

6.1.3. User Benefits – such as reduced travel time and operating costs, and increased safety have a NPV in the range of \$634,000 per km.

6.2. Sewer & Water Infrastructure Conclusions

6.2.1. Protecting Investment – Based on National Research Council sewer/water maintenance and replacement guidelines (conservative estimates based on 3% and 2% of replacement value respectively) there has been a total budget shortfall of \$67.7 million in the respondents sewer/water budgets covering the period 1997 – 2000.

6.2.2. Attracting Investment – there is evidence of communities ceasing development due to the inability of the water system expand. Further, easy, cost efficient provision of water services can be a contributor to investment decisions.

6.2.3. User Benefits – no quantification of user benefits was found; however, Canadians, and in particular Hamilton/Niagara residents, rank the provision of clean water as the number one program that should be

exempt from spending cuts. Clean water ranks ahead of public health, education and social assistance.

6.3. Common Conclusions

Research on the economic impact of infrastructure investment refers to either “highway capital stock”, “public capital stock” or “municipal projects”. There was no separate economic information on sewers/water mains; however, the public capital stock and municipal projects largely consist of highways and sewers/water mains. Further, the financial results of all three asset categories are similar. Hence for the purposes of this report the following conclusions regarding economic measures are common to both road and sewer/water investment.

- 6.3.1. Jobs – a \$1 million infrastructure project generates in the order of 29.3 local person years of employment.
- 6.3.2. Spending – a \$1 million infrastructure project generates a total benefit in the order of \$1,230,000 in Direct, Indirect and Induced local income.
- 6.3.3. Productivity – research on productivity impact shows there is a positive and strong correlation between investment and productivity in the order of: a 1% increase in public capital stock produces a 0.10% to 0.40% increase in productivity.
- 6.3.4. Costs – research on cost impact shows there is a positive and strong correlation between investment and reduction of manufacturing costs in the order of: a 1% increase in public capital stock produces a 0.11% to 0.22% decrease in manufacturing costs.
- 6.3.5. Return on investment – research on US investment impact shows that returns on infrastructure investment have dropped in the past 40 years from 40+% to 10%. This is due to diminishing benefits since the substantial completion of the US interstate highway system.

Returns in general are variable based on the type of infrastructure investment, with investment in maintenance generating 35% returns and investment in new rural construction generating low (unspecified) returns.

6.4. General Conclusions

The economic impact (jobs, spending, productivity, costs, return on investment and user benefits) of infrastructure investment is positive and significant. The drawback to the evidence reviewed may be in transferring the conclusions based on large areas and long time frames, directly to Niagara.

However, any doubts about the appropriateness of increased infrastructure investment as a leading policy for economic development should be over ridden by two strategic factors:

- Protecting Investment – there is a contingent liability of \$147.5 million in road reconstruction and a sewer/water budget shortfall of \$67.7 million in the past four years. The cost to replace failing infrastructure is far greater than the cost to maintain it on a regular basis.

<p>Protecting Investment</p> <p>Roads: contingent liability of \$147,500,000.</p> <p>Sewer/water: maintenance/replacement shortfall of \$67,700,000.</p>
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- Attracting Investment – To attract investment and retain investment Niagara needs to implement a program of road and sewer upgrades.

It is clear from the need to protect and attract investment, and the research on the economic impact of infrastructure investment, that increased infrastructure investment is a valuable and potentially leading economic development tool for the Region of Niagara.

7. EXHIBITS

7.1. EXHIBIT A - Niagara Municipal Infrastructure Survey – Roads Summary

This summary outlines the contingent liability of \$147.5 million to reconstruct 590 km of roads between 12-15 years old. Within 1-3 years, these roads will no longer be candidates for rehabilitation at a cost of only \$47.2 million. This delay will incur the contingent liability and cost an extra \$100.3 million above the cost to rehabilitate.

