

**TRANSPORT INFRASTRUCTURE INVESTMENTS
IN THE PRAIRIE REGION (1971-1980):
ANALYSES OF EXPENDITURE TRENDS AND
GOVERNMENT EVALUATION PROCEDURES**

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Presented to
The Faculty of Graduate Studies
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In Partial Fulfillment
of the Requirement for the Degree
Master of Science in Civil Engineering

by
Tuck Kar Mak
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ABSTRACT

The principal objectives of the thesis are (i) to create a comprehensive data base on government transportation expenditures in the Prairie region for the period 1971-1980, and (ii) to document and assess government transport-investment evaluation procedures. This study is retrospective in nature; it is believed that any further research in government transportation expenditures and/or evaluation approaches would require the historical perspective contained herein.

Transportation expenditures (in constant 1971 dollars) by all levels of governments in the Prairie region increased throughout the past decade. For the period 1975-79 (where complete expenditure data was available), federal transportation expenditures increased at an average compounded rate of 2.5% per year. Provincial and local transportation expenditures experienced higher growth rates than did federal expenditures; provincial transport expenditures increased by 5.5% per year while local expenditures rose by 4.8% annually. The increases in transportation expenditures, however, were less than the corresponding growths in gross government expenditures.

Analysis of government evaluation procedures indicates that substantial differences in methodologies and criteria existed between the three levels of government and between departments within the same government. These discrepancies apparently reflected the differences in governmental and departmental philosophies/objectives in transport-infrastructure developments. Examples include: investing

for strategic or social purposes (as in grantor agencies) vs. engineering deficiencies (as in provincial departments of highways), or investing in projects with long economic life (as for Alberta Transportation) vs. those with short economic life (as for Saskatchewan Highways and Transportation). Hence, it seems the same tax dollars would be expended differently, depending on the individual government department involved.

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MOTIVATION FOR THE RESEARCH

Federal, provincial and municipal governments are responsible for the provision and maintenance of most of the transport infrastructure in Canada, including airports, harbors and waterways, most roadways and related facilities. Construction and maintenance of this infrastructure and provision of other transport-related services account for a significant proportion of total government expenditures. For example, in the Prairie region alone, transport expenditures incurred by the three levels of government totalled \$1.43 billion in 1978-79, and this amount does not yet include law-enforcement costs and financing expenses.

Transport-investment evaluation typically (or at least ideally) occurs at the end of the transportation planning process. This planning process and components of this process relating to the development and application of predictive, analytical models are extensively discussed in the literature [44] [53] [70]. In addition, theoretical approaches to the evaluation component of the planning process are also widely addressed in the literature [28] [33] [47] [54]. The so-called classical evaluation techniques can be categorized into one of these groups: pure judgemental techniques [70]; economic analyses [2] [60] [86]; value analyses [40]; engineering analyses [11] [42]; and multi-objective evaluation [53] [70] [80].

Despite this wide array of evaluation techniques, Hutchinson [44] indicated that none of these methodologies has emerged as a "generally accepted" approach to evaluation. Further, Manheim [53] contends that "none of these [classical approaches] is acceptable as a comprehensive

evaluation method ...". These comments hence suggest that transport investments are made in the absence of established and generally-accepted evaluation method and criteria. Reviews of two government publications [62] [80] indicate that wide variations in evaluation methodologies and criteria exist in practice. Moreover, for any particular transport infrastructure investment, there is little information, at least in the public domain, which contributes to the understanding of either the nature or the detailed provisions of the evaluation procedure employed by the government departments.

Another area of deficient information is the disposition of government expenditures on transportation by department, by mode, and by province where expenditures were incurred [46]. Transport Canada concedes that "there has been little attempt to identify where these expenditures are being made. [However], the emphasis on increased accountability in the delivery of departmental programs requires more information as to where its resources are being expended in relation to its objectives ..." [26].

At the exploratory stage of the research, officials of three major government departments responsible for transport-infrastructure developments in the Prairie region - Transport Canada, Manitoba Department of Highways and Transportation, and Alberta Transportation - indicated a mounting concern in their respective governments to better justify future transport investments. It is of course unrealistic to expect the three levels of government to conduct evaluation with the same method and criteria; Bryan [12] predicts that "... the governments will continue to pursue transportation goals that counter each other to some extent

and create inefficiency. However, for the sake of both public economy and public service, there should be an effort to minimize such conflict." In order to achieve this end, serious research is required with a view to first effecting greater appreciation for the cause and ramification of inconsistencies in government evaluation procedures [12] [26].

Given the importance and size of transport-infrastructure investments in the Prairie region, and the lack of documentation of evaluation methods and criteria employed in the planning process relating to much of these investments, a research program has been funded by the Natural Sciences and Engineering Research Council (NSERC). This thesis is part of the NSERC research program; specific objectives and the scope of this thesis are outlined below.

The usefulness of this thesis is envisaged to be two-fold. First, the information presented in the study provides a historical perspective on the magnitude and allocation of government transportation expenditures in the Prairie region, as well as on the methods and criteria used by various government departments in evaluating these investments. This establishes a reference point on which future research in the field of transport-investment evaluation can be based. Secondly, the methodology used in assembling the data can be duplicated for future studies, to monitor and update potential changes in government transport-investment trends and/or in evaluation approaches.

Objectives and Scope

The objectives of this thesis are:

- to determine and assess government expenditures on transport infrastructure with respect to various indicators;

- to document and assess methods and criteria employed by the federal, provincial, and selected local governments in evaluating transport infrastructure investments in the Prairie provinces.

The scope of this study is limited to the consideration of transport investments for all modes, undertaken:

- by the federal government in the Prairie region for non-military objectives;
- by the governments of Manitoba, Saskatchewan and Alberta;
- by the local governments of Winnipeg, Regina, Saskatoon and Edmonton;
- in the ten-year period from 1970-71 to 1979-80.

Organization of the Thesis

Part I: Determination of Government Expenditure Trends in Transport Infrastructure Developments.

Part I presents the historical trends of government investments in transportation from 1970-71 to 1979-80 and relates the trends to various utilization indicators.

Part II: Documentation of Evaluation Methodologies Employed by Various Government Departments and Agencies.

Part II documents, examines, and compares the evaluation methodologies currently used by various government departments to provide a basis for decision-making. Case studies (presented in Appendix H) are used to illustrate government procedures in evaluating transport investments.

TO MY SISTER, MEI

PART I

GOVERNMENT TRANSPORTATION EXPENDITURES

I.1 INTRODUCTION

The objective of Part I is to document total annual government expenditures on transport infrastructure between 1971 and 1980, in order to facilitate further analyses on how and why the expenditures were incurred.

This task was accomplished through reviewing publicly-available financial reports and through personal communications with government officials. The methodologies used in assembling the data for this study could conceivably be duplicated for future collection of government transportation expenditure data. Sources of information included:

- Federal Expenditures: Transport Canada periodically publishes a report, "Federal and Provincial Government Transportation Expenditures by Province" [26]¹, detailing federal expenditures by agency, mode, and program. Statistics Canada also produces similar data [27], but only in an aggregate form.
- Provincial Expenditures: Data was obtained from annual reports published by provincial departments of highways and transportation. Other information (i.e. expenditures incurred by other provincial government departments) was collected through personal interviews with appropriate authorities.
- Municipal Expenditures: Aggregated municipal government transportation expenditures were procured from Statistics Canada [50]. Information on individual city government transportation

¹ At the time of printing (January, 1983), a new edition was released, covering expenditure data from 1979/80 to 1981/82. This data was not included in the study due to time constraint, but could be incorporated in other future studies.

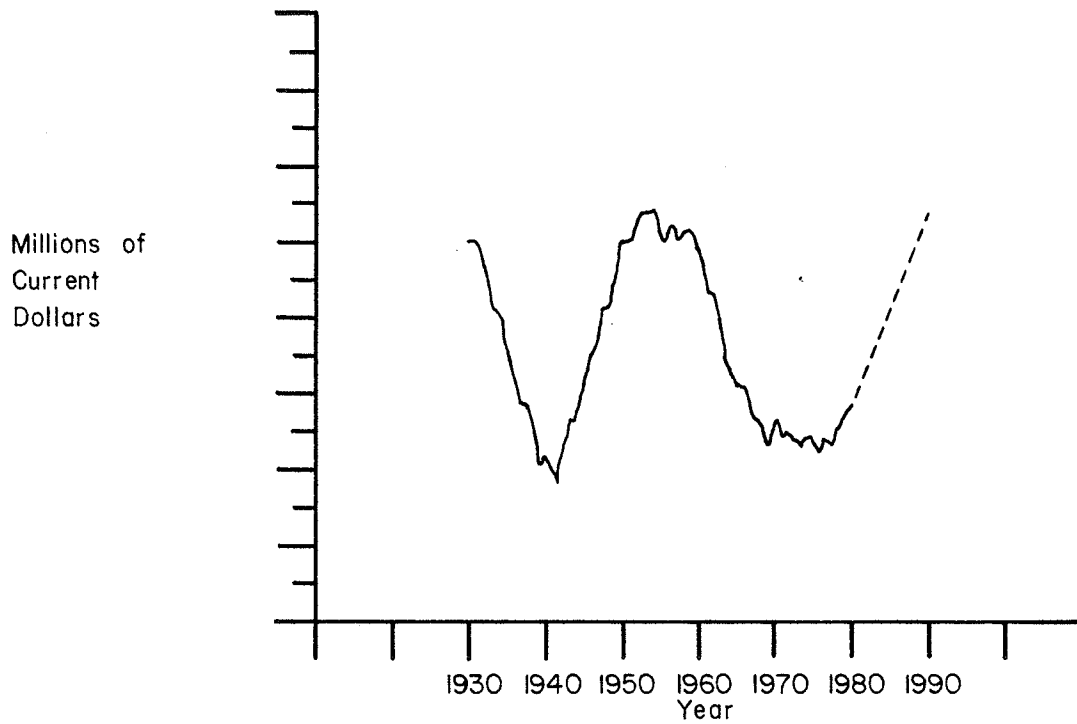


Figure I.1.1 Hypothetical Historical Trend in Government Transportation Expenditures

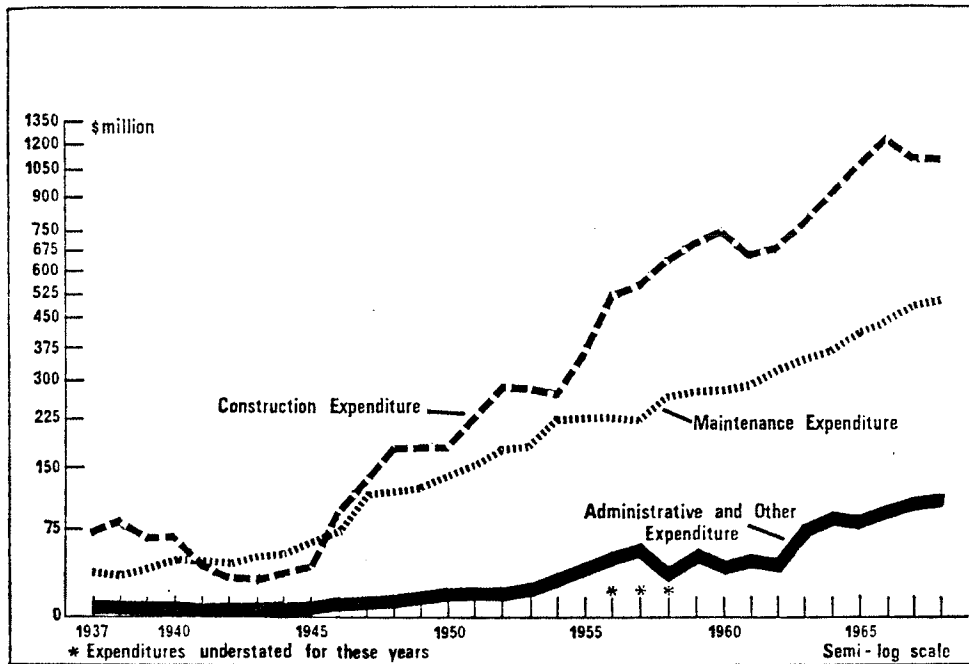


Figure I.1.2 Total Expenditures in Canada for Construction, Maintenance, and Administration of Highways and Related Facilities

Source: Bryan [12]

expenditures was collected from financial statements released by the cities and, in several instances, through consultations with city officials.

The accuracy of expenditure figures suffers from a lack of comprehensive financial recording and reporting standards [46]. The fact that the data was obtained from several sources is a poignant indication of the problem. Reconciliation of annual expenditures was further complicated due to different fiscal-year beginnings and endings defined by different authorities.

Two other issues pertinent to the analyses are:

- Expenditures reported are not the total costs of the resources dedicated to transportation.

As Bryan [12] indicated, some government expenditures are not attributed or attributable to the transportation system (e.g. traffic law enforcement costs, debt charges related to capital expenditures, etc.). "The reported annual expenditure on [transport infrastructure] is therefore less than the actual expenditure and considerably less than the total cost of the resources used for [transport infrastructure]".

- The 1971-1980 expenditure data, in relation to the history of government expenditure on transportation, may not be significant.

Two questions could be raised in this regard: (i) Did government expenditures on transportation fluctuate significantly from period to period? (ii) Was the expenditure level between 1971 and 1980 part of a general trend or a peak (or a trough) of historical government spending on transportation, as shown in Figure I.1.1?

Again from Bryan, Figure I.1.2 shows no significant fluctuations (as in Figure I.1.1) in historical government transportation expenditures. In fact, since the end of the Second World War,

government expenditures have steadily increased (in current dollars). It is therefore deduced that the spending level in the seventies would be significant and part of a general trend in the history of government transportation expenditures.

In recognition of these complexities, the following qualifications are warranted:

- the expenditure figures presented in the following sections are the costs of construction, maintenance, operation and administration of transport infrastructure, unless otherwise specified;
- the expenditure figures do not include law enforcement costs, debt charges, and other indirect costs;
- subsidies and grants are included under the assumption that these expenditures are directly related to the operation and maintenance of transport infrastructure;
- fiscal year stated means the fiscal year as reported by a particular department and may not coincide with the fiscal years of other departments; the year used by Statistics Canada is considered as the fiscal-year end, e.g. Statistics Canada's 1971 is regarded as fiscal year 1970-71;
- definitions of the terminology used in the following sections are contained in Appendix A.

Further, in order to determine expenditure trends in real dollar terms, annual expenditures were deflated to constant 1971 dollars, using Provincial Highway Construction Price Index for each of the Prairie provinces. Detailed discussions on calculating these indices can be found in [20]. Although the expenditures were not entirely incurred in highway construction, it has been estimated that more than 80% of these monies were indeed related to highway construction and rehabilitation. According to a Statistics Canada official, short of developing a new set of conversion

Table I.1.1 Highway Construction Price Indices - by Province

iscal Year	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980
nitoba	100.0	111.3	126.3	166.8	172.5	197.6	204.7	226.0	250.0	277.2
askatchewan	100.0	104.4	129.6	175.8	210.4	206.6	231.9	268.9	283.4	290.6
berta	100.0	99.5	128.6	184.7	209.7	200.5	222.9	257.0	285.8	320.4

Source: • Statistics Canada [20]

Note: • Base year 1971 = 100.0

factors, the Provincial Highway Construction Price Indices would be the most appropriate. The indices are shown in Table I.1.1. The construction price increases were significantly larger in the early seventies (averaging 18.4% per year from 1971 to 1975) than in the latter half of the decade (8.5% per year from 1975 to 1980). The unweighted average annual price increase was therefore 12.8% over the past decade.

Sections I.2 to I.5 inclusive examine government transport investments in the seventies and Section I.6 relates government transportation expenditures to various utilization indicators. The findings in Part I will form a basis for review of government evaluation methodologies in Part II of the study.

I.2 CONSOLIDATED GOVERNMENT TRANSPORTATION EXPENDITURES

Consolidated government transportation expenditures are total expenditures incurred by the three levels of government for all modes, and include subsidies and grants to crown corporations (e.g. Air Canada, Canadian National Railways, etc.). In order to eliminate multiple-counting of total government transportation expenditures, inter-government transfer payments were determined and subtracted from reported government expenditures. Due to different accounting and reporting procedures, discrepancies may occur between transfer payments reported by various government departments and data published by Statistics Canada [27] [64]. Because of the difficulty involved in collecting actual grants and subsidy payments from each jurisdiction, it was decided to use Statistics Canada data. An example of the calculations is shown below.

Example: 1974-75 Fiscal Year (in millions of current dollars)

Total Federal Transportation Expenditures	=	282.20 (Table C.1)
Total Provincial Transportation Expenditures	=	428.98 (Table D.4.1)
Total Local/Municipal Transportation Expenditures	=	<u>290.36 (Table E.1)</u>
		<u>1,001.54</u>
Total Federal-to-Provincial Transfer Payments	=	20.58 (Table F.3)
Total Provincial-to-Local Transfer Payments	=	94.81 (Table F.5)
Total Federal-to-Local Transfer Payments	=	<u>1.40 (Table F.7)</u>
		<u>116.79</u>

Consolidated Government Transportation Expenditures
 = \$1,001.54 m - \$116.79 m = \$884.75 m

Provincial and local/municipal government transportation expenditures presented in Tables B.5 to B.10 inclusive are net expenditures after subtraction of transfer payments from senior level of government. For example, in terms of current dollars, the net provincial and

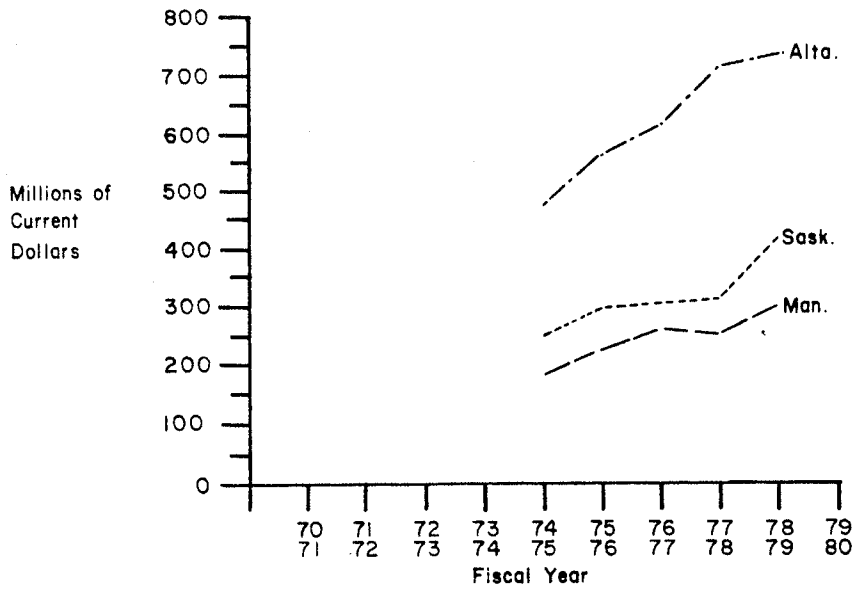


Figure I.2.1 Annual Consolidated Government Transportation Expenditures - by Province (in millions of current dollars)

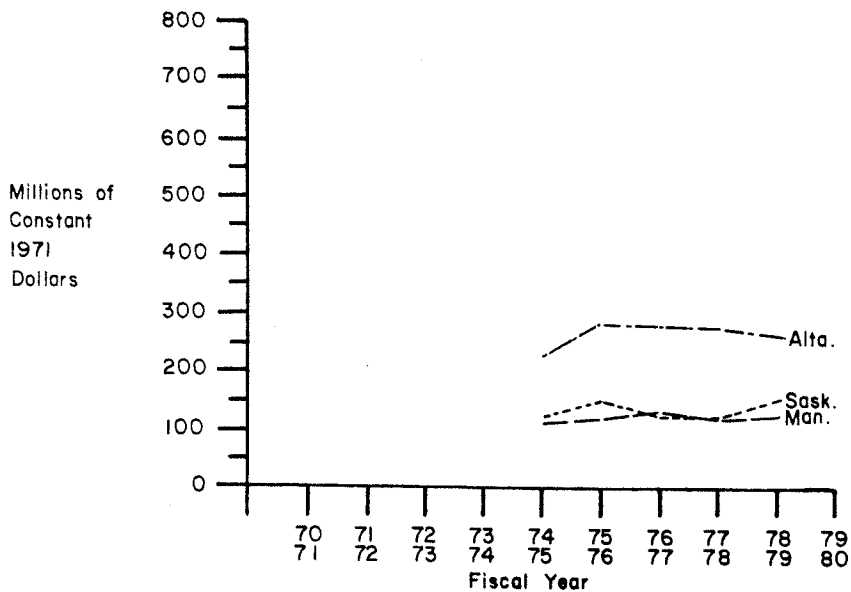


Figure I.2.2 Annual Consolidated Government Transportation Expenditures - by Province (in millions of constant 1971 dollars)

Local/municipal government transportation expenditures in Manitoba for the 1974-75 fiscal year were determined as follows:

Net Provincial Expenditures:

Total Provincial Expenditures = \$85.19 million (Table D.1.1)
 Federal-to-Provincial Transfer Payments = \$8.56 million (Table F.3)
 Net Provincial Expenditures = \$85.19 m - \$8.56 m = \$76.63 m

Net Local/Municipal Expenditures:

Total Local/Municipal Expenditures = \$48.22 million (Table E.1)
 Provincial-to-Local Transfer Payments = \$22.95 million (Table F.5)
 Federal-to-Local Transfer Payments = \$ 0.45 million (Table F.7)
 Net Local/Municipal Expenditures = \$48.22 m - \$22.95 m - \$0.45 m
 = \$24.82 m

There were two problems associated with the expenditure data. First, federal government transportation expenditures prior to 1974-75 were not compiled with breakdowns of departmental expenditures; hence, it would not be able to establish any substantial trends in federal expenditures with only 1974-75 to 1979-80 data.