Municipalities responding to survey		7
Population of respondents		323,935
% of Region population represented		84%
Total road km reported by respondents		5,432
Cost to rehabilitate roads 12-15 years old		
KM of roads 12-15 years	A	590
Rehabilitation cost/km	B	80,000
Cost to rehab roads 12-15 yrs.	C=AxB	\$ 47,209,212
Contingent Liability if those roads not rehabilitated in 1-3 years		
KM of roads 12-15 years	D	590
Reconstruction cost/km	E	250,000
Cost to reconstruct roads 12-15 yrs.	F=DxE	\$ 147,528,786
Savings if road are rehabilitated in 1-3 years	G=F-C	\$ 100,319,574
Current Liability of roads 15+ years old		
KM of roads 15+ years		2,166
Reconstruction cost/km		250,000
Cost to reconstruct roads		\$ 541,393,679

7.2. EXHIBIT B – Road Life Cycle Costs

As per Chart 1 “Road Cost Over Time” in section 2.1.1, typical roads require renewal between 12-15 years after original construction. It is estimated that road renewal “turns the clock back” eight years, while reconstruction, “resets the clock” to zero. In other words, roads can be maintained in an acceptable condition by “renewing” the road every 8 years (subsequent to original 12 year period) or by reconstructing them every 16 years.

Based on the ratio of costs per lane-km of \$1,000:80,000:250,000 over the initial, renewal and reconstruction phases of road life respectively, the table to the right shows the associated life cycle costs¹³ of these two alternatives over a 30 year period. The interim amounts represent approximate maintenance which increase over time. In year 30, each scenario is assigned an amount to represent the straight line depreciation of the road (plus annual maintenance), allowing us to compare the options on an “apples to apples” basis.

The net present value (NPV) of costs based upon renewal in year 13 and thereafter every 8 years, is \$71,355.

Life Cycle Costs			
Year	Renewal	Reconstruction at ...	
		Year 16	Year 20
1	\$1,000	\$1,000	\$1,000
2	1,000	1,000	1,000
3	1,000	1,000	1,000
4	1,000	1,000	1,000
5	1,000	1,000	1,000
6	2,000	2,000	2,000
7	2,000	2,000	2,000
8	2,000	2,000	2,000
9	2,000	2,000	2,000
10	2,000	2,000	2,000
11	4,000	4,000	4,000
12	4,000	4,000	4,000
13	80,000	4,000	4,000
14	1,000	4,000	4,000
15	1,000	4,000	4,000
16	1,000	250,000	8,000
17	1,000	1,000	8,000
18	1,000	1,000	8,000
19	2,000	1,000	8,000
20	2,000	1,000	250,000
21	80,000	1,000	1,000
22	1,000	2,000	1,000
23	1,000	2,000	1,000
24	1,000	2,000	1,000
25	1,000	2,000	1,000
26	1,000	2,000	2,000
27	2,000	4,000	2,000
28	2,000	4,000	2,000
29	80,000	4,000	2,000
30	11,000	220,750	126,000
NPV	\$71,355	\$115,881	\$93,160
Discount Rate 8.00%			

¹³ Original construction costs have no impact on ranking of the options, so are omitted to simplify the analysis.

In the case where investment in the road is delayed past the renewal period and into the reconstruction period at year 16 (the earliest reconstruction year), the NPV is \$115,881.

In the case where reconstruction is delayed a further 4 years, resulting in the potential for unsafe roads, the NPV is still greater than the renewal schedule, at \$93,160.

We can see from this schedule that the NPV per km of road is far higher – 62% - if the reconstruction option is chosen over the renewal option. This is due to the rapid deterioration of the road from years 12 and higher and accompanying increased costs. Even if reconstruction is delayed until the 20th year, the NPV is still higher – 31% – demonstrating clearly that delaying costs is false economy. Finally, consider that delaying road maintenance past year 16 can result in unsafe road conditions and most certainly in higher operating costs.

Exact maintenance costs and timing will differ for roads with different life-cycle characteristics, but this analysis shows that for a typical road, regular maintenance is less expensive than delaying required investment. Further, it also results in greater user benefits not accounted for here such as safety, lower operating costs, etc.

Delaying costs
is false economy

7.3. EXHIBIT C – Summary of Sewer/Water Budget Shortfall 1997-2000

This summary outlines the sewer/water budget shortfall of \$67.7 million over the years 1997 – 2000. This annual shortfall averages \$16.9 million or 37% of the required investment. Determining the full extent of decay will require inspection and analysis of the collection and distribution systems.