Secondly, expenditures presented in Tables B.11 to B.14 inclusive could not be reconciled with the data shown in Tables B.1 and B.2. This was a result of (i) different sources of information, and (ii) different fiscal-year beginnings and endings. Since expenditures in Tables B.1 and B.2 were assembled directly from the appropriate sources (i.e. from the annual reports published by the government departments or from personal communication with the department officials), these investment figures would be more accurate. However, Tables B.11 to B.14 are included in this study because the data covered the entire decade, and hence they would provide a proxy to the missing information (i.e. data from 1970-71 to 1973-74 inclusive) in Tables B.1 and B.2

Figures I.2.1 and I.2.2 show the general trends of consolidated government transportation expenditures in current dollars and in constant

1971 dollars, respectively. Detailed expenditure tables are presented in Appendix B. Major observations are as follows:

- Between 1974-75 and 1978-79, consolidated government transportation expenditures were largely concentrated in Alberta (52% of total expenditures), followed by Saskatchewan (26%) and Manitoba (22%). On a per-capita basis, aggregate expenditures in Alberta and Saskatchewan were very similar (totals of \$692.4 and \$688.1 in constant 1971 dollars per-capita over the five-year period, respectively). Expenditures in Manitoba were much lower at \$550.8 in constant 1971 dollars per-capita over the same period.
- From 1974-75 to 1978-79, total transport investments, in current dollars, experienced an annual compounded increase of 13% in the Prairie region, distributed as follows: Manitoba (13% increase), Saskatchewan (13%), and Alberta (12%). In terms of constant 1971 dollars, the annual increase was limited to 4% with the provincial increases as follows: Manitoba (3%), Saskatchewan (5%), and Alberta (4%).
- On a per capita basis, total transport investments in current dollars increased by 13% annually over four years in Manitoba, 12% in Saskatchewan, and 9% in Alberta. In constant 1971 dollars, the annual increases over four years were much smaller: 3% in Manitoba, 4% in Saskatchewan, and 2% in Alberta. Further, all three provinces experienced a decline (2% in Alberta, 13% in Saskatchewan and Manitoba) in per-capita expenditures in 1977-78.
- In Manitoba, provincial and federal expenditures on transportation were very close in both current and constant 1971 dollars, prior to 1977-78. Since 1977-78, provincial expenditures became higher than federal expenditures, due to a higher rate of increase for the former (e.g. in terms of current dollars, provincial expenditures increased by 28% annually from 1976-77 to 1979-80 while federal expenditures increased by 10% over the same period). Local/municipal government transportation expenditures in Manitoba were lower than either

the provincial or federal expenditures. The local/municipal expenditures generally fluctuated from year to year; for example, the expenditures in current dollars reached a high of \$51.4 million in 1976-77 (a 47% increase over the past year) and a low of \$18.1 million in 1977-78 (a 65% decrease over the previous year).

- In Saskatchewan, federal expenditures on transportation were consistently close to provincial transport expenditures; the ratios of federal to provincial transportation expenditures ranged from 0.81 to 0.94, except in 1977-78 where the ratio fell to 0.67, due to a 10% decrease in federal expenditures over the past year. From 1974-75 to 1979-80, federal transport expenditures increased by 13% annually in current dollars and 6% in constant 1971 dollars. Provincial government transportation expenditures in current dollars increased by about 10% annually from 1970-71 to 1979-80; however, in terms of constant 1971 dollars, the expenditure level fell by 2% per year over the same period. Local/municipal government expenditures were lower than provincial or federal transport expenditures; the local/municipal expenditures in current dollars increased by 15% per year from 1970-71 to 1978-79 but, in constant 1971 dollars, the annual increase was limited to less than 1% in this period.
- In Alberta, provincial government transportation expenditures were higher than local/municipal and federal expenditures. Provincial expenditures in current dollars increased by 20% per year from 1970-71 to 1979-80; despite inflation, the provincial transport expenditures in constant 1971 dollars experienced a 6% annual increase, much larger than those in Manitoba (2% increase) and Saskatchewan (2% decrease), over the same period. Local/municipal and federal transport expenditures in current dollars experienced annual increases of 6% and 13%, respectively. However, in terms of constant 1971 dollars, expenditures by these two levels of government decreased by 3% and 1%, respectively.
- Total value of new construction work, expressed as percentages of total value of all work

performed on transport infrastructure, steadily declined from a peak of 79% in 1972 to 72% in 1979. This suggests that an increasingly larger proportion of transport expenditures in the Prairie region was committed to maintenance work, at the expense of new capital construction.

In summary, overall consolidated government transportation expenditures (in current dollars) in the Prairie region increased by 13% annually from 1974-75 to 1978-79; however, due to inflation, real annual growth was limited to 4%. Further, it is evident that maintenance received an increasingly larger share of total transport expenditures. It is, however, premature to conclude the transport network in the Prairie provinces had matured; more data is required to determine if this shift reflects a matured transport-infrastructure network or simply a temporary shift in emphasis on resource allocation by the governments.

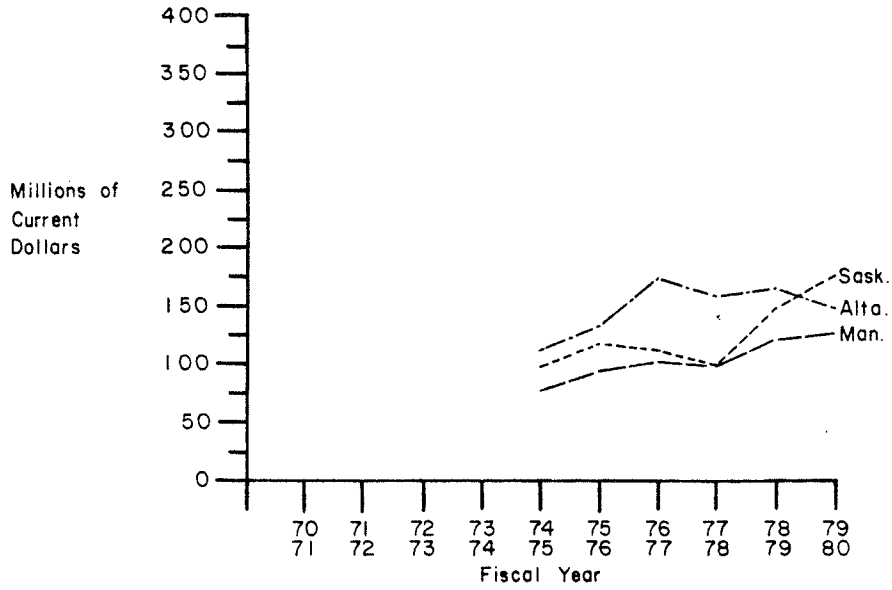


Figure I.3.1 Federal Government Transportation Expenditures - by Province (in millions of current dollars)

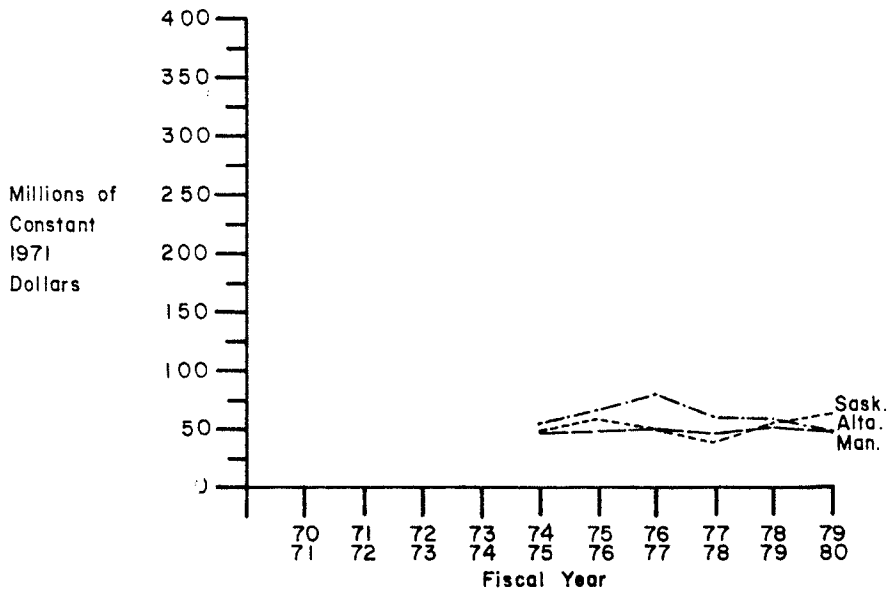


Figure I.3.2 Federal Government Transportation Expenditures - by Province (in millions of constant 1971 dollars)

I.3 FEDERAL GOVERNMENT TRANSPORTATION EXPENDITURES

Federal government expenditures, unlike expenditures incurred by the provincial and local/municipal governments, consisted of a major portion of funding to crown corporations, and contributions to other levels of government under joint, cost-sharing development programs. At least five federal government departments and agencies were found to be directly or indirectly involved in transport investments in the Prairie region: Transport Canada (TC), Canadian Transport Commission (CTC), Department of Indian and Northern Affairs (DINA), Public Works Canada (PWC), and Department of Regional Economic Expansion (DREE). TC and CTC were by far the largest contributors in the seventies.

Major joint federal-provincial transportation development programs in the past decade included (but were not limited to): the Highway Strengthening Program; the Northlands Agreement; the Airport Subsidy Program and Railway Grade Crossing Fund. Details of these programs and other federal government transportation expenditures are presented in Appendix C. Figures I.3.1 and I.3.2 illustrate federal government transportation expenditures in the Prairie provinces.

The following observations are made regarding federal expenditures:

- In terms of current dollars, total federal transportation expenditures increased by about 10% annually from 1974-75 to 1979-80. In Manitoba, the annual increase was 10%, in Saskatchewan the increase was 13%, and in Alberta the increase was 6% over the same period.

- In terms of constant 1971 and constant 1974 dollars¹, total federal expenditures reached the peaks of \$173.1 million and \$345.0 million respectively in 1976-77. Total federal transport expenditures in 1977-78 dropped by 19% over the previous year but recovered by about 7% in the next two years.
- On a per capita basis, federal transport expenditures in current dollars rose by 10% per year over five years in Manitoba and 11% in Saskatchewan. Per-capita federal expenditures fluctuated in Alberta but experienced an annual increase of 2% from 1974-75 to 1979-80.
- In terms of constant 1974 dollars, per-capita federal transport expenditures reached the peaks in Manitoba and Alberta in 1976-77 (\$81.9 and \$85.0 respectively). Since 1976-77, expenditures dropped by 3% per year over three years in Manitoba and 19% in Alberta. Per-capita expenditures in Saskatchewan increased by 22% in 1975-76 over the past year but dropped by 38% over the next two years; these expenditures recovered towards the end of the decade and resulted in an annual increase of 7% over five years.
- All five federal government departments experienced increases in current expenditures (ranging from an annual increase of 4% over five years for CTC to a 53% increase for PWC). The largest overall increase for each department occurred in the following provinces; TC (in Saskatchewan, 189% or \$57.3 million increase from 1974-75 to 1979-80); CTC (Alberta, 88% or \$20.4 million); DINA (Alberta, 404% or \$9.7 million); PWC (Manitoba, 15.4 times or \$7.7 million); DREE (Manitoba, 100% or \$2.9 million). In terms of constant 1974 dollars, TC, CTC and DREE experienced declines in expenditures since 1976-77 (i.e. annual decreases over 3 years of 4% for TC, 8% for CTC, and 18% for DREE). DINA and PWC

¹ Expenditures were considered in constant 1974 dollars in order to relate annual expenditures to 1974-75 expenditures (the first fiscal year for which data was available).

expenditures, despite construction price increases, rose annually by 17% and 39% respectively over the five year period.

- Federal government transportation expenditures in the Prairie provinces were unevenly distributed by mode; rail and air generally received larger proportions of federal resources (43% and 32% of total federal transport expenditures from 1974-75 to 1979-80, respectively), partly due to subsidies and grants made to the railways (primarily in the form of branch-line subsidies) and expenditures on airport construction and maintenance. Federal investments on highway construction/rehabilitation reached the lowest point in 1975-76 and the highest level in 1978-79, exhibiting a cyclical trend. Fundings for marine infrastructure accounted for only 2% of total federal transport expenditures because of limited operation of these facilities.
- Federal contributions to the Prairie provinces were made under joint development programs. The largest block of federal funds was made under the Highway Strengthening Program (54%) and the Northlands Agreement (28%). The remaining transfer payments were made in the form of Airport Subsidies, Railway Grade Crossing Fund, and others. Distribution by province is as follows: Manitoba (48% of total federal contributions), Saskatchewan (25%), and Alberta (27%).

From these findings, it is evident that federal government transportation expenditures, albeit increasing by about 10% annually from 1974-75 to 1979-80 (in terms of current dollars), barely kept pace with inflation during this period; real growth in federal transport expenditures was limited to about 1% per year. These increases were less than the annual increases in gross federal government expenditures during the period (at 13.1% in current dollars and 2.4% in constant 1971 dollars).

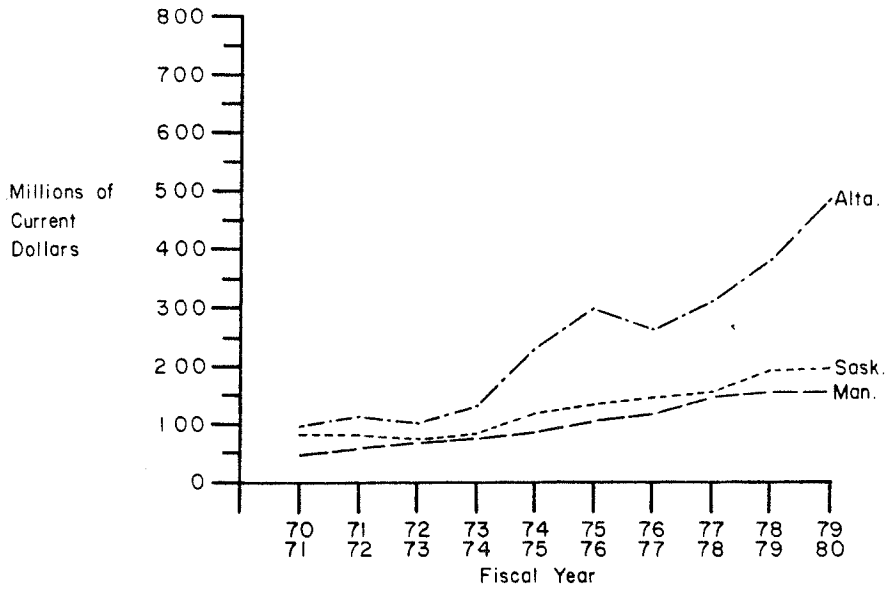


Figure I.4.1 Provincial Government Transportation Expenditures - by Province (in millions of current dollars)

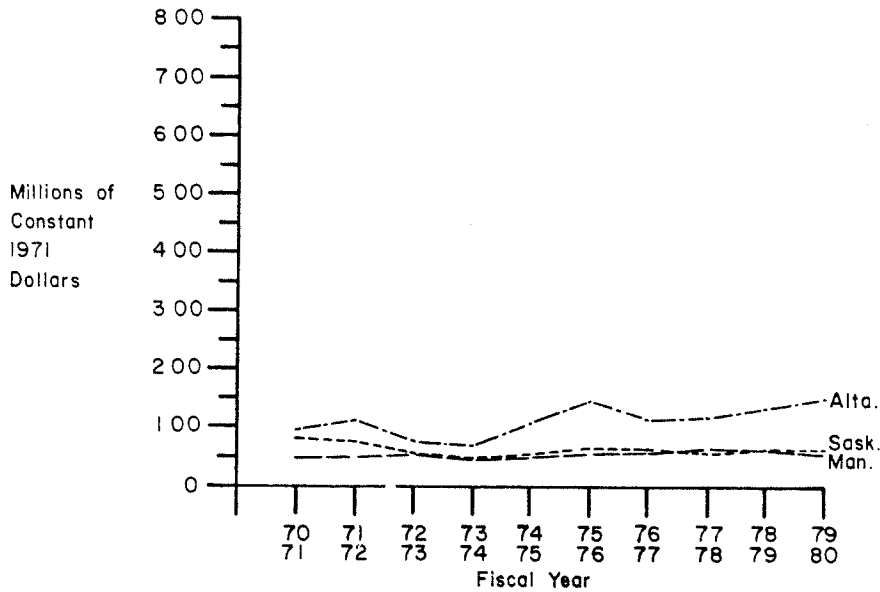


Figure I.4.2 Provincial Government Transportation Expenditures - by Province (in millions of constant 1971 dollars)

I.4 PROVINCIAL GOVERNMENT TRANSPORTATION EXPENDITURES

Provincial government transportation expenditures were normally and largely incurred by the provincial departments of highways and transportation. In Saskatchewan, however, the Department of Northern Saskatchewan (DNS) and Saskatchewan Rural Affairs (SRA) were involved in transport infrastructure developments, in addition to Saskatchewan Highways and Transportation (SHT). It was suspected that the Department of Municipal Affairs (DMA) in Manitoba might also be involved in transport investments; however, communications with DMA officials revealed that transportation expenditures were unavailable.

An overwhelmingly significant proportion of provincial government transportation expenditures were incurred in roadway construction/rehabilitation activities. Other expenditure areas included construction and maintenance of local/municipal airports, and aids and grants for urban transit. Figures I.4.1 and I.4.2 show the total provincial transportation expenditures in current dollars and constant 1971 dollars, respectively. Detailed expenditure data is presented in Appendix D.

I.4.1 Manitoba Provincial Government Transportation Expenditures

Provincial government transportation expenditures, as reported by the Manitoba Department of Highways and Transportation, indicate that:

- In terms of current dollars, total transportation expenditures increased by 14% annually from 1970-71 to 1979-80. The largest jump occurred in administration expenditures (an annual increase of 25% over the decade), followed by maintenance (16%) and capital construction (12%). Aids and grants to municipalities increased by 30% annually from 1970-71 to 1977-78

but fell sharply from \$21.87 million in 1977-78 to \$3.93 million in 1979-80.

- In terms of constant 1971 dollars, total provincial transport expenditures increased by 2% per year from 1970-71 to 1979-80. Again, administration expenditures experienced the largest increase (12% per year) while maintenance expenditures also showed a 4% annual increase over the nine-year period. Capital construction expenditures and aids to municipal governments declined from 1970-71 to 1979-80 by 0.4% and 9%, respectively.
- The annual increases in Manitoba provincial government transportation expenditures were almost identical to the annual increases in gross provincial government expenditures (at 14% in current dollars and 3% in constant 1971 dollars). Hence provincial transport expenditure trends were consistent with overall provincial expenditure trends in the last decade.

I.4.2 Saskatchewan Provincial Government Transportation Expenditures

Three Saskatchewan government departments were responsible for transport infrastructure developments in the province. Among them, Saskatchewan Highways and Transportation (SHT) was the major funding source. Tables D.2.1 and D.2.2 show the expenditures of SHT and the highlights are as follows:

- In terms of current dollars, total provincial government transportation expenditures increased by 10% per year from 1970-71 to 1979-80. Maintenance expenditures experienced the largest growth (14% annually) followed by capital construction (9%). Aids and grants to municipal governments, and administration expenditures all increased by 8% per annum in the decade.
- In terms of constant 1971 dollars, total expenditures declined by 3% per year in the seventies. Only capital construction expenditures showed an increase (1% per year) from 1970-71 to 1979-80; all the other expenditure areas experienced declines (about 3% per year) over the same period.

Saskatchewan Rural Affairs (SRA) was not directly involved in the planning, design or construction activities of transport infrastructure. The transportation component of its overall responsibilities was to distribute resources to municipalities for the provision of transportation services. Funds were paid to the municipal governments in the form of conditional grants (i.e. monies to be used on designated, cost-sharing roadway development programs) and unconditional grants (i.e. provincial payments "with no strings attached"). It was estimated that most, if not all, of the unconditional grants were expended by the municipalities to finance their share in joint provincial-municipal roadway developments. All grant payments, therefore, were assumed to be used in capital construction work.

Tables D.2.3 and D.2.4 show the amounts of grant payments made by SRA annually:

- In terms of current dollars, total grant payments increased by 11% per year from 1970-71 to 1979-80. The largest increase occurred in unconditional grants (19% annually over the nine-year period) while conditional grants increased by 8% per year over the same period.
- In terms of constant 1971 dollars, total grant payments decreased by about 1% per year from 1970-71 to 1979-80, as a result of a 4% annual decline in conditional grant payments. Unconditional grants, on the other hand, increased by 6% annually over the nine-year period.
- An increasingly larger proportion of transfer payments was made in the form of unconditional grants. In 1970-71, unconditional grants constituted 20% of total grant payments, whereas in 1979-80 these grants accounted for 38% of total payments.

Prior to 1973-74, transport infrastructure development in northern Saskatchewan was the responsibility of the Department of Natural Resources. The responsibility was transferred to the Department of Northern Saskatchewan (DNS) in 1973. Tables D.2.5 and D.2.6 show the DNS expenditures on transportation:

- DNS transportation expenditures¹ were very small in magnitude in comparison with SHT and SRA transport expenditures, accounting for less than 7% of total provincial government transportation expenditures.
- In terms of current dollars, total expenditures increased by 44% per year from 1973-74 to 1979-80. Capital construction expenditures increased by 2% annually from 1975-76 to 1979-80 while maintenance expenditures rose by 21% per year during this period.
- In terms of constant 1973 dollars, total transport expenditures increased by 32% annually from 1973-74 to 1979-80. Maintenance expenditures increased by 14% per year from 1975-76 to 1979-80; capital construction expenditures, however, declined by 4% per annum over the same period.

Total provincial government transportation expenditures in Saskatchewan experienced an annual increase of 10% in current dollars but an annual decrease of 2% in constant 1971 dollars. However, gross provincial government expenditures in Saskatchewan increased annually by about 17% in current dollars and 5.5% in constant 1971 dollars. Hence, transportation services in Saskatchewan received proportionately less funding during the seventies than other provincial services.

¹ DNS transportation expenditures did not include administration costs as these costs were absorbed in the DNS general budget.

I.4.3 Alberta Provincial Government Transportation Expenditures

Similar to the MDHT, Alberta Transportation (AT) was the major provincial agency responsible for transportation development and funding. AT expenditures are shown in Tables D.3.1 and D.3.2, outlining the expenditures by function, in terms of current dollars and constant 1971 dollars respectively. Highlights of AT expenditures are:

- In terms of current dollars, total provincial government transportation expenditures increased by 20% per year from 1970-71 to 1979-80. The largest increases occurred in aids and grants to municipalities (22% per year) and capital construction expenditures (21%). In comparison, maintenance and administration expenditures experienced only "modest" increases (by 16% and 4% per year, respectively).
- In terms of constant 1971 dollars, total AT expenditures increased by 5% annually from 1970-71 to 1979-80. Every expenditure area, except administration expenditures, showed an increase: capital construction (6% per annum over the decade); maintenance (2%); and aids and grants (7%) annually from 1970-71 to 1979-80.
- Transportation expenditures in current dollars (20%) experienced a slightly larger annual increase than gross provincial government expenditures (19%) in Alberta. However, transportation expenditures in constant 1971 dollars (5%) increased at a lower annual rate than gross provincial government expenditures (7%), due to higher increases in construction prices than government goods and service prices.

I.4.4 Comparisons of Provincial Government Transportation Expenditures

Tables D.4.1 to D.4.6 inclusive compare provincial government expenditures on transportation. Highlights are as follows:

- In terms of current dollars, total provincial government transportation expenditures in the

Prairie region increased by 16% annually from 1970-71 to 1979-80. The largest increase occurred in Alberta (20% per year over ten years), followed by Manitoba (14%) and Saskatchewan (10%).

- In terms of constant 1971 dollars, total provincial transport expenditures in the Prairie provinces increased by 2% per year from 1970-71 to 1979-80. Only Alberta and Manitoba showed annual increases over the decade (by 5% and 2%, respectively); Saskatchewan provincial expenditures declined by 2% per year over the same period.
- Alberta had the highest provincial government transportation expenditures, in both current dollars and constant 1971 dollars, followed by Saskatchewan and Manitoba. However, on a per-capita basis, Saskatchewan led the other two provinces in expenditures over the decade. Manitoba, in the seventies, had the lowest expenditure level, in absolute dollars or in dollars per capita.
- In terms of current dollars, all three Prairie provinces experienced remarkable increases in capital construction expenditures: Alberta (21% per year from 1970-71 to 1979-80), Manitoba (12%), and Saskatchewan (10%). However, in terms of constant 1971 dollars, only Alberta experienced an increase (6% per year) while the other two provinces showed decreases in capital construction expenditures (0.4% annually for Manitoba and 2% annually for Saskatchewan, from 1970-71 to 1979-80).
- Capital construction expenditures, expressed as a ratio of total provincial expenditures, decreased in Manitoba and Saskatchewan from 1970-71 to 1979-80. This ratio increased in Alberta from 1970-71 to 1976-77 but declined thereafter. This suggests a gradual shift, at least in resource allocation, towards maintaining existing facilities instead of constructing new infrastructure.

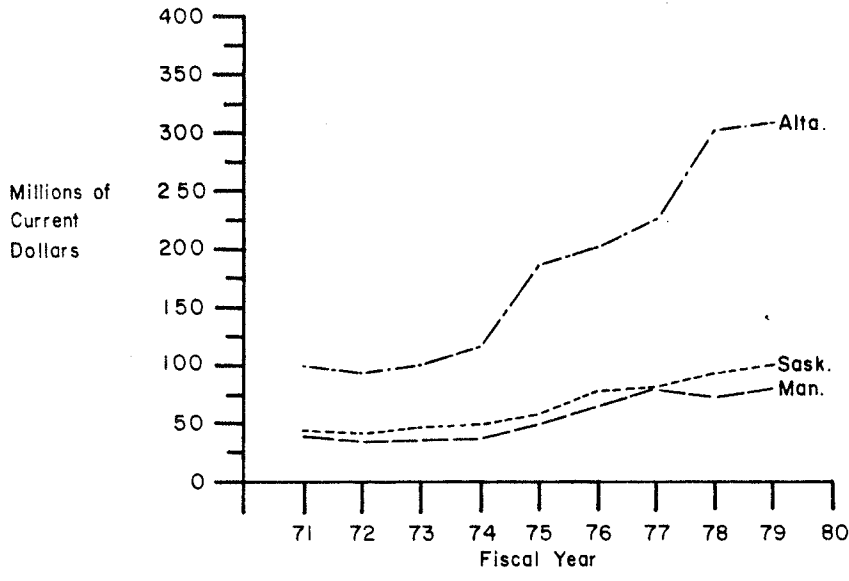


Figure I.5.1 Total Annual Expenditures on Transport Infrastructure by Local/Municipal Governments - by Province (in millions of current dollars)

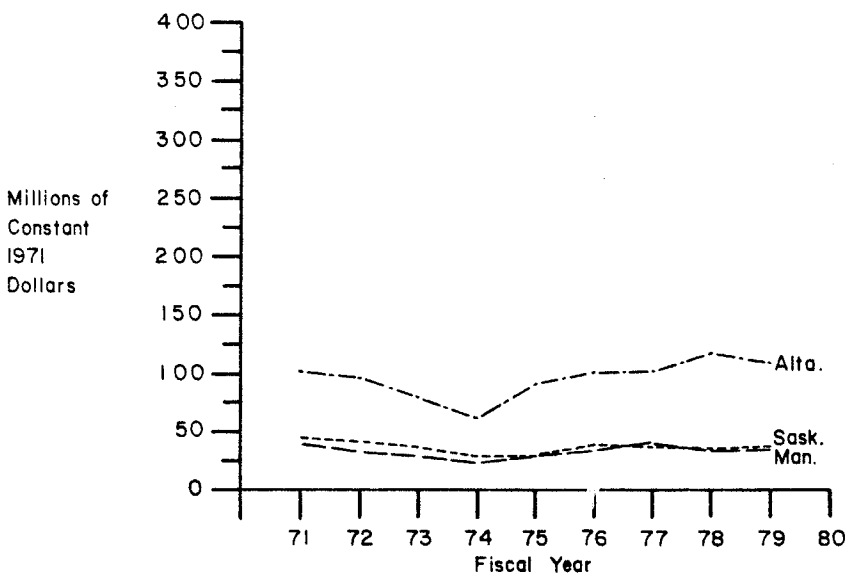


Figure I.5.2 Total Annual Expenditures on Transport Infrastructure by Local/Municipal Governments - by Province (in millions of constant 1971 dollars)

I.5 LOCAL/MUNICIPAL GOVERNMENT TRANSPORTATION EXPENDITURES

Due to the lack of a comprehensive data base, this section briefly discusses total annual local/municipal government transportation expenditures by province. In particular, expenditures incurred by four cities in the Prairie region are also examined. Selection of these cities was partly dictated by data availability, and also by the need of representative small (i.e. populations of 100,000 to 500,000) or medium-sized (i.e. populations of 500,000 to 1,000,000) cities in each of the Prairie provinces.

Total annual local/municipal government transportation expenditures as well as transportation expenditures of four Prairie cities - Winnipeg, Regina, Saskatoon and Edmonton - are presented in Appendix E.

Figures I.5.1 and I.5.2 show the total local/municipal government transportation expenditures in current dollars and constant 1971 dollars, respectively:

- In terms of current dollars, local/municipal transport expenditures in Alberta showed the largest increase (15% annually from 1971 to 1979), followed by Saskatchewan (10%) and Manitoba (9%). Further, municipal governments in Alberta incurred higher expenditures than those of the other two provinces combined.
- In terms of constant 1971 dollars, only Alberta municipal government transport expenditures showed real increases (less than 1% per year) in the seventies. Local/municipal transport expenditures for Saskatchewan and Manitoba declined by 3% annually from 1971 to 1979.

Unlike other jurisdictions, the City of Winnipeg considered both new/capacity-improvement projects and maintenance as capital work.

Expenditure data is presented in Tables E.3 and E.4:

- In terms of current dollars, total transport expenditures increased by about 20% per year from 1972 to 1980. New/capacity-improvement expenditures increased by 21% annually while maintenance expenditures rose by 18% annually over the eight-year period.
- In terms of constant 1971 dollars, total transport expenditures increased by 7% per year in the seventies. New/capacity-improvement expenditures (8% per year from 1972 to 1980) again experienced a larger increase than maintenance expenditures (5%).
- Unlike in most other government departments, new capital construction expenditures for the City of Winnipeg assumed an increasingly larger share of total transport expenditures (from 53% in 1972 to 73% in 1979).

Local/municipal government transportation expenditures incurred by the cities of Regina and Saskatoon are presented in Tables E.5 to E.8 inclusive. The highlights are as follows:

- In terms of current dollars, total transport expenditures in Regina increased by 20% per year from 1971 to 1980, with the largest increase occurring in capital construction (a 36% annual increase); general expenditures (which include operation and maintenance, administration and other expenses) increased by 15% per year over the decade. Total transport expenditures in Saskatoon rose by 28% annually from 1971 to 1980. The largest jump occurred in capital construction expenditures (a 47% annual increase in nine years), followed by transit capital expenditures and operating grants (a 19% annual increase), and maintenance expenditures (17%).
- In terms of constant 1971 dollars, total transport expenditures in Regina increased by 7% per year from 1971 to 1980. Capital construction expenditures increased by 21% annually while general expenditures increased by 2% annually over the decade. In Saskatoon, total transport expenditures experienced an annual increase of 14% from 1971 to 1980. Capital construction expenditures increased by 31% annually in the seventies; the other

expenditure areas also experienced annual increases: transit capital expenditures and operating grants (6%) and maintenance expenditures (4%).

- Although Regina and Saskatoon had approximately the same population, transport expenditures in Regina were consistently higher than those in Saskatoon until 1979 when Saskatoon expenditures became higher than Regina expenditures. Further, in Regina, maintenance expenditures were always higher than capital construction expenditures, whereas, in Saskatoon, capital construction expenditures were higher than maintenance expenditures, at least since 1975. The only major similarity was that capital construction expenditures in both cities experienced a higher growth rate than maintenance expenditures.

Transport investments undertaken by the City of Edmonton are illustrated in Tables E.9 and E.10. The following observations are made:

- In terms of current dollars, total transport expenditures increased by 21% per year from 1970-71 to 1979-80. Total capital expenditures (composed of capital construction expenditures and capital grants provided by the provincial government) rose by 22% annually in the seventies. Maintenance and administration expenditures also experienced annual increases (of 20% and 7% respectively) over the decade.
- In terms of constant 1971 dollars, total transport expenditures incurred by the City of Edmonton rose by 7% per year from 1970-71 to 1979-80. Both total capital expenditures and maintenance expenditures increased annually (by 7% and 5% respectively) over the ten-year period; administration expenditures, however, declined by 6% annually in the decade.

In summary, although Statistics Canada [50] reported that total local/municipal government transportation expenditures in constant 1971 dollars declined in Manitoba and Saskatchewan (3% annually) from 1971 to 1979, these decreases were not evident in the largest cities in both

provinces. Further, all four cities experienced larger increases in new capital construction than in maintenance work; this trend was contrary to the provincial trend where maintenance received increasingly larger funding in the past decade.

I.6 RELATIONSHIPS BETWEEN GOVERNMENT TRANSPORTATION EXPENDITURES AND VARIOUS INDICATORS

Bryan [12] argues that governments, in evaluating transport investments, are primarily concerned with the level of utilization of such infrastructure. This section attempts to determine whether there exist any relationships between government transport investments and indicators of utilization and prevailing economic climate (as reflected by gross government expenditures and total capital investments in the Prairie region). More importantly, this section is intended to illustrate how expenditure data presented in the preceding sections can be used to facilitate meaningful research.

The independent variables (i.e. the indicators) used in the analyses were defined as follows:

x_1 = provincial population estimates (in millions)

x_2 = total provincial road motor vehicle registrations (in millions)

x_3 = total distance travelled by for-hire carriers (in millions of km.)

x_4 = total in-bound tonnage of freight carried by for-hire carriers (in millions of tonnes)

x_5 = total out-bound tonnage of freight carried by for-hire carriers (in millions of tonnes)

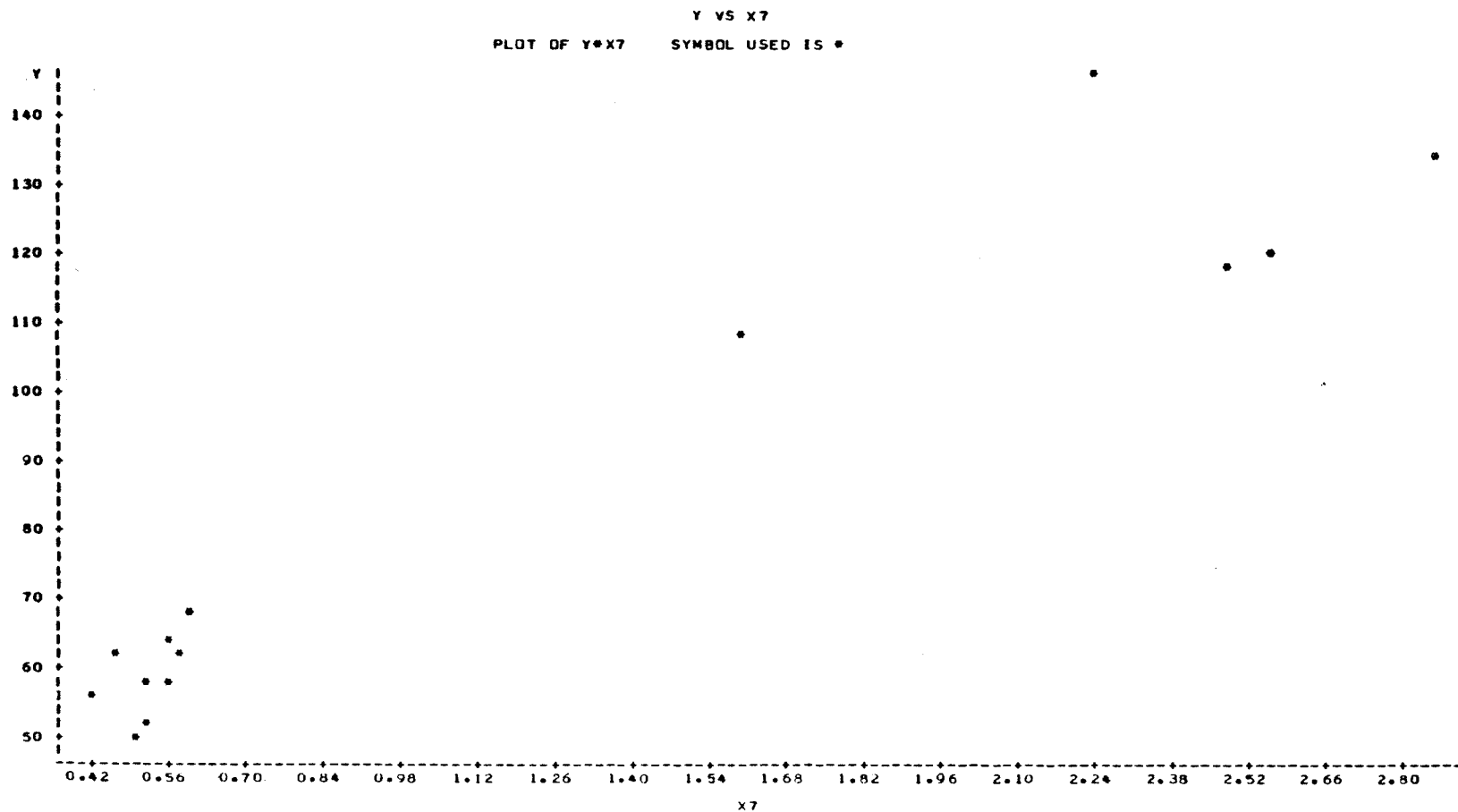
x_6 = gross general expenditures by provincial governments (in billions of constant 1971 dollars)

x_7 = total investments in capital construction (in billions of constant 1971 dollars)

Detailed information for these indicators is tabulated in Appendix G. These independent variables were selected primarily because they were perceived to have some direct influence on provincial government

STEP 1	VARIABLE X7 ENTERED	R SQUARE = 0.91251338	C(P) = 1.33630570		
		DF	SUM OF SQUARES	MEAN SQUARE	F PROB>F
	REGRESSION	1	14234.68747975	14234.68747975	135.59 0.0001
	ERROR	13	1364.74129358	104.98009951	
	TOTAL	14	15599.42877333		
		B VALUE	STD ERROR	TYPE II SS	F PROB>F
	INTERCEPT	42.42306466			
	X7	34.52760625	2.96514538	14234.68747975	135.59 0.0001

Figure I.6.1 Plot of Provincial Government Transportation Expenditures against Total Real Investments in Capital Construction



NOTE: 1 OBS HIDDEN

transportation expenditures, and also because data for these indicators was readily available from Statistics Canada. Data used in these regression analyses covered only five years (i.e. from 1975 to 1979) due to incomplete information for the other years.

For this study, only provincial government transportation expenditures were used in the analyses, due to a lack of information on allocation by province of gross federal government expenditures and on city-specific indicators (such as vehicle registrations or distance travelled in a particular city). Provincial transport investments used in the study were stated in terms of constant 1971 dollars. Since the utilization indicators (i.e. x_1 to x_5) were expressed in real (constant) terms, it would be inappropriate to relate nominal provincial transport expenditures to these indicators. Therefore, the dependent variable was provincial government transportation expenditures in constant 1971 dollars, denoted as y . Consequently, it was hypothesized that

$$y = f(x_1, x_2, x_3, x_4, x_5, x_6, x_7)$$

for the Prairie region as a whole and for each of these three provinces.