				Sewer	Water	Total	Annual Shortfall
Municipalities responding to survey		7					
Population of respondents		323,935					
% of Region population represented		84%					
Annual budget guidelines							
Total pipe km reported by respondents		A		2,163	1,501	3,664	
Replacement cost per km		B		\$ 250,000	\$ 250,000		
Total Replacement cost		C=AXB		540,750,000	375,200,000	\$ 915,950,000	
Annual budget guidelines							
NRC annual maintenance average		D=CX3%		16,222,500	11,256,000	27,478,500	
NRC annual replacement average		E=CX2%		10,815,000	7,504,000	18,319,000	
				\$ 27,037,500	\$ 18,760,000	\$ 45,797,500	
Shortfall: Municipal budgets vs. NRC guidelines							
1997	Budget	Maintenance	F	4,302,077	7,209,023	11,511,100	
		Replacement	G	9,668,000	3,806,000	13,474,000	
	Shortfall	Maintenance	H=F-D	(11,920,423)	(4,046,977)	(15,967,400)	
		Replacement	I=G-E	(1,147,000)	(3,698,000)	(4,845,000)	(20,812,400)
1998	Budget	Maintenance		6,748,252	8,066,513	14,814,765	
		Replacement		8,827,960	4,635,000	13,462,960	
	Shortfall	Maintenance		(9,474,248)	(3,189,487)	(12,663,735)	
		Replacement		(1,987,040)	(2,869,000)	(4,856,040)	(17,519,775)
1999	Budget	Maintenance		7,760,820	5,867,067	13,627,887	
		Replacement		10,746,000	4,033,000	14,779,000	
	Shortfall	Maintenance		(8,461,680)	(5,388,933)	(13,850,613)	
		Replacement		(69,000)	(3,471,000)	(3,540,000)	(17,390,613)
2000	Budget	Maintenance		7,736,000	8,801,400	16,537,400	
		Replacement		11,286,000	5,990,000	17,276,000	
	Shortfall	Maintenance		(8,486,500)	(2,454,600)	(10,941,100)	
		Replacement		471,000	(1,514,000)	(1,043,000)	(11,984,100)
Total	Budget	Maintenance		26,547,149	29,944,003	56,491,152	
97-'00		Replacement		40,527,960	18,464,000	58,991,960	
	Shortfall	Maintenance		(38,342,851)	(15,079,997)	(53,422,848)	
		Replacement		(2,732,040)	(11,552,000)	(14,284,040)	(67,706,888)
		Total		(41,074,891)	(26,631,997)	(67,706,888)	

7.4. EXHIBIT D – Infrastructure Survey

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**9.APPENDICES – BDO Dunwoody Firm Profile
Consultants' Resumés**

FIRM PROFILE

BDO Dunwoody LLP is one of Canada's foremost accounting and consulting firms, committed to helping independent businesses grow and succeed. For over 75 years, we have worked with Canadian businesses and we understand their unique needs.

HOW BDO DUNWOODY CAN HELP YOU REACH YOUR GOALS

BDO Dunwoody – Your Client Service Office

Your BDO Dunwoody representation will be provided through the Hamilton office. This office is a member of our firm's "South Central Ontario" region along with Brantford, Guelph, Kitchener-Waterloo and Niagara. Your engagement partner will ensure that all BDO Dunwoody specialty services, available within the firm, are made accessible to you.

Our **region's philosophy**, the value system by which we measure our performance as a service organization, can be outlined as follows:

- to **provide the finest** accounting, assurance, tax, information technology and management advisory services available;
- to be **associated with outstanding clients**, and through planning and management advice, help each client reach its maximum potential;
- to be a firm that is **exciting** to work for and **rewarding** to work with;
- to grow in size as needed to **meet the requirements** of our clients, but always to retain the local identity and personalized services that are the foundation of our practice;
- to **build professional relationships** with our clients that continue throughout the year.

A quality that distinguishes our firm from others, we believe, is the availability of our partners and top technical experts to clients of all sizes. This means, quite simply, the complete resources of our firm are available to all of our clients.

BDO Dunwoody – National

BDO Dunwoody is **national** in scope, allowing us to provide specialized advisors who meet your unique needs through a network of over 1,300 professionals.

BDO International

BDO has a **global** presence through its membership in BDO International. As one of the world's largest accounting and consulting firms, we are represented in more than 85 countries and on every continent.