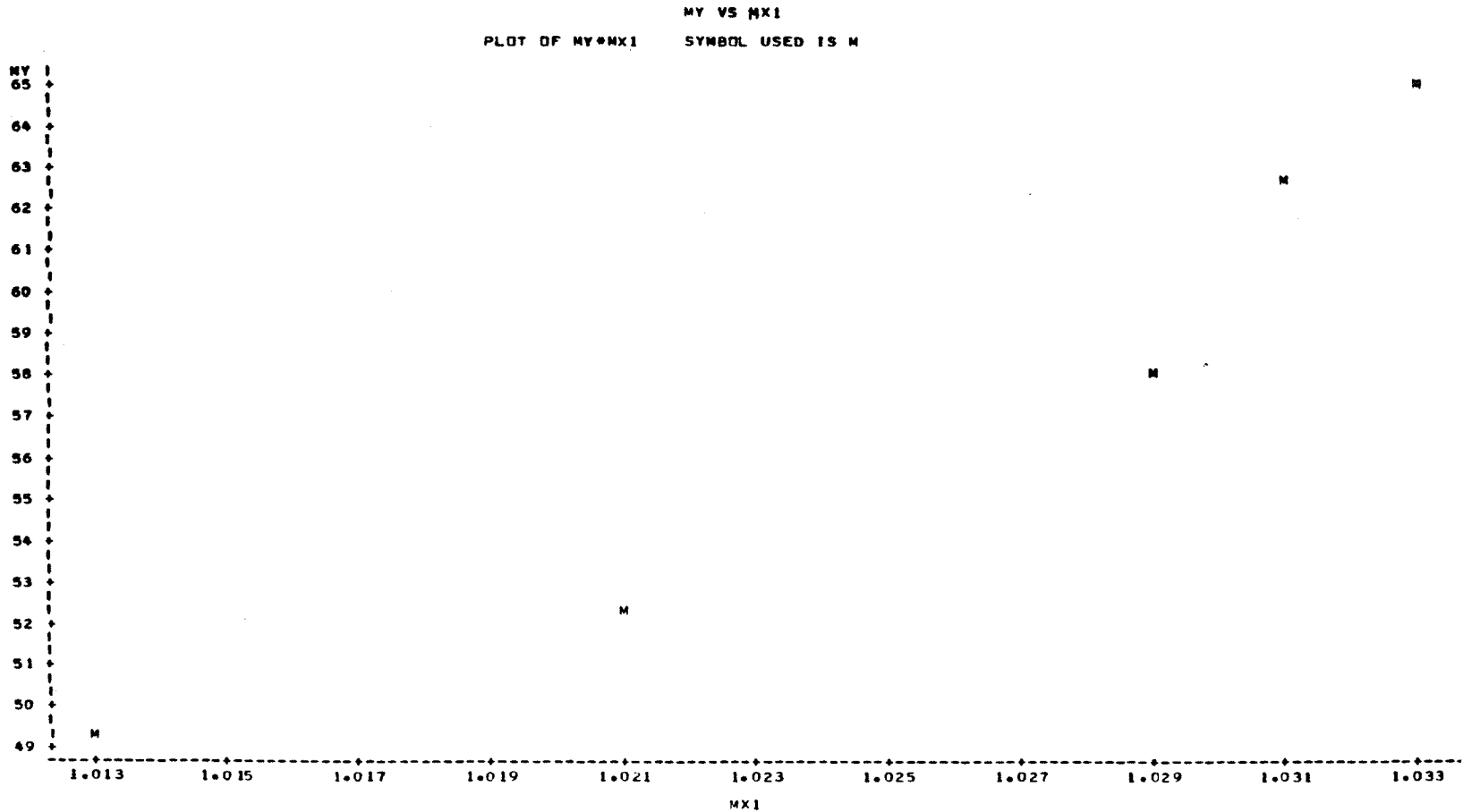
A stepwise regression analysis was performed (using the Statistical Analysis System package) on each function to find the best-fit line, and to test the statistical significance of the regression line and the independent variables.

Complete outputs of the stepwise regression analyses are presented in Appendix G. For discussion purposes, however, only the best equations with one independent variable are shown here. Plots of these relationships are presented in Figures I.6.1 to I.6.4 inclusive.

FORWARD SELECTION PROCEDURE FOR DEPENDENT VARIABLE MY

STEP 1	VARIABLE MX1 ENTERED	R SQUARE = 0.92243535	C(P) = .			
		DF	SUM OF SQUARES	MEAN SQUARE	F	PROB>F
	REGRESSION	1	159.35705326	159.35705326	35.68	0.0094
	ERROR	3	13.39982674	4.46660891		
	TOTAL	4	172.75688000			
		B VALUE	STD ERROR	TYPE II SS	F	PROB>F
	INTERCEPT	-722.81566861				
	MX1	760.95930233	127.39862755	159.35705326	35.68	0.0094

Figure I.6.2 Plot of Manitoba Provincial Government Transportation Expenditures against Provincial Population Estimates



Prairie Region

From Table I.6.1

$$y = 42.4231 + 34.5276 x_7$$

$$R^2 = 0.9125$$

$$s = 10.246$$

$$\text{PROB>F} = 0.0001$$

Manitoba

From Table I.6.2

$$y = -722.816 + 760.959 x_1$$

$$R^2 = 0.9224$$

$$s = 2.1134$$

$$\text{PROB>F} = 0.0094$$

Saskatchewan

From Table I.6.3

$$y = 28.4335 + 62.5441 x_7$$

$$R^2 = 0.8579$$

$$s = 2.0527$$

$$\text{PROB>F} = 0.0238$$

Alberta

From Table I.6.4

$$y = 99.3208 + 1.93306 x_5$$

$$R^2 = 0.2189$$

$$s = 15.514$$

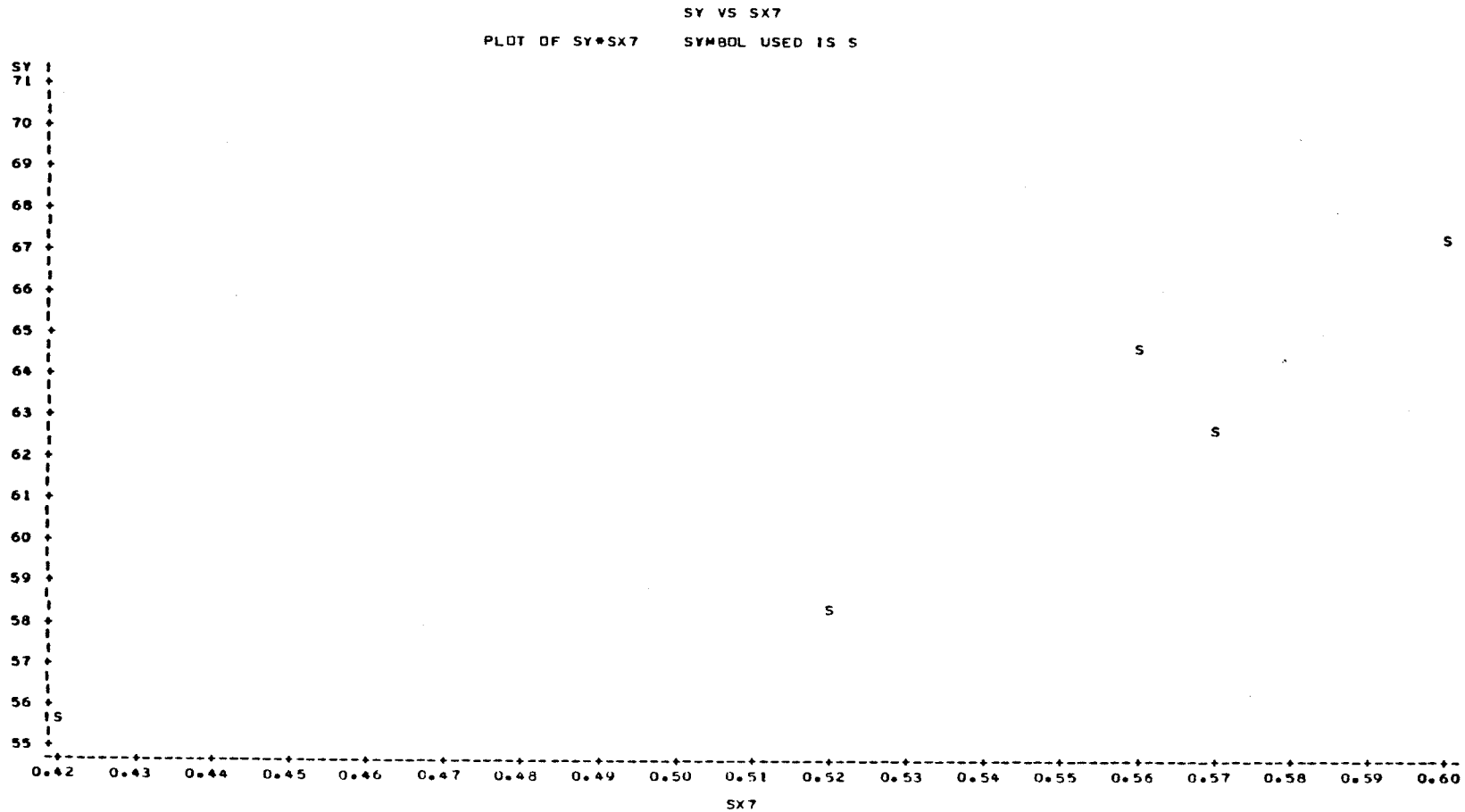
$$\text{PROB>F} = 0.4268$$

The following observations are of relevance to the regression equations:

- At the 5% significance level (i.e. $\alpha = 0.05$), all equations, except the Alberta equation, are statistically significant, i.e. the independent variable is significant in the determination of the dependent variable. The "PROB >F" value of the Alberta equation is larger than the α value, hence the equation is not statistically significant at this significance level.
- With the exception of the Alberta equation, the R^2 values of the other regression equations range from 0.8579 to 0.9224; an R^2 value of 0.8579 means that 85.79% of the total variability of the dependent variable is

STEP 1	VARIABLE SX7 ENTERED	R SQUARE = 0.85796259	C(P) = .			
		DF	SUM OF SQUARES	MEAN SQUARE	F	PROB>F
	REGRESSION	1	76.35753789	76.35753789	18.12	0.0238
	ERROR	3	12.64114211	4.21371404		
	TOTAL	4	88.99868000			
		B VALUE	STD ERROR	TYPE II SS	F	PROB>F
	INTERCEPT	28.43347336				
	SX7	62.54405738	14.69239592	76.35753789	18.12	0.0238

Figure I.6.3 Plot of Saskatchewan Provincial Government Transportation Expenditures against Total Real Investments in Capital Construction



explained by the regression. These values are relatively high, considering the fact that there may be numerous other factors which would influence the provincial government transportation expenditures. The R^2 value of the Alberta equation is 0.2189; the low value confirms the observation that out-bound freight tonnage carried by commercial truckers is not a statistically good predictor of Alberta provincial transport expenditures, although the tonnage measure is the best among the seven indicators used in the analysis.

- The standard deviations range in values from 2.0527 to 15.514; the largest value, however, represents only about 12% variation from the mean ($\bar{y} = 125.39$).

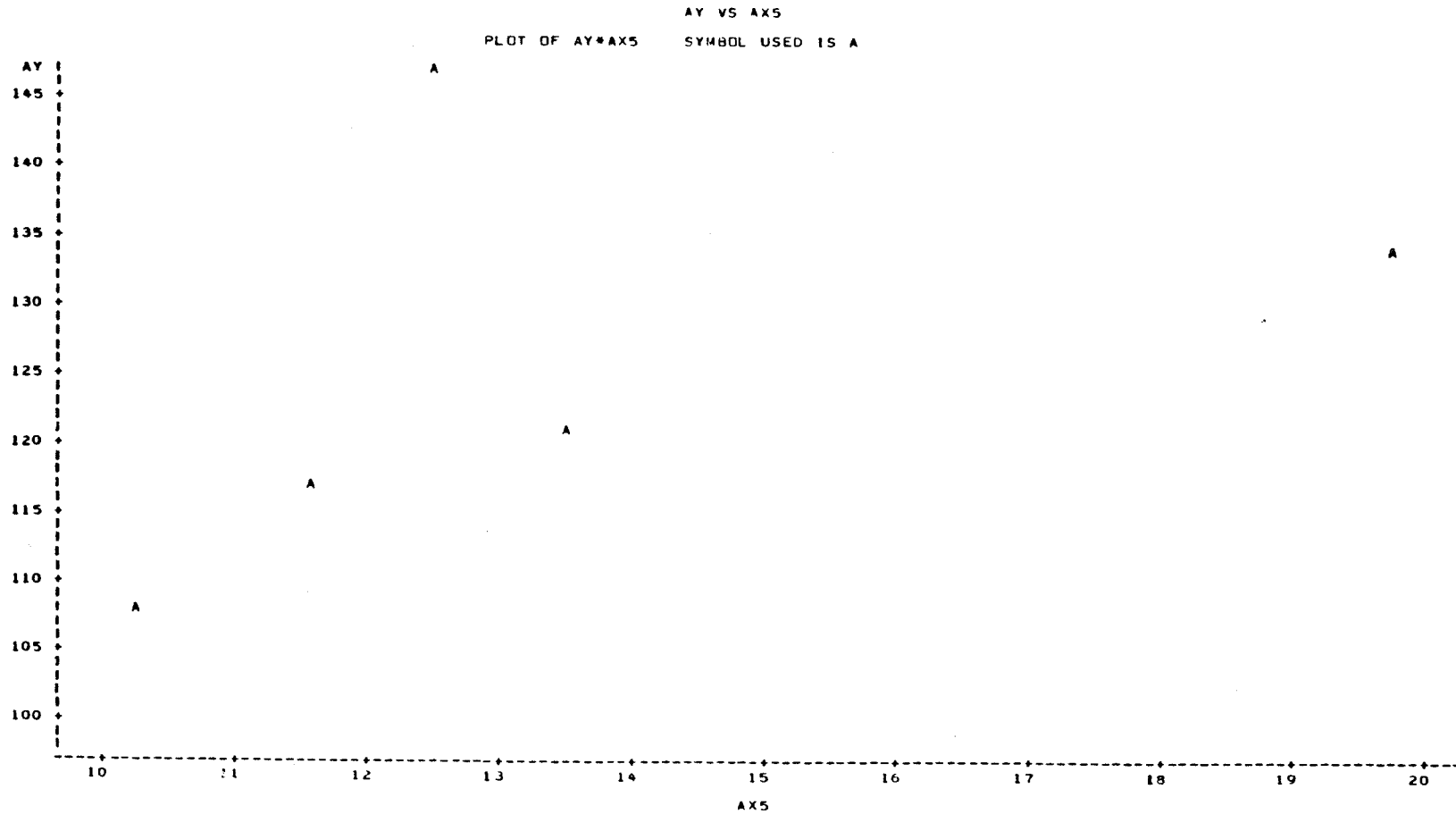
Despite the apparently good quality of the regression equations (i.e. with high R^2 values and low standard deviations), the absence of a common independent variable in all the equations fails to prove or disprove Bryan's assertion. The failure to do so may be explained by one or a combination of the following:

- Data for five years was insufficient to establish any substantial relationship between provincial government transportation expenditures and the indicators.
- There might be other independent variables, such as gross provincial product, industrial production output, farm output, etc., which would contribute to the understanding of government transportation expenditures but were not included in the analyses.
- Decision-making with respect to transportation expenditures was done independent of any indicators.
- A lag relationship might have existed between government transportation expenditures and the indicators (especially measures of utilization). This in particular relates to the issue of "overbuilding" of transport infrastructure prior to the seventies. Should there be excess capacity as a result of

FORWARD SELECTION PROCEDURE FOR DEPENDENT VARIABLE AY

STEP 1	VARIABLE AX5 ENTERED	R SQUARE = 0.21887520	C(P) = .			
		DF	SUM OF SQUARES	MEAN SQUARE	F	PROB>F
	REGRESSION	1	202.32657519	202.32657519	0.84	0.4268
	ERROR	3	722.06582481	240.68860827		
	TOTAL	4	924.39240000			
		β VALUE	STD ERROR	TYPE II SS	F	PROB>F
	INTERCEPT	99.32080901				
	AX5	1.93305584	2.10836453	202.32657519	0.84	0.4268

Figure I.6.4 Plot of Alberta Provincial Government Transportation Expenditures against Total Out-bound Freight Tonnage Carried by Commercial Truckers



overbuilding in the 50's or 60's, the pressure on the governments to undertake large capital investments in the seventies would be minimal, hence capital expenditures for this decade would be distorted considerably.

- The dependent variable y used in the analyses might have to be broken down to capital transport investments and maintenance expenditures, in constant 1971 dollars. This distinction might be necessary because some of the indicators would influence capital expenditures while the other indicator would be significant in the determination of maintenance expenditures.

Granted, the attempt to establish a relationship between provincial government transportation expenditures and various indicators in this study was rudimentary at best. Future research would be required to determine if any relationship (with a common independent variable) indeed existed, and whether government should allocate resources based on these indicators. Nevertheless, the analyses conducted in this section have demonstrated the usefulness of the government transportation expenditures presented in the earlier sections.

PART II

GOVERNMENT TRANSPORT-INVESTMENT EVALUATION

II.1 INTRODUCTION

II.1.1 What is Evaluation?

Evaluation of transport investments is an integral part of the transportation planning process. Manheim [53] defines evaluation as an "activity of examining the available alternative actions in light of the possible goals, assessing the desirability of each action, and summarizing the key issues to be considered by interested parties in reaching a decision".

The evaluation process encompasses both technical and ethical considerations, both social and physical aspects, as well as both present and future concerns [28] [89]. This process has quite often been mistakenly perceived as a value-free and objective analysis. This is of course not true, since evaluation incorporates an assessment of achievements with respect to initial goals and objectives. These goals and objectives are an expression of public values or preferences; they are generally formulated by decision-makers who are (supposedly) held accountable to the public.

The strongest criticism regarding the role of an analyst in project evaluation has been his preoccupation with mere economic justification or cost minimization. Project evaluation, eloquently argued by Manheim and Wohl, should go beyond optimization of resource allocation and should investigate alternatives that will satisfy public aspirations.

Recently, investment evaluation has been given a systems approach. The advantage of systems analysis, as indicated by Thomas and Schofer [80], is that "it provides an organized framework within which an analyst may

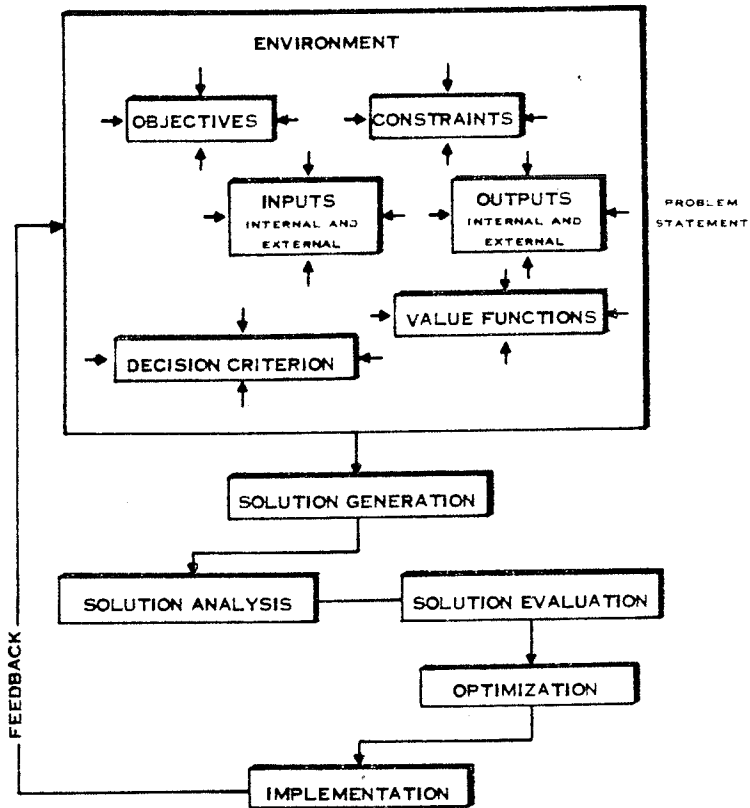


Figure II.1.1 A Framework for Project Evaluation

Source: O'Flynn [60]

think more broadly and comprehensively about his problems". At a more philosophical level, O'Flynn [60] proposes a formal framework within which the task of project evaluation can be accommodated (Figure II.1.1). The environment is defined as the complementary collection of systems, entities and activities outside , but which interacts with, the transportation system. The iterative process suggested by O'Flynn is typical of systems analysis. Manheim, in his discussions of the systems-analysis process, also proposes a similar approach (Figure II.1.2). He places particular emphasis on formulation of models which are simplified versions of the real systems but more easily described and analyzed.

The issues that are of concern to both analysts as well as decision-makers can be summarized as follows:

- inclusion of major alternatives in the analysis;
- identification of interest groups that may be affected by alternatives;
- accommodation of the views of these interest groups;
- identification of major advantages and disadvantages of each alternative;
- investigation of uncertainties regarding the impacts of each alternative.