In addition to accounting and auditing services, clients have access to and have successfully utilized the following additional services offered by BDO Dunwoody LLP:

Consulting Group Services

Our Management consulting team has the size and strength to present our clients with a full range of comprehensive consulting services, while retaining the flexibility and attention to detail that is needed to focus on individual client needs. Our purpose, as a firm, is to help our clients succeed. To achieve this, we need to understand our clients' needs and to provide services to meet those needs. Some of the consulting services we offer include:

- Process Innovation
- Information systems design and review
- Computer consulting
- Human resources and personnel placement
- Strategic planning
- Valuations, mergers and acquisitions
- Feasibility studies
- Corporate finance and recovery
- Corporate reorganization
- Insolvency
- Personal financing planning
- Forensic accounting
- Litigation support
- Arbitration and mediation
- ISO Quality Standards
- Healthcare consulting

Our clients expect and deserve the highest quality of professional services. We achieve this through:

- Designing customized solutions to meet the needs of our clients
- Regular contact among members of the client service team. This ensures that emerging issues and problems are viewed from the different perspective and skills of the team
- Regular consultation with management to ensure that we are meeting our client's expectations
- Using qualified professionals who possess the appropriate knowledge and skills for each additional service provided
- Continually searching for new, innovative and cost effective ways to carry out our assignments

GEORGE BARKWELL, C.A.

Partner – Management Consulting

PROFESSIONAL EXPERIENCE

Appointed Senior Vice-President of BDO Dunwoody & Associates Ltd. in 1998
Admitted to partnership in BDO Dunwoody in 1998
Appointed Vice-President, Hamilton/Niagara for KPMG Quality Registrar Inc. in 1996
Admitted to partnership in KPMG in 1985

EDUCATIONAL BACKGROUND

Obtained C.A. designation in 1973
Obtained ISO 9000 Lead Auditor Certificate in 1998

RELEVANT EXPERIENCE

George has extensive experience in providing audit, accounting, taxation and consulting services to a broad-based number of clients. George has over 15 years experience auditing municipalities and their related enterprises. This experience covered both Tier I and Tier II Municipalities; he was also responsible for performing quality reviews on other partners' municipal audit files. He is experienced in leading project teams in the analysis, design, development, and implementation of business solutions in the following areas:

- Leadership Governance
- Business Plans
- Process Mapping
- Process Innovation
- Business Process Re-engineering
- Technology Assessments
- Continuous Improvement
- Supply Chain Management

George is a leader of the BDO ISO Consulting Practice and a member of the Brock University Dean's Advisory Council for The Faculty of Business.

George was recently involved as a member of the Review Team for the Task Group revising ANSI/ASQC Z1.11 – 1996 American National Standard, Quality Assurance Standards – Guidelines for the Application of ANSI/ISO/ASQC Q9001 or Q9002 to Education and Training Institutions.

Recent and ongoing engagements include:

- Project Director for the development of a business and governance plan for a privately owned dental hygienist school;
- Project Leader for several financial performance reviews;
- Project Leader for the development of web enabled training programs for Canadian Chartered Accountants;
- Project Director for a major Corporate IT Software Implementation for a National NPO;
- Project Leader to eight ISO 9002:1994 Quality Management System Implementations;
- Principal consultant to the privatization of a hospital service;

- Principal consultant representing an employee group in the negotiations for the purchase of a minority share position in a medium-sized construction company (100+ employees);
- Principal consultant developing a Team Building/Leadership Workshop for an eight (8) person Management Team as the beginning of an overall Organizational Performance Improvement Plan;
- Principal consultant developing a management structure for an organization that will assist with the implementation of the owner/manager's succession plan.
- Principal consultant leading a facilitated strategic planning exercise for a medium sized enterprise.

PROFESSIONAL AND COMMUNITY INVOLVEMENT

George is regularly a featured speaker at various internal and external seminars and conferences on a variety of topics including Federal and Provincial Budget Releases, Income Tax, Economic Forecasts, ISO 9000 Quality Standard and the ISO 14000 Environmental Standard. George recently delivered a presentation to the University of Ottawa MBA Alumni as part of their Business Development Series, the topic "What's the Big Deal about Quality", a discussion on the importance of quality and quality management systems to the success of an organization. Another such conference was a Healthcare Quality Conference held in Niagara Falls during February 1997 where George spoke on the relevance of ISO 9000 Standard to the Healthcare industry. George recently attended the United Nations Environmental Program Finance Initiative Roundtable in Frankfurt, Germany dealing with Environmental Performance by the Finance Sector.