In practice, there are usually two stages of evaluation. The initial stage is to identify, evaluate (primarily through goals-achievement analysis) and select the projects to be implemented. At this stage, projects are evaluated (and selected) on the basis of how well they meet the goals and objectives of the department or agency concerned. Priority ranking is always introduced and the cut-off point (i.e. above which the

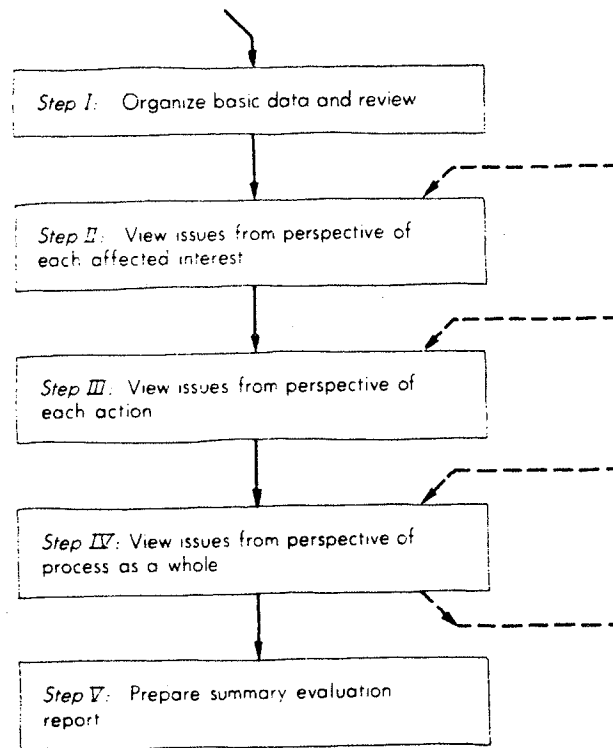
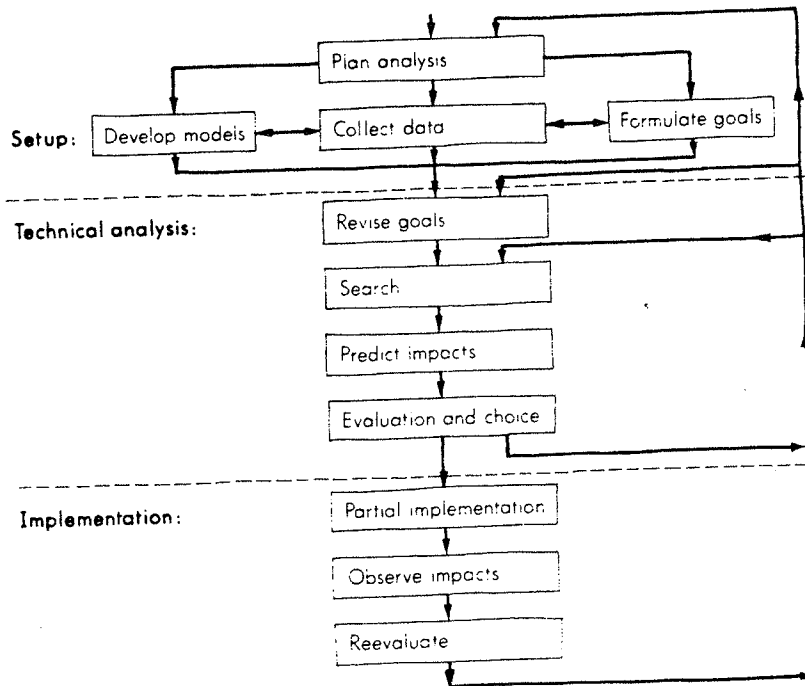


Figure II.1.2 A Systems Approach to Project Evaluation

Source: Manheim [53]

projects are accepted) is determined by resource availability. Economic analysis is often excluded at this stage, because the objectives may be incommensurable and, in practice, projects are often undertaken for strategic purposes rather than pure economics.

Once the projects are selected, the second stage is to identify, evaluate and select the most appropriate course of action¹. Evaluation includes a detailed analysis of (often mutually exclusive) alternatives for a particular project. The list of methodologies often employed includes, but is not limited to, the following:

- benefit-cost analysis;
- cost-effectiveness method;
- simple plus-or-minus method;
- cross-impact matrix;
- community value-effectiveness method;
- goals-achievement analysis.

The principles of these methodologies are briefly described in Section II.1.2.

¹ In the event that only a single course of action is generated, no comparison is made and the project is either accepted or rejected.

II.1.2 Conventional Evaluation Methodologies

Numerous techniques have been developed for evaluation of transport investments. Basis of choice usually depends on the type of data available and/or the preference of the analyst [70].

Detailed discussions on the techniques, which are beyond the scope of this thesis, can be found in [10] [23] [39] [40] [44] [45] [52] [53] [70] [73] [80] [86] [87] [88]. Nonetheless, some of the more common techniques are briefly presented as follows:

- Equivalent Uniform Annual Cost Method: this method selects the project with the lowest average annual costs, which include equivalent annual capital costs and annual operation and maintenance costs.
- Internal Rate of Return Method: this is a trial-and-error, iterative method which determines the discount rate that equalizes costs and benefits (or returns). In general, the project with the lowest costs and highest rate of return is selected.
- Cost-Effectiveness Method: the basic process determines the extent to which departmental objectives or goals have been accomplished by undertaking a particular project. Hence, a project with the lowest relative cost and highest fulfillment of objectives is chosen.
- Benefit-Cost Analysis: this method is vastly different from other economic analysis techniques, in that the benefit-cost analysis usually includes incommensurable impacts other than user consequences. An alternative which has the highest benefit/cost ratio and the highest net benefit will receive top ranking.
- Community Value-Effectiveness Method: this technique resembles the cost-effectiveness method for both compute the probability that a particular objective is achieved when a particular transport

investment is undertaken. The major difference between the two methods is that one relates to departmental objectives while the other deals with community objectives, where these objectives are not necessarily identical.

- Goals-Achievement Analysis: this method is a more advanced form of the community value-effectiveness method. The goals-achievement analysis often considers the fulfillment of a specific goal as a benefit to one group and a cost to another group within the community. The final step of this method usually involves benefit-cost analysis.
- Objective Achievement Evaluation: Two concepts are incorporated in this method: (i) "utility values" which relate the comparative importance of every community objective to overall objectives, and (ii) "effectiveness" which states the probability that a certain objective will be fulfilled when a specific course of action is taken.
- Cross Impact Analysis: this method is used to determine the probability of a particular impact occurring as a result of a specific transport-investment decision. With this approach, it is possible to develop a most likely scenario for future investment decision.
- Simple Plus-or-Minus Method: this is a crude method, simply indicating positive or negative impacts on certain characteristics. This method is often used for route selection rather than investment decision.

Other methods which have been employed infrequently include, but are not limited to, the Factor Profile Method, the Statistical Decision Method, and the Planning-Programming-Budgeting Method. None of the government departments surveyed had incorporated any of these techniques in the evaluation process.

Issues relating to the application of evaluation methodologies (e.g. discount rate, shadow pricing, definitions of costs and benefits, etc.) are well-discussed in [2] [10] [17] [23] [47] [48] [51] [54] [60] & [85].

II.1.3 Survey Methodology

One of the study objectives is to document actual methodologies and criteria used by government departments in evaluating transport-infrastructure investments. A preliminary literature search revealed that, although several reports on the recommended evaluation framework were published by the government departments [80] [81], there was no reference to the past or existing evaluation procedures used by these governments. Therefore, a survey was necessary in order to understand the rationale behind the approach to evaluation.

Officials from the following departments had agreed to participate in the survey, which commenced in July, 1982 and ended in November, 1982 (the numbers in brackets denote the number of officials consulted):

- | | |
|------------------------------|---|
| <u>Federal Government</u> | <ul style="list-style-type: none"> ● Transport Canada (4) ● Department of Regional Economic Expansion* (1) ● Public Works Canada (1) |
| <u>Provincial Government</u> | <ul style="list-style-type: none"> ● Manitoba Department of Highways and Transportation* (4) ● Saskatchewan Highways and Transportation* (1) ● Saskatchewan Rural Affairs* (1) ● Department of Northern Saskatchewan (2) ● Alberta Transportation* (3) |
| <u>Local Government</u> | <ul style="list-style-type: none"> ● Streets and Transportation Division, Winnipeg* (2) ● Engineering Department, Saskatoon (1) ● Systems Planning Branch, Edmonton* (1) |

Survey of departments marked with asterisks was conducted through personal interviews with the officials. Officials from MDHT and Winnipeg Streets and Transportation Division were visited on more than one occasions to clarify certain issues relating to their evaluation procedures. The other departments were surveyed by mail. Except for MDHT and Winnipeg Streets and Transportation Division, follow-up survey was done by phone and, in some cases, by mail.

Personal interviews were conducted in an informal atmosphere,

while survey by mail was more structured and hence less spontaneous. The following list of questions was used as a guide to initiate discussions on transport evaluation:

- were there any established guidelines for the planning, conduct and reporting of project evaluation?
- what were the methods and criteria commonly used in evaluating transport-infrastructure investments? and why?
- if economic analyses were conducted, what were the discount rates and economic lives of the infrastructure? what was the rationale behind these assumptions?
- if intangible impacts were considered, how were they accommodated in the analysis?
- were there any transport studies which would illustrate the departmental approach to evaluation?

These questions were formulated with a view to effecting a better understanding of issues respecting transport-investment evaluation. The survey has therefore resolved itself to two major questions: (i) how was evaluation of transport infrastructure investments conducted, and (ii) why were the methodology and criteria adopted in the analysis?

The methodology used in the analysis (e.g. the type(s) of techniques, consideration of costs and benefits) was often a reflection of departmental objectives and policies. Some departments, because of their legislative responsibility to finance transport developments in remote communities for social needs, would place particular emphasis on value analyses (e.g. goals achievement method, community value-effectiveness method, etc.). Other departments, especially provincial departments of highways, would place more emphasis on engineering evaluation (e.g. structural conditions of roadways, traffic

flow, etc.). Further, the criteria used in the evaluation would sometimes determine the viability of a particular project. Take the discount rates for example: a project might not be economically feasible (i.e. with a B/C ratio less than 1.0) at a high discount rate (e.g. 15%), but would become economically feasible at a low discount rate (say, 6%). The survey was intended to find out what kind of criteria had been used and the rationale behind using these criteria.

The structure of these questions was set up to provide the respondents with flexibility while attaining some uniformity in the responses to enable comparisons of the evaluation procedures used by different government departments.

Numerous problems were encountered in the course of conducting the survey, including:

- Identification of officials responsible for, or knowledgeable in, project evaluation in their respective departments was complicated by the many administrative units in a department. It was often necessary to pursue several officials before the appropriate one was found.
- many of the officials surveyed had been with their department for less than five years, hence they were unable to provide information with respect to evaluation procedures prior to their appointments.
- There was little documentation of the evaluation methodologies and criteria used by these government departments, except for the following publicly-available reports: Treasury Board of Canada [10] [62], City of Winnipeg [80], and City of Edmonton [81] [82]. Although there is no reason to question the honesty of the respondents, it is evident from the above publications that there existed some discrepancy between the purported evaluation procedures and the actual practice; this will be discussed in more detail in the ensuing sections.

It was discovered during the interviews that there was little appreciation, on the part of these officials, of how evaluation was conducted by their counterparts in other departments. However, due to recent demands for accountability in their departmental expenditures (particularly from the decision-makers), there has been a mounting interest in many government departments to search for a legitimate evaluation procedure, in order to justify future transport investments. Some officials surveyed in the study conceded that their efforts had been hampered by a lack of coordination with other government departments to formulate a uniform approach to transport-investment evaluation.

Part II of this thesis is therefore intended to provide an overview of the evaluation process in various government departments, based on information gathered from the survey and, in several cases, using information from publicly-available government publications (e.g. [10] [33] [62] [80]) and/or transportation studies (e.g. [37] [61] [74]) to collaborate the survey findings.

II.2 EVALUATION BY FEDERAL GOVERNMENT DEPARTMENTS

As indicated in Section I.3, at least five federal government departments and agencies were involved in transport investments in the Prairie region. Among them, information regarding the evaluation procedures was available and obtained from Transport Canada (TC), the Department of Regional Economic Expansion (DREE) and Public Works Canada (PWC). Evaluation methodologies used by the Department of Indian and Northern Affairs (DINA) and the Canadian Transport Commission (CTC) could not be documented; it is believed that these two departments, if they had undertaken pre-implementation evaluation, would follow the procedures established by DREE and TC respectively, due to the similarities in the legislative responsibilities between these departments.

The Treasury Board of Canada (TBC), in 1981, produced two documents that clearly set forth a set of guidelines for evaluation by federal departments. The first document, "Guide on the Program Evaluation Function" [33], philosophically outlines the need and formulation of program evaluation. The second document, "Principles for the Evaluation of Programs by Federal Departments and Agencies" [62], provides a framework for the actual planning, conduct and reporting of program evaluation. This latter publication will be discussed in more detail here, for it represents a significant effort on the part of the federal government to achieve consistency and effectiveness in the evaluation of investments.

The evaluation procedure proposed by the TBC greatly resembles the approach suggested by Manheim [53]. However, the Treasury Board guidelines are better-defined in terms of general evaluation approaches. More specifically, the document states that "the assessment of alternatives to the program or its delivery system requires that the probable results of each alternative be determined in a systematic manner and that comparisons between such alternatives be made in terms of a set of relevant, comprehensive and consistent criteria".

Although specific evaluation methodologies or techniques are not prescribed¹, the document recommends the use of several techniques in the absence of a well-established analytical procedure. Further, it is required that the logic of the method(s) be made explicit, in order to offer credibility to the whole evaluation exercise.

The major weaknesses of these principles lie in the vagueness of certain guidelines and some veiled recommendation to manipulate the data. Notwithstanding these setbacks, the Treasury Board believes that, after the federal government has gained more experience with the conduct of evaluation studies, a set of explicit standards can be developed.

Evaluation procedures of TC, DREE and PWC are described in subsequent sections. Although the methodologies and criteria discussed here were used in the seventies, most of them are still in effect at the writing of this thesis.

¹ TBC, in 1976, published the "Benefit-Cost Analysis Guide" [10] which specified the application of this technique (e.g. the use of social discount rates, shadow pricing, etc.).

II.2.1 Transport Canada (TC)

Transport Canada was the major federal agency involved in the construction and maintenance of transportation infrastructure. Among other responsibilities, TC also acted as a grantor, on behalf of the federal government, to distribute funds to other agencies for infrastructure developments and rolling-stock acquisitions.

For evaluation prior to resource allocation, the Priority Analysis System, developed by the Ontario Ministry of Transportation and Communication, was used in the past. Currently, efforts are concentrated on developing an "enhanced" package. A model developed for the Department of Regional Economic Expansion, known as the Socio-Economic Assessment System (SEAS), has been incorporated into the new TC evaluation framework.

The main evaluation criteria established by Transport Canada were

- transportation efficiency;
- regional impact;
- national access;
- compatibility with other federal programs.

In conjunction with the criteria, methodologies commonly used in evaluating investment activities included the cost-benefit analysis, goals-achievement analysis, and the cost-effectiveness method.

For benefit-cost analysis¹, benefits included travel-time

¹ TC, in conducting benefit-cost analysis, followed a set of guidelines prescribed by the TBC [10]. The guidelines specified the use of discount rates, shadow pricing, and definitions of benefits and costs; all federal government departments were required to adhere to these criteria.

savings, reduced accident rates, and user-cost savings. Costs, on the other hand, included capital and maintenance expenditures. The range of discount rates used by Transport Canada was between 5% and 15%. Service lives ranging from 20 years (for rural highways) to 25 years (for freeways) were assumed in the economic analysis.

Other costs and benefits were identified separately using the SEAS. In essence, the intangible costs and benefits were considered using arbitrarily-assigned monetary values. A "decision table" with raw findings was prepared; weighting was not introduced at the evaluation stage in order to provide flexibility for political maneuver.

In the early seventies before the general guidelines were set forth by TBC, evaluation was not effectively conducted, as evident in the 1974-79 Federal-Provincial Highway Strengthening Program in the west. No TC-commissioned pre-implementation evaluation studies can be documented; there is also no evidence that TC had any knowledge of how the provincial governments had conducted evaluation prior to the signing of the agreement. A TC official privately conceded that the investments were made as a result of political concessions, without any engineering and/or economic justification. This program, because of its questionable achievements, led to a revamped approach, at least on the part of TC, to participating in future joint development programs. An example would be the current Federal-Provincial Strengthening/Improvement Program in the Atlantic provinces, which requires engineering and economic evaluation before commencement and after termination of the Program. A more detailed assessment of the Western Highway Strengthening Program is presented in Appendix H.1.

II.2.2 Department of Regional Economic Expansion (DREE)¹

DREE's involvement in northern access programs was primarily through the Northlands Agreement with the three Prairie provinces. This 5-year agreement commenced in 1976 but was extended for an additional year in 1981, pending the negotiation of a future, similar agreement².

The mandate of DREE in transportation development was to finance (on a cost-sharing basis³ with the provinces) surface transportation projects (roads and small marine facilities) and remote airstrip improvement programs, designed to provide economically-viable and reliable access to the northern communities which otherwise would be isolated from the more developed southern regions.

DREE had established a "minimum standard on adequacy" concept which allowed a more uniform approach to project evaluation⁴:

- For community access, there should be at least two alternative and complementary modes of transport available on a year-round basis.
- For resource development, there should be at least one mode of transport available on a year-round basis.

Since DREE was a "grantor agency", it did not actively engage in engineering or economic evaluation. Detailed evaluation was carried out by the provinces and only the cost estimates were submitted to DREE

¹ DREE was in the process of reorganization in the late summer of 1982. Its transportation responsibility would be transferred to Transport Canada.

² The new agreement was officially signed in November, 1982.

³ DREE only cost-shared the initial construction cost; the provinces (as "implementing agencies") were in charge of setting construction standards and would pay for the full maintenance costs.

⁴ This was adapted from an unpublished report, "Western Northlands - Transportation", prepared by DREE.



for funding approval. In reviewing applications for federal assistance under the Northlands Agreement, DREE would use benefit-cost analysis¹ (as required by TBC) and goals achievement method to determine resource allocation. This funding prioritization process was often independent of the evaluation conducted by the provinces.

Due to strong emphasis on DREE's "de-isolation" policy, projects were normally funded for "strategic development" (i.e. social benefits and needs). Under such circumstances, it was not unusual that economically-infeasible projects (i.e. with a benefit/cost ratio of less than 1.0) were approved and funded by DREE.

II.2.3 Public Works Canada (PWC)

The role of Public Works Canada in transportation was to construct and maintain roadway facilities under federal jurisdiction.

The three evaluation techniques employed by PWC were

- net present worth method;
- benefit-cost analysis;
- elementary (intuitive) evaluation techniques.

Both tangible and intangible impacts were studied by PWC in its evaluation. Intangible benefits and costs were evaluated by non-monetary weighting of impacts as well as by pure intuitiveness. The null ("do-nothing") alternative was also included in the evaluation.

¹ Intangible benefits and costs were always considered qualitatively.

Prior to 1978, the range of interest rates used by PWC was between 5% and 10%¹. From 1980 until recently (December, 1982), the range has been between 5% and 15%. PWC projects (mostly highways and bridges) had an assumed economic life of 20 years. This assumption was similar to that of the provincial departments of highways.

PWC also carried out post-construction evaluation to determine the actual impacts of roadway constructions. In the case of construction within a National Park, a thorough environmental assessment (both before and after construction) was conducted as required by federal statute.

¹ The range was different from that prescribed by TBC in 1976; TBC recommended "the use of a social discount rate of 10%, and of 5% and 15% for sensitivity analyses". No reason was given by PWC as to why this discrepancy had existed.

II.3 EVALUATION BY PROVINCIAL GOVERNMENT DEPARTMENTS

In this section, evaluation methodologies used by five provincial government departments are discussed. The departments are:

- Manitoba Department of Highways and Transportation (MDHT);
- Saskatchewan Highways and Transportation (SHT);
- Saskatchewan Rural Affairs (SRA);
- Department of Northern Saskatchewan (DNS);
- Alberta Transportation (AT).

Information was obtained primarily through personal interviews with officials in appropriate departments. Again, although the procedures described in the following sections were in use in the seventies, they would generally still be applicable at the time of writing this thesis (January, 1983).

This section is intended solely to provide an overview of provincial government procedures in the evaluation of transport investments. Detailed discussions of some of their actual applications are presented in Appendix H.

II.3.1 Manitoba Department of Highways and Transportation (MDHT)

The Manitoba Department of Highways and Transportation was the primary agency responsible for transport-facility construction in the Province of Manitoba. Other provincial agencies likely to be involved in transportation construction included the Department of Municipal Affairs (responsible for allocating grants to municipalities) and the Department of

Natural Resources (responsible for private resource roads)¹.

There were basically two classifications of roadways under the MDHT jurisdiction: Provincial Roads (PR) and Provincial Trunk Highways (PTH). Accordingly, there were two approaches to evaluating investments in these roadways.

In evaluating investments in Provincial Roads, an empirical approach was employed. Usually a district engineer would conduct a field survey of a particular road section. He would then arbitrarily rank the section according to the urgency for rehabilitation. Economic analysis was normally excluded from the evaluation process.

The evaluation of PTH, on the other hand, involved a more formal procedure. The MDHT would normally carry out a "Needs Study" to identify both current needs and expected needs, with the aid of a computer package called "Automated Advance Highway Programming" (AAHP).

This AAHP package² was supposedly an optimization process for resource allocation. The first phase of this procedure was to identify present and future deficiencies. In determining present deficiencies, the following elements were considered:

¹ Their involvements, if any, would be of a much lesser magnitude than MDHT and the investment criteria would very often be heavily influenced by factors external to the normal evaluation process. In this regard, their evaluation methodologies will not be examined in detail.

² For a more detailed description of the principles and application of the AAHP package, see [11].

- surface type (including base thickness, width, condition, and maintenance);
- shoulder type and width;
- gradient;
- curvature;
- passing sight distance;
- number of passing sight restrictions per mile¹;
- accident rate;
- capacity (i.e. volume-to-capacity ratio and speed).

An illustration of the data input is shown in Figure II.3.1.1

To determine future deficiencies, three service lives were estimated for a particular road section:

- remaining surface life in years (based on construction standard and existing surface condition);
- number of years to reach design capacity (based on AADT);
- number of years to reach the next higher classification (based on AADT and road type).

The lowest of these projections would then determine the future time period in which this section should be rehabilitated.

After the timing was established, phase II - prioritization - would be undertaken with a rating system to evaluate the following items:

¹ The MDHT is currently (September, 1982) converting this package into metric form.

MANITOBA HIGHWAYS DEPARTMENT - PLANNING DIVISION

DATE 21/05/75

PROVINCE-WIDE PRIORITY ARRAY BY TIME PERIOD AND PRIORITY GROUP

DIST	H.WY	SECT	START MILEAGE	END MILEAGE	DUP	SURF TYPE	SURF COND RTNG	SURF LIFE YRS	VOL CAP RAT	YRS TO CAP	GEOM PRIOR	ACC RATE	COST PRIOR	ADT	PROJ COST (1000)	PROJ MILES	ACCUMULATED IMPROVEMENT COST (1000)	MILES	
TIME PERIOD 1																			
PRIORITY GROUP 1A																			
10	10	12	3.6	19.5	1	BIT	46	0	1.05	0	0	2.36	5	1316	3,500	31.8	3,500	31.8	
6	1A	51	0.9	1.9	1	BIT	53	0	1.13	0	9	3.69	1	7046	210	1.0	3,710	32.8	
PRIORITY GROUP 1B																			
10	10	12	2.4	3.6	1	BIT	46	0	0.80	5	0	11.21	5	815	30	1.2	3,740	34.0	
1	11	03	3.6	11.6	1	BIT	17	0	0.56	15	0	3.31	5	724	680	8.0	4,420	42.0	
1	44	01	0.0	10.0	1	BIT	26	0	0.73	5	0	2.13	5	644	785	7.5	5,205	49.5	
1	44	01	0.0	22.4	1	BIT	26	0	0.50	12	0	2.17	5	204	1,300	12.4	6,505	61.9	
10	10	11	0.0	4.4	1	BIT	42	0	0.34	22	4	2.58	5	728	2,000	20.8	8,505	82.7	
10	10	12	0.0	2.4	1	BIT	46	0	0.46	16	4	1.58	5	725	115	2.4	8,620	85.1	
10	10	11	4.4	17.1	1	BIT	42	0	0.45	16	4	2.61	5	852	2,450	20.6	11,070	105.7	
2	52	01	0.0	7.7	1	K-M	46	0	0.25	56	6	3.99	5	1212	754	7.2	11,824	112.3	
7	41	01	10.3	11.8	1	AST	54	0	0.21	63	6	2.17	5	844	234	4.4	12,058	117.3	
3	3	06	15.1	18.4	1	R-M	43	0	0.21	40	6	0.59	5	756	1,340	9.0	13,398	126.3	
8	104	51	0.0	2.1	1	R-M	38	0	0.21	83	6	2.03	5	644	145	3.0	13,543	129.3	
6	20	01	0.0	15.1	1	HIT	46	0	0.18	87	6	2.93	5	621	265	15.1	13,808	144.4	
4	3	01	0.0	5.8	1	R-M	52	0	0.13	52	6	3.22	5	573	552	11.2	14,360	155.6	
6	26	02	0.0	10.8	1	BIT	41	0	0.10	99	6	3.00	5	90	11	0.1	14,671	165.4	
1	44	01	22.4	22.5	2	BIT	26	0	0.07	44	6	0.00	5	90	11	0.1	14,682	166.5	
5	10	03	0.0	0.5	1	BIT	33	0	N/A	N/A	9	0.00	1	10229	230	0.5	14,912	167.0	
5	10	02	14.6	15.1	1	BIT	35	0	N/A	N/A	9	0.00	5	8990	0	0.3	14,912	167.3	
6	1A	51	3.1	3.4	2	BIT	53	0	N/A	N/A	9	10.61	5	6026	0	0.3	14,912	167.6	
6	1A	51	3.1	3.4	3	BIT	53	0	N/A	N/A	9	10.67	5	6026	0	0.3	14,912	167.9	
6	1A	51	2.2	3.1	2	BIT	53	0	N/A	N/A	9	17.11	5	5696	0	0.9	14,912	168.8	
6	1A	51	2.2	3.1	3	BIT	53	0	N/A	N/A	9	18.18	5	5696	0	0.9	14,912	169.7	
6	1A	51	3.4	3.6	2	BIT	53	0	N/A	N/A	9	2.61	5	5254	40	0.2	14,952	169.9	
6	1A	51	3.4	3.6	3	BIT	53	0	N/A	N/A	9	2.61	5	5254	0	0.2	14,952	170.1	
6	1A	51	1.9	2.2	3	BIT	53	0	N/A	N/A	9	1.97	5	4638	0	0.3	14,952	170.4	
6	1A	51	1.9	2.2	2	BIT	53	0	N/A	N/A	9	1.97	2	4638	70	0.3	15,022	170.7	
12	1	03	4.0	5.7	3	C	34	0	0.41	14	9	0.37	1	4374	340	1.7	15,362	172.4	
6	1	01	0.0	2.2	3	C	38	0	0.38	15	9	4.81	2	4056	410	2.0	15,772	174.4	
12	7	02	0.0	5.0	1	BIT	54	0	0.84	3	9	2.83	2	3874	220	10.0	17,592	184.4	
6	1A	51	3.6	4.4	2	BIT	53	0	N/A	N/A	9	8.32	5	3708	200	0.8	16,192	185.2	
6	1A	51	3.6	4.4	3	BIT	53	0	N/A	N/A	9	8.32	5	3708	0	0.8	16,192	186.0	
5	10	04	0.0	1.0	1	BIT	50	0	0.35	20	9	1.57	5	3513	0	1.0	16,192	187.0	
6	7	01	1.8	5.8	1	BIT	28	0	0.75	5	9	2.35	1	3219	971	8.4	19,163	195.4	
6	7	01	0.0	1.8	1	BIT	28	0	0.70	7	9	2.37	1	3216	380	3.0	19,543	198.4	
5	10	04	1.0	9.3	1	BIT	50	0	0.48	25	9	1.29	5	3083	0	8.3	19,843	206.7	
2	59	04	6.2	11.7	1	BIT	43	0	0.51	11	9	2.75	1	2574	210	7.5	19,803	210.2	
6	67	01	0.0	3.0	1	BIT	36	0	0.61	17	9	0.37	1	2478	350	3.0	20,153	213.2	
5	10	05	0.0	3.1	1	BIT	53	0	0.35	30	9	1.54	5	2300	0	3.1	20,153	216.3	
1	8	01	0.0	0.0	1	BIT	47	0	0.56	10	9	10.47	3	2292	340	1.8	20,493	218.1	
1	11	04	0.0	3.1	1	BIT	26	0	0.74	6	9	1.73	1	2050	294	3.1	20,787	221.2	

MANITOBA HIGHWAYS DEPARTMENT - PLANNING DIVISION

DATE 21/05/75

PRIORITY ARRAY BY DISTRICT, BY TIME PERIOD AND PRIORITY GROUP

H.WY	SECT	START MILEAGE	END MILEAGE	DUP	SURF TYPE	SURF COND RTNG	SURF LIFE YRS	VOL CAP RAT	YRS TO CAP	GEOM PRIOR	ACC RATE	COST PRIOR	ADT	PROJ COST (1000)	PROJ MILES	ACCUMULATED IMPROVEMENT COST (1000)	MILES
DISTRICT 1																	
TIME PERIOD 1																	
PRIORITY GROUP 1B																	
11	03	3.6	11.6	1	BIT	17	0	0.56	15	0	3.31	5	724	680	8.0	660	8.0
11	03	0.0	10.0	1	BIT	26	0	0.73	5	0	2.13	5	644	785	7.5	1,465	15.5
11	01	0.0	22.4	1	BIT	26	0	0.50	12	0	2.17	5	204	1,300	12.4	2,765	27.9
11	01	0.0	4.4	1	BIT	47	0	0.07	44	6	0.00	5	90	11	0.1	2,776	28.0
11	01	0.0	17.1	1	BIT	47	0	0.56	10	9	10.47	3	2292	340	1.8	3,116	29.8
11	04	0.0	3.1	1	BIT	26	0	0.74	6	9	1.73	1	2050	294	3.1	3,410	32.9
11	01	0.0	10.0	1	BIT	47	0	0.48	13	9	1.34	2	1987	1,285	12.2	4,695	45.1
11	04	3.1	5.6	1	BIT	26	0	0.62	9	9	3.14	2	1750	245	2.5	4,940	47.6
11	04	5.6	11.5	1	BIT	41	0	0.54	16	9	1.64	2	1515	559	5.9	5,499	53.5
9	06	4.1	4.4	1	AST	54	0	0.40	16	9	0.00	2	1359	24	0.3	5,523	53.8
9	06	4.1	5.6	1	BIT	54	0	0.56	10	9	0.00	2	1356	120	1.2	5,643	55.0
9	06	3.1	4.1	1	BIT	54	0	0.50	14	9	0.00	3	1261	120	1.0	5,763	56.0
11	04	11.5	16.3	1	BIT	50	0	0.35	27	9	1.59	3	1078	435	4.8	6,198	60.8
11	01	0.0	5.2	1	AST	53	0	0.20	41	9	3.04	6	520	425	5.2	6,623	66.0
12	04	13.3	14.9	1	BIT	54	0	0.09	99	9	3.68	5	466	0	1.6	6,623	67.6
12	04	14.9	15.2	1	AST	54	0	0.07	99	9	0.00	7	450	143	1.8	6,766	69.4
12	04	15.2	22.8	1	BIT	54	0	0.08	99	9	2.82	8	384	638	7.6	7,404	77.0
12	04	22.4	22.5	3	BIT	26	0	0.05	50	9	0.00	9	90	11	0.1	7,415	77.1
PRIORITY GROUP 2																	
15	01	0.0	10.3	1	GR	N/A	N/A	N/A	N/A	1	0.00	5	272	948	10.3	8,363	87.4
PRIORITY GROUP 3A																	
59	01	0.9	4.5	1	BIT	69	0	1.03	0	9	2.30	2	2650	538	3.6	6,901	91.0
PRIORITY GROUP 3B																	
1	01	1.2	9.4	1	BIT	78	4	1.40	0	9	2.95	5	2950	0	8.2	8,901	99.2
1	02	0.0	3.2	1	BIT	87	9	1.39	0	9	1.94	4	3100	1,083	3.3	9,984	102.5
59	02	0.0	10.3	1	BIT	72	1	1.01	0	9	1.72	2	2322	1,268	10.3	11,252	112.8
PRIORITY GROUP 4																	
11	02	0.0	4.8	1	AST	64	0	0.15	96	6	9.39	5	365	496	4.8	11,746	117.6
11	01	0.0	2.8	3	BIT	53	0	0.33	24	0	3.37	1	3200	390	1.0	12,130	118.6
11	01	0.0	17.1	1	BIT	50	0	0.40	21	0	2.45	3	2708	552	2.4	12,688	120.6
14	05	0.0	9.2	1	BIT	64	0	0.94	1	9	1.03	0	3200	1,405	18.4	14,093	139.0
11	03	0.0	4.8	1	BIT	64	0	0.34	19	9	2.88	5	1390	0	4.8	14,093	143.8

Figure II.3.1.2 Priority Array Developed by the AHP Package

Source: Brown [11]

- structural conditions of roadway;
- ratio of current design-hour volume to limiting service volume;
- geometric conditions of roadway;
- cost to improve roadway relative to vehicle-miles of travel.

Given time and budget as the limiting factors, the computer would produce a list known as the priority array (Figure II.3.1.2) for all deficient sub-sections of the roadways within the specified constraints. This output could be obtained for the entire province or for a highway district, supplemented by a proposed work schedule. This list would then be submitted to the Cabinet for approval. Specific projects on the list might be rejected at this stage, even though they were otherwise justified. Once a project received the go-ahead, field surveying and acquisition of right-of-way, if required, would begin. From the time a deficiency was identified to the time actual construction commenced, it would generally take three years or more.

It is obvious that AAHP, as applied by the MDHT, placed heavy emphasis on engineering considerations (e.g. roadway structure, geometric design, traffic volume, etc.). Economic analysis only received token attention; hence the potential of resource optimization was not fully exploited. An internal study was therefore initiated in early 1983 to better justify future transport investments (in economic terms) to the provincial Cabinet.

TYPICAL HIGHWAY CROSS-SECTIONS AND ESTIMATED LIFE

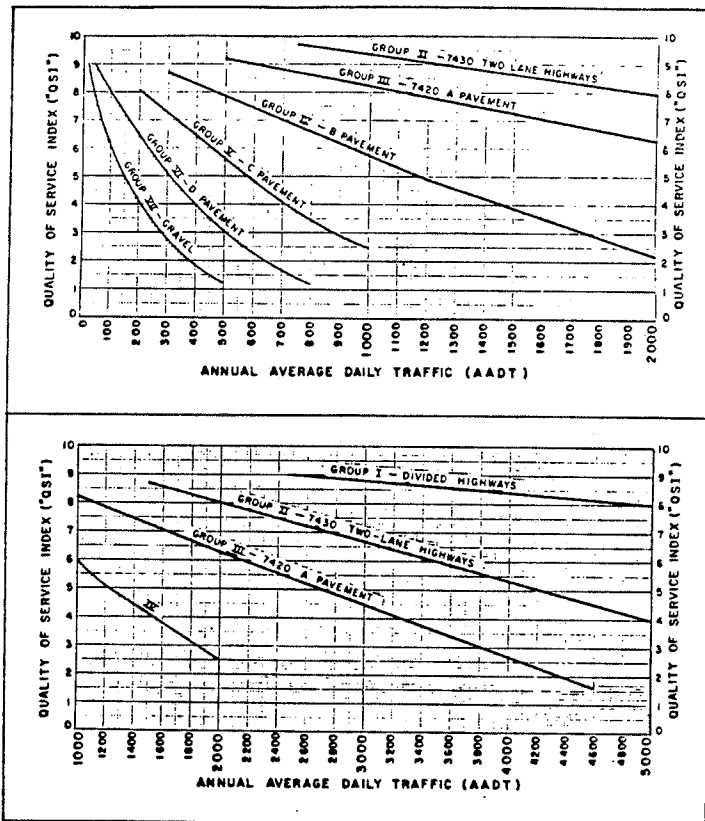
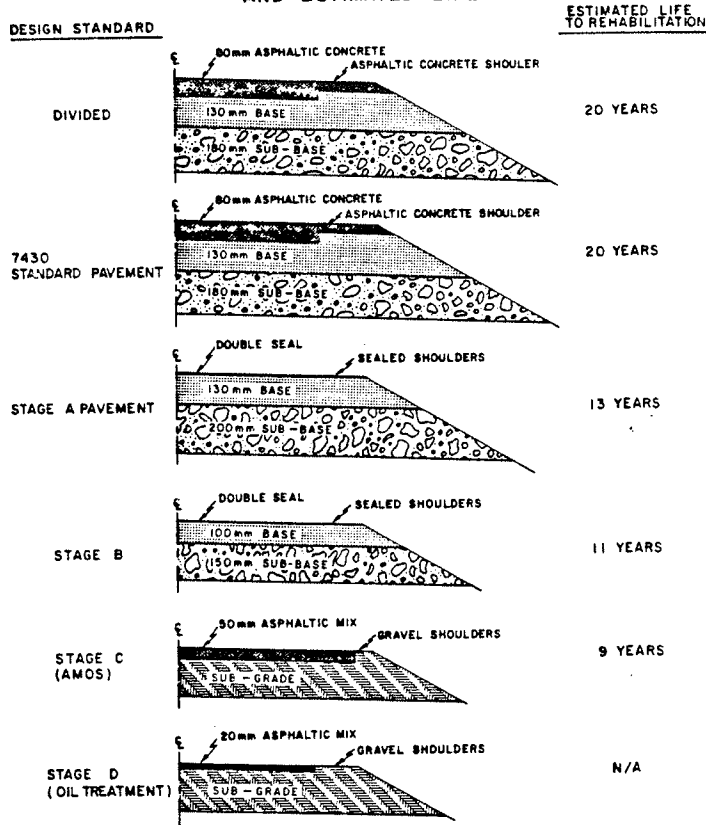


Figure II.3.2.1 Pavement Types and QSI Charts

Source: Hopkins & Hassan [42]

II.3.2 Saskatchewan Highways and Transportation (SHT)

SHT was responsible for highway construction in southern Saskatchewan¹ and for providing grants to urban centres². In evaluating new highway construction projects, two different approaches, priority ranking and route selection, were used in sequence³.

Like the MDHT, SHT employed a modified version of the Needs Study, a concept referred to as the "Quality of Service Index" (QSI). This index, in essence, measured the degree of "public utility" (or satisfaction) derived from construction or upgrading of a particular highway section. On a scale of 0 (least) to 10 (most), this index was a seemingly arbitrary measure of benefit or output. The interrelationship of the QSI, design standard, and the annual average daily traffic (AADT) volume is shown in Figure II.3.2.1.

The QSI was used in compiling an annual or long-range (5- to 10-year) program list. This application involved one or a combination of the following steps [42]:

¹ Theoretically, SHT's legislative responsibilities were to "maintain the quality of service on the southern road system and to respond to the needs for more highway investment to help expand northern industries" [38]. In reality, the latter responsibility has been delegated to other provincial agencies, chiefly the Department of Northern Saskatchewan.

² These grants were in the form of airport assistance and transit aids.

³ For rehabilitation or upgrading, only priority ranking was involved in the evaluation process.

- identification of deficiencies (i.e. needs for rehabilitation or upgrading);
- allocation of resources;
- prioritization of projects;
- selection of design standards for individual projects¹.

After candidate projects were determined, route selection would be carried out for each of the projects, dependent on user costs and benefits, and construction costs. The two most frequently-used economic evaluation techniques were benefit-cost analysis and the cost-effectiveness method, and, to a lesser extent, the SHT resorted to the intuitive evaluation technique².

The "do-nothing" alternative was only included in the development of a long-range infrastructure investment plan [22]. The reason that this null alternative was excluded from the annual capital program was due to the implicitness of the QSI concept; the QSI defined the needs of a particular project and hence rendered it unnecessary to consider the "do-nothing" alternative.

The discount rate often used in the economic analysis was 8%. A range from 6% to 12% was also used to test the sensitivity. No reason was given as to why these rates were adopted in the analysis. The estimated lives of highway projects ranged from 9 years (for AMOS³ pavements) to 20

¹ The standard was normally selected based on a 20-year projected AADT volume.

² This was especially true when intangible impacts were considered in the analysis.

³ Asphalt Mat on Subgrade is a 50 mm asphaltic mix placed on a prepared subgrade.

years (for standard pavements). A popular pavement type was an oil-treatment surface (usually for low-volume roads) which had a less-than-5-year economic life, and necessitated frequent resurfacing due to a rapid deterioration rate. Extensive use of this roadway type exemplified SHT's philosophy of "low initial capital costs but high maintenance costs"¹. Although this might not be a deliberate departmental policy, it was a conscious decision on the part of SHT [38].

II.3.3 Saskatchewan Rural Affairs (SRA)

From an unpublished data source², it was estimated that approximately 50% of the Saskatchewan population lived in communities of less than 2,000 people. Further, the importance of agricultural economy necessitated a comprehensive road network to sustain the farming industry. Since 1956, two major rural road networks have been put in place on a cost-sharing basis between the provincial government and the rural municipalities [69]. The first major project, known as the "Grid Road Program", resulted in 16,000 miles of all-weather rural roads. The next major system, known as the "Farm Access Road Program", is currently (January, 1983) still under way with the aim of providing farmstead access with a network of all-weather roads.

¹ This was also a reaction to public pressure for dust-free highways and to the reality of funding constraint [38].

² This unpublished source was the "Population Abstract" prepared by the Planning Branch of Saskatchewan Highways and Transportation in 1979.

Saskatchewan Rural Affairs was responsible for the allocation of resources to the 299 municipalities in the Province. Under the revenue-sharing scheme, tax dollars were distributed in the form of conditional grants and unconditional grants.

Conditional grants were essentially funds set aside for various road programs in concert with SRA policies and cost-sharing formulae. In order to be eligible for these funds, rural municipalities would be required by law to construct the designated roads in accordance with established standards¹.

Unconditional grants were distributed to the municipalities as an all-purpose assistance to provide necessary services. Although there were no conditions attached to the use of these grants, it was estimated that the rural municipalities expended approximately 95% of these grants to finance their shares in joint road construction programs.

Unconditional grants consisted of three components:

- basic grant;
- organized hamlet grant;
- equalization grant.

A basic grant was provided on the rationale that each municipality

¹ In general, SRA would not be directly involved in the construction process. This responsibility rested with the rural municipalities. As mentioned before, SRA only acted as a grantor on behalf of the provincial government.