In the past eight years on the Board of Trustees of Brock University, George has been involved in Board Governance Reform, a Strategic Planning and Priorities exercise, major capital expansion and the launch of the corresponding capital campaign. He is also the Director of the Transitional Task Force to develop a Governance Structure within the BDO Dunwoody South Central Region. George was instrumental in developing a pilot project for The Ministry of Health concerning the implementation of ISO 9000 Quality Management Systems in Ontario nursing homes. Under George's direction, BDO Dunwoody recently completed an economic feasibility study to assist a Home for the Aged in their response to The Ministry of Health's Request for Proposal to Develop Long Term Care Facility Beds in The Regional Municipality of Hamilton-Wentworth.

George is an active member of the Hamilton-Niagara community. He is Immediate Past Chair, Brock University, a member of The Dean's Advisory Council for The Faculty of Business, Brock University, a member of the American Society for Quality - Hamilton and Toronto Chapters, a member of the Canadian Association of Management Consultants and a member of several local Chamber of Commerce organizations. George was recently appointed to the Canadian Institute of Chartered Accountants/Canadian Association of Management Consultants Joint Liaison Committee. He is also a recreational member of the South Niagara Rowing Club and the St. Catharines Golf and Country Club.

MARK HUDSON, B.A., M.B.A.

Associate Consultant

PROFESSIONAL EXPERIENCE

Associate Consultant – joined BDO Dunwoody & Associates Ltd. in 1999
President – started Hudson Aviation Services in 1998
Director of Marketing – promoted to YVRAS contract at Moncton Airport in 1997
Marketing and Commercial Manager – joined YVR Airport Services as on site management consultant at Hamilton International Airport in 1996
Manager Business Development – joined Prestwick International Airport in 1994
Consultant – to Prestwick International Airport in 1993

EDUCATIONAL BACKGROUND

Obtained M.B.A. from University of Western Ontario in 1992
Obtained B.A. (Economics) from University of Western Ontario in 1988

RELEVANT EXPERIENCE

Mark has experience in providing marketing, business development and strategic planning services to a number of clients within the following industry sectors:

- Airports
- Airlines
- Real Estate Development
- Industrial Coatings
- Not For Profit
- Retail
- Medical Supplies
- Aircraft manufacturer
- Water / Wastewater

Engagements include:

- Marketing plans – Project Leader for development of several integrated marketing and communications plans including strategic positioning, branding, advertising, customer service, sales plans, public relations;
- Market research – Project Leader for a number of projects including a Canada-wide program to determine market position, in-depth traffic studies, customer preference surveys and business to business interviews;
- Business plans and budgets – Principal consultant for development of a variety of business plans and a number of budgets;
- Public Relations – Principal consultant and representative for creation of airport's positive public image including writing media releases, live interviews, product launches and press conferences;
- Strategic planning – Project Leader for Corporate Strategy Workshop for a high profile not-for profit airport authority; advisor to start up industrial coatings supplier;
- Policy development – Principal consultant for the development of pricing and land development policy;
- Financial and Management systems – Project Leader for development of financial and management reporting systems including analysis of business processes, development of Business Centres, translating accounting data into management information and training managers;

- Financial risk model – Principal consultant for development of an airline financial risk model for a major aircraft manufacturer;
- Passenger operations – Principal consultant for program that developed passenger facilities for re-introduction of service including, computerized check-in, passenger and baggage handling systems, and retail facilities;
- Airport Improvement Fee – Project Leader for development and implementation of the first AIF in New Brunswick;
- Start-up operations – experience with several clients creating new systems and procedures for start-up and privatized businesses in an environment of limited resources.

PROFESSIONAL AND COMMUNITY INVOLVEMENT

Mark is active in the Chamber of Commerce and the Hamilton Rotary Club. When on location he has been involved in industry organizations and was recently Chair of the Greater Moncton Vision 2020 Airport Development Committee. Mark also launched and ran two Travel Agent associations, in Hamilton and Moncton.