TABLE II.3.3.1

Organized Hamlet Grant: Basic Amount

<u>Population</u>	<u>Basic Amount</u>
0-149	\$1,840
150-299	\$2,450
300+	\$2,700

Source: SRA [84]

should have a share of the unconditional grants¹. This was a percentage of a municipality's annual costs of providing services, and the actual amount paid annually would be dependent on the funds available from this category.

The organized hamlet grant itself had two elements:

- a basic amount as determined by population size, (Table II.3.3.1)
- a per-capita grant of \$48.90 in addition to the basic amount.

The equalization grant was first established in 1966 to assist rural municipalities in providing necessary services, regardless of their financial position. The equalization formula ensured that rural municipalities with a low tax base and high expenditures would receive a larger grant than "wealthy" municipalities.

The expenditures considered in the equalization formula included administration, road construction and maintenance, and bridge construction and maintenance.

Administration costs represented the annual cost of running a rural municipal office and was an average cost based on the most recent three years. These costs would be shown in the municipal financial statement forwarded to SRA annually.

¹ A provision had been established to ensure no municipality would receive less than \$3,000 a year from the basic grant.

TABLE II.3.3.2

Road Type as a Percentage of M.F.A. Costs

<u>Road Type</u>	<u>Percentage of M.F.A. Costs</u>
Primary Grid	130
Grid*	110
Main Farm Access	100
Local Access	50
Land Access	25

* This category includes other designated roads such as Regional Park, Industrial Access, Oil Access, Resort and Indian Reserve Access.

Source: SRA [84]

Road construction costs were based on the main farm access (M.F.A.) construction costs since these up-to-date costs would be readily available for all rural municipalities¹ [84]. The economic life of these roads was assumed to be 20 years².

Road maintenance costs were composed of surface blading, right-of-way mowing, regravelling, and snow removal. Annual costs were established for each of these factors and summed to represent the total annual maintenance cost for a specific road type. This cost differed for each road type.

The life expectancy of a bridge structure was forty years and, therefore, the annual cost for bridge construction and maintenance would be 1/40 of the total construction and maintenance costs³ of a bridge unit⁴.

The rural revenue-sharing pool was adjusted annually using an "escalator index" to reflect the strength of the provincial economy (and hence the availability of funds). This index took into account three major

¹ Costs for all other types of roads were calculated as a percentage of the M.F.A. road costs (Table II.3.3.2).

² The discount rate was assumed to be zero by SRA, therefore the annual cost of construction would be 1/20 of the total construction costs. It was of little material relevance as to what discount rates were used since SRA was not involved in any economic analysis.

³ The assumption of zero discount rate still applied.

⁴ A bridge unit was defined as a 20-foot span of bridge.

provincial tax bases¹:

- provincial sales tax;
- corporate income tax;
- personal income tax.

Each tax base component was given equal weight and a three-year averaging was utilized. A detailed discussion of the principles and application of the escalator index can be found in [72].

SRA was not involved in the evaluation of transport investments undertaken by the department. As stated earlier, unconditional grants were distributed to the municipal governments as an all-purpose assistance to provide necessary services and conditional grants were given to municipalities to construct designated roads in accordance with SHT design standards. It was up to the municipalities to conduct their own evaluation. However, the municipal governments were not required to submit the evaluation results, if any, to SRA, and none was documented.

II.3.4 Department of Northern Saskatchewan (DNS)²

DNS, since 1974, had been responsible for the development of northern transportation network in Saskatchewan. The network included the highway system, remote airstrips and small marine facilities.

Resources were allocated on the basis of priority ranking. The criteria used in prioritization were similar to those employed by DREE. The main objective was to provide adequate transportation service

¹ A fourth tax base, gasoline and fuel taxes, was removed after the 1982 provincial elections.

² DNS was disbanded in the summer of 1982.

level for social and economic development needs.

Evaluation methodologies commonly used by DNS included: community value-effectiveness method; crude intuitive evaluation technique; goals-achievement analysis; and cost-effectiveness method. Intangible impacts were considered in the analysis either by pure intuitiveness or by non-monetary weighting of impacts. The discount rate used by DNS prior to 1980 was unavailable; the rates used from 1980 to 1982 ranged between 10% and 14%. However, economic life assumptions were not used in the economic analysis. It is interesting to note that DNS, as a grantor agency which was bound by legislation to invest in transport-infrastructure developments even if they were not economically feasible (i.e. with benefit-cost ratios less than 1.0, for instance), used a higher discount rate than SHT. However, there was no explanation as to why these rates were chosen.

This list of evaluation techniques suggested a strong inclination towards subjective, non-economic analysis. Like DREE or SRA, DNS had the legislative responsibility to provide access to remote communities for "strategic developments" (i.e. social benefits). This emphasis on investments for strategic purposes and "de-isolation" policy hence influenced the nature of the evaluation process, resulting in the adoption of value analyses (such as the community value-effectiveness approach) by DNS.

II.3.5 Alberta Transportation (AT)

Alberta Transportation was the primary agency on behalf of the Provincial Government of Alberta to carry out transportation planning and construction activities as well as to allocate grants to urban and rural municipalities for transportation purposes.

In evaluating its capital programs¹ for highway infrastructure developments, Alberta Transportation employed priority ranking for allocating resources. There were three major items under consideration: safety, costs, and pavement structure. This was essentially a Needs Study, similar to the ones conducted by the MDHT and SHT. A list was drawn up with the projects (new and rehabilitation) ranked according to needs. Availability of funds would dictate the cut-off point. After the projects were approved by the provincial cabinet, detailed alternative plans (e.g. route selection) were evaluated using one or more of the following techniques:

- intuitive evaluation method;
- benefit-cost analysis;
- simple plus-or-minus method.

Intangible impacts were not always considered in the evaluation. In the rare event that intangibles were being considered, Alberta Transportation would use non-monetary weighting of impacts and/or a crude plus-or-minus approach. The null alternative, however, was always included in the analysis.

Over the past decade, Alberta Transportation had consistently used a range of between 6% and 12% as the discount rates; the rationale

¹ Capital programs included new constructions and reconstructions.

behind using these rates was uncertain but an AT official claimed that this was a traditional, long-standing criterion adopted by the department. With these relatively low rates¹, Alberta Transportation estimated that only about 15% of its projects were not economically feasible (i.e. with a benefit/cost ratio of less than 1.0).

Alberta has always incurred a much higher capital expenditure in transportation than Manitoba and Saskatchewan. Besides economic growth in the past decade, the main reason for the high expenditure was that Alberta had a de facto policy of investing in projects with long economic lives (i.e. high capital costs but low maintenance costs). This was apparently contrary to SHT's investment approach (i.e. low initial costs but high maintenance costs), probably due to a difference in tax revenues between the two provinces [64].

In resource-access development, AT cost-shared the initial construction expenditures with the private industry. In the case where the industry had originally paid for the entire construction cost, Alberta Transportation might purchase the road², upon approved application from the industry, if the AADT had a high proportion of public traffic.

A major transport-infrastructure investment undertaken by AT was the Grande Prairie-Grande Cache Corridor Project [82] in the late seventies. Four potential impact elements were incorporated in

¹ The AT rates were lower than the 15% discount rate used by the federal government departments. A DREE official estimated that, by using the higher rate, a majority of the projects had had a benefit/cost ratio of less than 1.0.

² The compensation was normally equivalent to contractor bid-prices for similar highway construction projects.

the study: economic factor, resource factor, regional factor, and recreation factor. The technique used in the evaluation was benefit-cost analysis, and ranking of the four alternative routes was by the simple plus-or-minus method; the methodologies used in the study were apparently consistent with AT's departmental guidelines stated above. A more detailed discussion of this project is presented in Appendix H.2.

The Urban Transportation Assistance Program (UTAP) package, administered by the Urban Transportation Branch (UTB) of Alberta Transportation, provided financial assistance (for a six-year period from 1979) to Alberta cities and townships for roadway (on a per lane-mile basis) and public transit (on a per capita basis) developments. In order to effectively and efficiently allocate resources, UTB conducted a major review of its funding approach. The consequence of this review led to the development, in early 1982, of an evaluation framework [49] to

- assess short and long-term urban transportation (roadway and public transit) requirements;
- establish priorities for major transportation investments.

More specifically, UTB prepared two manuals (Transit Review Manual and Road Needs Study Manual) to ensure consistency in the determination of needs. The manuals were employed in

- collecting useful information respecting system planning, capital and operating/maintenance needs;
- establishing a specific set of performance measures for system evaluation;
- identifying deficiencies and ranking of funding priorities (according to needs).

The Transit Review Manual defined, in detail, the types of information required for evaluation, including:

- socio-economic characteristics and travel patterns of trip-makers;
- fleet characteristics (e.g. number and type of vehicles, number of revenue vehicles versus non-revenue vehicles, etc.);
- operation characteristics (e.g. total revenue kilometers, operating hours and costs, etc.).

Performance measures for assessing transit needs included revenue/cost ratio, total passenger trips per revenue kilometer, and average maintenance costs per kilometer for different types of vehicles.

The Road Needs Study Manual also set out guidelines to uniform

- roadway classifications;
- urban and rural cross-section standards for cities (and towns) with no such standards;
- forecast methodology for estimating existing and future traffic volumes;
- costing procedure.

It was discovered that the Road Needs Study could be completed within a shorter time-frame than a conventional study, through the elimination of

- unnecessary or lengthy data collection;
- public/political input (through public hearings);
- detailed calculations for roadway condition ratings;
- a priority rating system for roadway improvements.

From the review carried out in 1981/82, UTB concluded that the manuals "provided Alberta Transportation with a reasonably accurate and comprehensive outline of the current, one to five-year and six to ten-year

roadway and public transit capital and operating/expenditure needs of the cities of Alberta."

As a result, UTB now uses the "needs" information, in conjunction with other relevant financial and transportation data, to develop an updated UTAP package with respect to Alberta Transportation policies and fund availability.

AT, similar to PWC, conducted both pre-construction evaluation (i.e. "project development") and post-construction appraisal of impacts (i.e. "program evaluation"). This exemplified the systems approach to evaluation proposed by Manheim [53] and O'Flynn [60].

II.4 EVALUATION BY LOCAL GOVERNMENT DEPARTMENTS

Section II.4 examines the evaluation procedures followed by selected local governments. The sample represented a small-sized city (Saskatoon), a medium-sized city with low growth (Winnipeg), and a medium-sized city with high growth (Edmonton).

The following sub-sections briefly discuss the evaluation approach of each city. Although these evaluation procedures were used in the last decade, they would still be pertinent at the writing of this thesis (January, 1983), unless otherwise specified.

II.4.1 City of Winnipeg

The City of Winnipeg usually contracted private consulting firms to undertake major transportation studies. A City of Winnipeg official claimed that there was no formal guideline to the evaluation methodology being used¹ but that public information forums were often required.

¹ A City-commissioned report on the use of evaluation procedure was prepared by the IBI Group in 1978 [80]. The report recommended that the City use the objective achievement approach to assess transport-infrastructure investments. This document also outlined in detail the procedure to be used in rating the performance of alternatives, weighting the importance of criteria, and conducting sensitivity analyses (respecting changes in weighting of criteria). It was uncertain, however, whether these recommendations had been officially adopted by the City.

Economic analysis was restricted to determination of capital construction and annual maintenance costs. However, since 1982, user cost savings were included, as evident in the Kildonan Corridor Study (Appendix H.3). However, a City of Winnipeg official conceded that there was no firm guideline on the use of discount rates and economic life assumptions.

Winnipeg, similar to most other local governments, was very vulnerable to political interference. In Winnipeg, spending priority was seemingly arbitrarily pre-determined by the decision-makers. Transportation planners were always foretold the funding level and priority, and hence they eroded impartiality in evaluation. Despite the existence of long-term transportation and land-use objectives, there was no indication that transport investments in the seventies would fulfill these objectives. Instead, as mentioned in Section I.5, capital construction and maintenance expenditures varied considerably from year to year, lacking stability and a sense of direction for rational transport investments.

The need and usefulness of public forums (primarily in the form of public hearings) are also debatable [41]. It has often been argued that only opponents of a particular project would appear in these hearings and, therefore, only negative feedbacks were voiced. Decision-makers, facing political reality, would invariably opt for a course of action contrary to sensible engineering and economic judgements.

Winnipeg, in this regard, experienced the same dilemma quite frequently in the last few years; some notable examples are the Sherbrooke-McGregor Overpass and Kildonan Corridor projects.

II.4.2 City of Saskatoon

The City of Saskatoon had a higher per-capita transportation expenditure level than either Winnipeg or Edmonton. However, like these two cities, Saskatoon did not have any formal guidelines regarding the evaluation of transport investments.

Project evaluation normally involved priority ranking. The methods usually employed were conventional benefit-cost and internal rate of return analyses. However, there was no established policy concerning the determination of benefits and costs or the use of discount rate and economic life assumptions.

Despite the lack of stringent evaluation standards, there was apparently little effect on the transport investment level. In fact, Saskatoon's transportation expenditures were fairly consistent in the seventies, without any significant fluctuations as experienced in the other cities.

II.4.3 City of Edmonton

The City of Edmonton, although incurring the highest transportation expenditures among the cities studied, also showed an apparent lack of formal evaluation guidelines.

Evaluation conducted by the City of Edmonton itself usually involved one or more of the following: goals-achievement analysis, community value-effectiveness framework, cross impact matrix method, and engineering consideration. In long-term planning, evaluations were done intuitively without critically addressing economic and social impacts. Evaluation carried out by private consultants, on behalf of the City, normally involved simple plus-or-minus method; the appropriateness of this approach had been questioned by the City but no action was initiated to abandon this technique.

Discount rates employed in the analysis were determined by the City of Edmonton Finance Department; they usually varied in accordance with the prevailing bank lending rate. Sensitivity analysis was done using forecasted interest rates, differing from the conventional, fixed range of discount rates used by most other government departments.

Intangible impacts were considered by assigning monetary values to impacts or by weighting of impacts. Sometimes these impacts were evaluated intuitively. Regardless of the approach, the City of Edmonton claimed that consideration of intangible impacts was "consistent and objective on a city-wide basis".

As far as can be determined from available information, there was no direct relation between the City of Edmonton's evaluation approach and Alberta Transportation's UTAP. In general, the former dealt with evaluation of (often mutually-exclusive) alternative routes where

resources had already been allocated; the UTAP, however, was used by AT to allocate provincial funds to municipal governments, mostly based on engineering considerations.

A major capital investment undertaken by the City of Edmonton in the seventies was the construction of the light rail transit infrastructure. The evaluation involved cost-effectiveness method and benefit-cost analysis; this emphasis on economic evaluation was unusual as the City of Edmonton claimed to have placed more emphasis on engineering consideration and value analyses. Despite the magnitude of this investment, the LRT project did not achieve the "hoped-for shift to public transit or reduced automobile ownership and usage" in the city [82]. A detailed discussion on this project, and the aftermath, is presented in Appendix H.4.

II.5 COMPARISONS OF GOVERNMENT TRANSPORTATION EVALUATION PROCEDURES

This section summarizes and compares the methodologies and criteria employed by various government departments in evaluating transport-infrastructure investments, as discussed in the preceding sections.

II.5.1 Summary of Federal Government Transport Evaluation Procedures

Evaluation of transport investments by all three federal government departments - Transport Canada, Department of Regional Economic Expansion, and Public Works Canada - was apparently guided by the Treasury Board of Canada directives on the planning and conduct of project evaluation [10] [33] [62]. As required by TBC, all three departments conducted benefit-cost analysis, usually as a basis for priority ranking.

The discount rates were prescribed by TBC: "We recommend the use of a social discount rate of 10%, and of 5% and 15% for sensitivity analyses" [10]. The economic-life assumptions used in the benefit-cost analysis differed by the type of infrastructure and were not explicitly outlined by TBC. From the survey, it seemed that the three departments had generally adhered to these TBC guidelines; an exception was that PWC, prior to 1978, had used 5% and 10% as the social discount rates, different from the 5% to 15% proposed by TBC in 1976.

In addition to benefit-cost analysis, these departments also employed other techniques to evaluate transport investments. TC claimed to have used goals-achievement analysis and the cost-effectiveness method; DREE, in allocating federal resources (primarily under the Northlands

Agreement), used goals-achievement analysis while PWC used the net present worth method and the elementary (intuitive) technique.

The major evaluation criteria were also different for the departments. The criteria established by TC were transportation efficiency, regional impacts, national access and compatibility with other federal programs. The DREE criteria were more "local" in nature than those of TC; DREE's "de-isolation" policy culminated in the evaluation of transport investments based on the extent to which these investments would provide access to northern communities and for resource developments.

Involvement of TC and DREE in transport developments was primarily through joint programs with the Prairie provinces (e.g. the Highway Strengthening Program and the Northlands Agreement). It was discovered that there had been little coordination between the federal and the provincial government departments in the evaluation of these investments. For the Highway Strengthening Program, TC apparently did not conduct its own pre-implementation evaluation, nor did they have any knowledge of, and access to, evaluation conducted by the provincial government departments. In the case of the Northlands Agreement, DREE conducted limited evaluation in reviewing provincial applications for federal assistance. Detailed evaluation was supposed to be carried out by the provincial departments but there was no evidence that DREE had had any access to the evaluation results; only cost estimates of the projects were submitted by the provinces to DREE for funding approval, and the funding prioritization process was often independent of the

evaluation conducted by the provinces.

II.5.2 Summary of Provincial Government Transport Evaluation Procedures

Provincial government departments responsible for transport-infrastructure developments can be classified into one of these groups: provincial departments of highways and transportation, and "grantor agencies" (i.e. departments which were not normally involved in the actual construction of transport infrastructure but, on behalf of their respective governments, distributed grant payments to the local governments). The departments of highways generally incurred much larger transportation expenditures than the grantor agencies, as discussed in Section I.4.

These two groups of departments carried out evaluation differently, particularly due to their different legislative responsibilities regarding the provision, and maintenance, of transport infrastructure.

Evaluation conducted by MDHT, SHT, and AT centred on the engineering aspects of the existing or proposed infrastructure. Considerations usually included the geometric and structural conditions of the roadway, traffic flows and composition, and safety concerns. These elements were incorporated in a so-called "Needs Study"; the deficiencies identified in the Needs Study were analyzed and ranked by computer packages developed by these departments (e.g. MDHT's Automated Advance Highway Programming [11] and SHT's Quality of Service Index [42]). Economic

analyses conducted by SHT were limited to identifying the lowest-cost alternatives, while economic analyses by AT were more broad-based; AT incorporated assessments of economic impacts in both local and regional perspectives (e.g. Grande Prairie-Grande Cache Corridor Study [32]). MDHT did not incorporate any economic analysis in the evaluation of transport infrastructure investments; communication with an MDHT official indicated that, since early 1983, the department had actively searched for a legitimate analytical method to justify (in economic terms) future investments to the provincial cabinet.

In conducting the economic analyses, both AT and SHT used the same range of discount rates (6%-12%) and the same assumed economic life for provincial highways (20 years). However, due to its philosophy of "low initial capital costs and high maintenance costs", SHT accepted the use of low-quality roads (i.e. oil-treatment surface) which would have been rejected by other provincial departments of highways. On the other hand, AT's philosophy of "high capital costs and low maintenance costs" in transport investments led to considerably higher capital expenditures in Alberta than those in Saskatchewan and Manitoba (see Section I.4.4).

DNS, as a grantor agency, did not have any formal guidelines regarding the evaluation of transport investments. Like DREE, DNS was bound by legislation to participate in transport developments for strategic purposes (i.e. social needs and benefits). The emphasis hence was on value evaluation, such as community value-effectiveness method and goals-achievement analysis. Although economic analysis was routinely conducted, DNS would still invest in economically-infeasible projects for strategic developments.

Another provincial grantor agency, SRA, did not conduct any evaluation. SRA used established formulae to distribute grant payments to the municipalities [72] [84], and it was up to the municipal governments to carry out the detailed evaluation. There was no indication that the evaluation results had been submitted to SRA; it would seem that SRA had little appreciation of how evaluation, if any, was conducted by these municipal governments.

II.5.3 Summary of Local Government Transport Evaluation Procedures

All three local governments surveyed did not have any formal evaluation guidelines with respect to transport investments. Two of the cities - Winnipeg and Edmonton - commissioned internal studies in 1978 and 1982, respectively, which resulted in the recommendations on the evaluation procedures to be followed by these governments [80] [81] [82].

In the City of Winnipeg, evaluation was limited to assessing different alternatives of a particular project, since funding level and priority had been pre-determined by the city council. The technique used was the objective achievement evaluation method, as recommended in the IBI report [80]. The report also specified the three procedures in this evaluation framework: rating the performance of the alternatives; weighting the importance of the criteria; and conducting a sensitivity analysis regarding changes in weighting. However, a major transportation study undertaken in the late seventies, the Kildonan Corridor Study [61], only fulfilled one of the three IBI requirements; the alternatives were rated mainly based on engineering considerations and community impacts.

There was no weighting of the criteria used in the study and hence no sensitivity analysis. The discrepancy might be due to the fact that this project did not warrant such an extensive evaluation approach as proposed by the IBI Group. Based on the comprehensive nature of the recommendations, it is believed that the IBI approach is better suited to evaluating long-term transportation strategies.

The City of Edmonton, in evaluating transport investments, claimed to have put more emphasis on engineering considerations and value analyses. Economic analysis was restricted to identifying the lowest-cost alternative; unlike other government departments, Edmonton used a variable range of discount rates in the analysis instead of a fixed range similar to that proposed by the Treasury Board of Canada. The rates were determined by the City's Finance Department and varied in accordance with prevailing and forecasted bank lending rates. Like Winnipeg, the City of Edmonton had prepared a document outlining the methodology, criteria, weighting, and sensitivity analyses to be used in the evaluation of transport-infrastructure investments [81] [82]. There was, however, no documentation as to whether these guidelines had actually been followed by the city.

Project evaluation conducted by the City of Saskatoon normally involved prioritization of potential transport projects and, after the projects were ranked, assessment of mutually-exclusive alternatives. Unlike Edmonton and Winnipeg, the City of Saskatoon claimed to have employed economic analyses as a basis for evaluation, different from the evaluation emphases (i.e. value analyses and engineering considerations) of the other two cities. However, there was no established policy concerning the use of discount rate and economic life assumptions.

Again, there was no documentation of the evaluation procedure followed by the city.

II.5.4 Comparisons of Evaluation Procedures between Levels of Government

As apparent from the preceding sub-sections, there existed some inconsistencies in evaluation procedures between the three levels of government.

At the federal level, all government departments were required to follow the TBC guidelines on project evaluation [62]. Benefit-cost analysis was routinely carried out [10], and value analyses (e.g. community value-effectiveness method) were also incorporated in project evaluation. From the survey and follow-up consultations, it was discovered that the departments, especially TC and DREE, were inclined to investing for strategic purposes, usually with only incidental regard to economic and engineering justifications (e.g. the Highway Strengthening Program and Northlands Agreement).

At the provincial level, MDHT, SHT and AT all had formal evaluation guidelines. Transport-infrastructure investments were always justified by engineering considerations [11] [42] and value analyses. Unlike the federal government departments, there was no established policy regarding the conduct of economic analyses. Nonetheless, transport investments undertaken by the provincial departments of highways and transportation were more thoroughly evaluated and better justified than those undertaken by federal departments. Transport developments undertaken by grantor agencies such as DNS and SRA were fairly similar to those of the federal departments; these departments were bound by legislation

to invest for social benefits, which precipitated in the emphasis of value analyses by these departments.

Unlike the federal and provincial departments, local government departments did not have any established guidelines on project evaluation. The Cities of Winnipeg and Edmonton generally put more emphasis on the engineering aspects of the infrastructure and in value analyses. Although a set of evaluation procedures was recommended to each of these two cities, there was no evidence that these frameworks were adopted and used by the cities. The City of Saskatoon claimed to have used only economic analyses in evaluating transport investments but there was no formal guideline on the use of discount rates and economic life assumption.

In summary, the inconsistencies between different levels of government occurred in the established guidelines, or the lack of them, on evaluation methodologies and criteria. This might be a result of the different objectives with which the governments pursued evaluation. Federal government departments considered evaluation as a means to justify investments to the general public [62], whereas provincial and local government departments approached evaluation with a view to obtaining funds from the provincial cabinets or city councils by justifying these transportation expenditures (for example, [32] [37] [61] [74]).

II.5.5 Comparisons of Evaluation Procedures between Departments within the Same Government

At the federal level, the only significant similarity in evaluation approach between the three federal government departments was that they all conducted benefit-cost analysis, as required by TBC

[10]. Other different evaluation techniques were also used by TC, DREE, and PWC. Further, the criteria employed in the analyses varied from department to department: TC considered transport efficiency, regional impact, national access, and compatibility with other federal programs as the major criteria while the main criterion for DREE was its "de-isolation" policy (i.e. to provide reliable access to the northern communities which otherwise would be isolated from the more-developed southern regions).

In Saskatchewan, there was apparently no significant similarity in the evaluation methodologies and criteria used between the three provincial government departments. SHT, the only Saskatchewan department with a set of established guidelines, put much emphasis on engineering considerations [37] [42] and conducted limited economic analyses. DNS, due to its grantor status, was inclined to use value analyses in evaluating transport investments; although economic analysis was also used, DNS was bound by legislation to invest for strategic developments in northern Saskatchewan whether or not these projects were economically feasible. Another grantor agency, SRA, was responsible for the distribution of provincial funds to assist rural municipalities in the provision of transport services. However, SRA did not conduct any evaluation of its own but relied on established formulae to distribute grant payments. The criteria used by SHT were broader in perspective, in that (i) the investments were made with a view to effecting a better transportation system in the entire province [38], and (ii) individual investments constituted portions of the long-range plan designed by SHT [22]. The major criteria established by DNS and SRA were more pertinent to the

"local" impacts resulted from the investments; there was no long-range transportation planning in any of these departments since transportation was only a component of their overall departmental functions.

In summary, substantial differences in evaluation methods and criteria are apparent between different governments, and between agencies within a single government. These differences appear to often reflect differences in governmental and departmental objectives; hence the same tax dollar would be expended in many different ways dependent on the individual government department.

SUMMARY OF FINDINGS

The major findings, based on the materials presented in Parts I and II, are summarized as follows:

- For the period 1975-79 (where complete expenditure data was available), referencing constant 1971 dollars:

- total consolidated government transportation expenditures in the Prairie region increased at an annual compounded rate of 4.1%, from \$439.7 million to \$516.0 million over four years. Average increases by province are: Manitoba (3.4%/year), Saskatchewan (5.3%/year), and Alberta (3.8%/year).

Federal government transportation expenditures increased by 2.5% per year for the region, distributed as follows: Manitoba (2.1%/year), Saskatchewan (2.9%/year), and Alberta (2.4%/year).

Total provincial government transportation expenditures rose by 5.5% annually, distributed as follows: Manitoba (6.1%/year), Saskatchewan (4.9%/year), and Alberta (5.5%/year).

Total local government transportation expenditures increased by 4.8% per year, distributed as follows: Manitoba (2.9%/year), Saskatchewan (6.7%/year), and Alberta (4.9%/year).

- provincial governments contributed to an increasingly larger share of government transportation expenditures in the Prairie region, from 42.7% of total consolidated government transportation expenditures in 1974-75 to 44.4% in 1978-79. Local transport expenditure share also experienced a slight increase, from 28.7% in 1975 to 29.1% in 1979. Federal share dropped from 28.5% to 26.4% over 4 years.
- real growths in government transportation expenditures were lower than real increases in gross government expenditures over

this period. The annual compounded increases in gross government expenditures, by level of government, are as follows, with corresponding increases in transport expenditures shown in parentheses: federal government, 3.0% (2.5%); provincial governments, 6.6% (5.5%); and local governments, 6.6% (4.8%).

- At the provincial level, capital expenditures, expressed as a ratio of total transport expenditures, declined in Manitoba and Saskatchewan from 1970-71 to 1979-80. The ratio increased in Alberta until 1976-77 but decreased thereafter. This suggests that an increasingly larger proportion of provincial transport expenditures in the Prairie region was committed to maintenance work, at the expense of new capital construction. Over the same period, the trend was exactly reverse in local government transportation expenditures. The four cities surveyed - Winnipeg, Regina, Saskatoon, and Edmonton - all experienced higher growth rates in capital construction expenditures than in maintenance expenditures over the past decade. Federal expenditure data was incomplete to determine if fund priority had been accorded to either capital construction or maintenance.
- Several statistically-significant relationships were established between provincial government transportation expenditures (in real dollars) and various utilization/economic indicators. Despite the apparently good quality of the regression equations (i.e. with high R^2 values and low standard deviations), the absence of a common independent variable in all the equations could not conclusively prove or disprove Bryan's assertion that governments, in evaluating transport-infrastructure investments, are primarily concerned with the level of utilization of such infrastructure [12].
- Interviews with government officials indicated that these officials apparently had had little appreciation of the methods and criteria used by their counterparts in other departments in evaluating transport investments. This observation was further substantiated by

reviewing several transport investments, including:

- Highway Strengthening Program: There is no evidence indicating TC had any knowledge of, or access to, the evaluation conducted by the provincial governments.
 - Northlands Agreement: DREE conducted its own evaluation independent of and apparently with no regard to the evaluation conducted by the provincial grant-recipient departments.
 - Grants made by SRA: The municipal governments were not normally required to submit their evaluation results to SRA when applying for provincial assistance. SRA was evidently uncertain if any, and how, evaluation had been carried out by these municipal governments prior to the grants being made.
- Inconsistencies in evaluation procedures existed between the three levels of government. At the federal level, all government departments were required to adhere to the TBC guidelines on project evaluation [62]. More specifically, TBC recommended the use of benefit-cost analysis in evaluating transport investments [10]; the three federal departments surveyed apparently had adopted this technique as a basis for priority ranking. Further, these departments also incorporated, and were often dependent on, value analyses (such as goals achievement analysis and community value-effectiveness method) in evaluation. At the provincial level, the departments of highways (i.e. MDHT, SHT, and AT) were primarily concerned with the engineering aspects of evaluation (e.g. structural and geometric conditions/designs of roadways, traffic flows, accident rates, etc.). The provincial grantor agencies, SRA and DNS, were bound by legislation to invest for strategic (i.e. social) developments; their evaluation, if any, was more restricted in scope than the provincial highways department. In fact, SRA did not conduct any evaluation at all but relied on established formulae to distribute grants to the rural municipalities. Unlike the federal departments, there was no established guideline

at the provincial departments with respect to the conduct of economic analyses. At the local level, two of the three cities surveyed - Winnipeg and Edmonton - apparently employed engineering considerations and value analyses in the project evaluation process. The City of Saskatoon, however, claimed to have used economic analyses (i.e. internal rate of return and benefit-cost analyses) to prioritize transport investments.

A probable explanation for these inconsistencies may be that the governments approached evaluation with different governmental objectives. Federal government departments regarded evaluation as a means to justify investments to the general public [62]. Provincial and local government departments, however, pursued evaluation with a view to obtaining fundings from their respective governments, by justifying these transport expenditures to the provincial cabinets or city councils (e.g. [32] [37] [61] [74]).

- Inconsistencies in evaluation methodologies and criteria also existed between departments within the same government, as evident in the federal government and Saskatchewan provincial government. At the federal level, all three government departments employed, in addition to the benefit-cost analysis as prescribed by TBC, other different methods in evaluating and prioritizing transport investments. TC claimed to have conducted cost-effectiveness evaluation and goals-achievement analysis, while PWC and DREE purportedly used intuitive, judgemental evaluation technique and goals-achievement matrix, respectively. The criteria used in evaluating transport-infrastructure investments also differed from one department to another. The main criteria established by TC were transport efficiency, regional impact, national access and compatibility with other federal programs, whereas the main criterion for DREE was its "de-isolation" policy (i.e. to provide reliable, year-round access to the northern communities which otherwise would be isolated from the southern regions).

In Saskatchewan, SHT, the only Saskatchewan transportation agency with a set of formal evaluation guidelines [37] [42], put much emphasis on engineering considerations but conducted limited economic analyses (for identifying the lowest-cost alternative). DNS, however, relied heavily on value analyses (e.g. goals-achievement matrix and community value-effectiveness method) in evaluating transport investments. SRA did not conduct any evaluation at all but used established formulae [72] [84] to distribute grants to rural municipalities. The criteria established by SHT were more broad-based, in that the investments were made with a view to effecting a transportation network conducive to economic and social developments in the entire province [38]. Unlike SHT, the criteria used by DNS and SRA were more pertinent to "local" benefits accrued from the transport investments.

- The effects of departmental objectives on evaluation were prominent in "grantor agencies" (i.e. departments which were not normally involved in actual construction but were responsible for distributing grants to other government departments). All three federal government departments, SRA, and DNS, because of their legislative responsibility and departmental objective to provide transportation services for "strategic development" (i.e. social benefits and needs), favored value analyses over other evaluation methods. Economic analyses, as conducted by these grantor agencies, were restricted to investigating the costs and benefits from a local perspective. Examples include grants made under the Northlands Agreements and by SRA, and investments undertaken by DNS in developing northern roads.

The impacts of departmental objectives or policies on evaluation approach were less noticeable in other government departments. However, for example, SHT's philosophy of "low initial capital costs but high maintenance costs", due to public pressure for dust-free highways and the reality of funding constraints [38], led to consideration of low-quality roads (i.e. oil treatment surfaces) which would otherwise be rejected by other provincial government departments. At the municipal

government level, the nature and extent of evaluation were affected by factors external to the departments of street and transportation. The city or town councils, by allocating funds to a transport project in a particular fiscal year (and, in the process, disregarding the priority ranking established by the transportation departments), relegated evaluation to only assessing different alternatives of that project, and not justifying the investment with respect to other potential transport investments. Further, frequent disregard of evaluation results seemed to have led to changes in the evaluation approach. An example would be the rejection of the Sherbrooke-McGregor Overpass Project in Winnipeg, due to negative public response over community disruption; it effected a more thorough value analyses on the part of the Winnipeg Streets and Transportation Division in future studies, as evident in the Kildonan Corridor Study [61].

APPENDICES

APPENDIX A
DEFINITIONS

APPENDIX A

DEFINITIONS

A.1 GLOSSARY

Unless otherwise specified, the definitions of the terms used in this thesis are as follows:

- transport infrastructure: any immobile facility (including any alteration to the topography of the ground) used by one or more transport modes.
- evaluation: appraisal of impacts before implementation of a particular project.
- transport investment/
expenditure: all costs incurred directly or indirectly in the construction of the infrastructure, including the cost of right-of-way acquisition.
- capital construction: all new work put in place, as well as major upgrading that raises an existing infrastructure to a higher design standard.
- maintenance: minor work, alteration, or rehabilitation where normal operating condition is maintained.
- procedure: methodology and criteria.
- inter-government
transfer payment: financial contribution from one level of government to another.

A.2 ABBREVIATIONS

Abbreviations used in the thesis are defined as follows:

AADT:	Annual Average Daily Traffic
AAHP:	Automated Advance Highway Programming (Manitoba)
AT:	Alberta Transportation
COE:	City of Edmonton
COR:	City of Regina
COS:	City of Saskatoon
COW:	City of Winnipeg
CTC:	Canadian Transport Commission
DINA:	Department of Indian and Northern Affairs
DMA:	Department of Municipal Affairs (Manitoba)
DNS:	Department of Northern Saskatchewan
DREE:	Department of Regional Economic Expansion
LRT:	Light Rail Transit (Edmonton)
MDHT:	Manitoba Department of Highways and Transportation
MFA:	Main Farm Access (Saskatchewan)
N/A:	Not Available
PR:	Provincial Road (Manitoba)
PTH:	Provincial Trunk Highway (Manitoba)
PWC:	Public Works Canada
QSI:	Quality of Service Index (Saskatchewan)
SEAS:	Socio-Economic Assessment System (Federal)
SHT:	Saskatchewan Highways and Transportation
SRA:	Saskatchewan Rural Affairs
TBC:	Treasury Board of Canada
TC:	Transport Canada
TSP:	Transportation System Plan (Edmonton)
UTB:	Urban Transportation Branch (Alberta)
-:	Nil or Negligible
--:	Incomplete Information

APPENDIX B
CONSOLIDATED GOVERNMENT TRANSPORTATION EXPENDITURES

Table B.1 Annual Consolidated Government Transportation Expenditures
- by Province
(in millions of current dollars)

Fiscal Year	74-75	75-76	76-77	77-78	78-79
Manitoba	177.2	219.8	254.4	247.6	293.5
Saskatchewan	244.5	292.7	298.0	307.0	403.6
Alberta	463.0	553.8	607.4	703.0	731.4
TOTAL	884.7	1066.3	1159.8	1257.6	1428.5

- Sources:
- Manitoba Dept. of Highways & Transportation [9]
 - Saskatchewan Highways & Transportation [7]
 - Saskatchewan Rural Affairs [8]
 - Project Management Sector, Dept. of Northern Saskatchewan
 - Alberta Transportation [4] [5]
 - Statistics Canada [27] [50] [64]
 - Transport Canada [26]

- Notes:
- Expenditures include grants and subsidies to crown corporations.
 - Double-counting is eliminated through discounting inter-government transfer payments.

Table B.2 Annual Consolidated Government Transportation Expenditures
- by Province
(in millions of constant 1971 dollars)

Fiscal Year	74-75	75-76	76-77	77-78	78-79
Manitoba	102.8	111.2	124.1	109.5	117.4
Saskatchewan	116.1	140.6	119.2	114.4	142.7
Alberta	220.8	276.2	271.3	270.1	255.9
TOTAL	439.7	528.0	514.6	494.0	516.0

- Sources:
- Manitoba Dept. of Highways & Transportation [9]
 - Saskatchewan Highways & Transportation [7]
 - Saskatchewan Rural Affairs [8]
 - Project Management Sector, Dept. of Northern Saskatchewan
 - Alberta Transportation [4] [5]
 - Statistics Canada [20] [27] [50] [64]
 - Transport Canada [26]

- Notes:
- Expenditures include grants and subsidies to crown corporations.
 - Double-counting is eliminated through discounting inter-government transfer payments.

Table B.3 Annual Consolidated Government Transportation Expenditures

- by Province

(in current dollars per capita)

Fiscal Year	74-75	75-76	76-77	77-78	78-79
Manitoba	175.0	215.2	247.2	239.6	284.6
Saskatchewan	269.6	315.0	320.0	324.6	421.6
Alberta	260.4	301.5	319.0	359.4	361.4

- Sources:
- Manitoba Dept. of Highways & Transportation [9]
 - Saskatchewan Highways & Transportation [7]
 - Saskatchewan Rural Affairs [8]
 - Project Management Sector, Dept. of Northern Saskatchewan
 - Alberta Transportation [4] [5]
 - Statistics Canada [27] [50] [64] [68]
 - Transport Canada [26]

Table B.4 Annual Consolidated Government Transportation Expenditures

- by Province

(in constant 1971 dollars per capita)

Fiscal Year	74-75	75-76	76-77	77-78	78-79
Manitoba	101.5	108.9	120.8	105.6	114.0
Saskatchewan	128.1	152.5	138.0	120.7	148.8
Alberta	124.2	150.4	143.1	139.8	134.9

- Sources:
- Manitoba Dept. of Highways & Transportation [9]
 - Saskatchewan Highways & Transportation [7]
 - Saskatchewan Rural Affairs [8]
 - Project Management Sector, Dept. of Northern Saskatchewan
 - Alberta Transportation [4] [5]
 - Statistics Canada [20] [27] [50] [64] [68]
 - Transport Canada [26]

Table B.5 Annual Consolidated Government Transportation Expenditures in the Province of Manitoba
- by Level of Government
(in millions of current dollars)

Fiscal Year	70-71	71-72	72-73	73-74	74-75	75-76	76-77	77-78	78-79	79-80
Federal	N/A	N/A	N/A	N/A	75.9	92.1	100.1	97.2	119.9	124.4
Provincial	46.3	55.2	66.4	72.8	76.6	92.8	102.9	132.3	145.0	157.4
Local/Municipal	26.2	20.3	19.0	18.2	24.7	34.9	51.4	18.1	28.6	N/A
TOTAL	--	--	--	--	177.2	219.8	254.4	247.6	293.5	--

Sources: • Transport Canada [26]
• Manitoba Dept. of Highways & Transportation [9]
• Statistics Canada [27] [64]

Notes: • Federal expenditures include grants and subsidies to other levels of governments and crown corporations.
• Double-counting is eliminated through subtractions of transfer payments received by either the provincial or the local/municipal governments.

Table B.6 Annual Consolidated Government Transportation Expenditures in the Province of Manitoba
- by Level of Government
(in millions of constant 1971 dollars)

Fiscal Year	70-71	71-72	72-73	73-74	74-75	75-76	76-77	77-78	78-79	79-80
Federal	N/A	N/A	N/A	N/A	44.0	46.6	48.9	43.0	48.0	44.9
Provincial	46.3	49.6	52.6	43.6	44.4	47.0	50.2	58.5	58.0	53.1
Local/Municipal	26.2	18.2	14.9	10.8	14.4	17.6	25.0	8.0	11.4	N/A
TOTAL	--	--	--	--	102.8	111.2	124.1	109.5	117.4	--

Sources: • Transport Canada [26]
• Manitoba Dept. of Highways & Transportation [9]
• Statistics Canada [20] [27] [64]

Notes: • Federal expenditures include grants and subsidies to other levels of governments and crown corporations.
• Double-counting is eliminated through subtractions of transfer payments received by either the provincial or the local/municipal governments.

Table B.7 Annual Consolidated Government Transportation Expenditures in the Province of Saskatchewan - by Level of Government
(in millions of current dollars)

Fiscal Year	70-71	71-72	72-73	73-74	74-75	75-76	76-77	77-78	78-79	79-80
Federal	N/A	N/A	N/A	N/A	96.5	117.5	109.7	98.2	146.1	175.4
Provincial	79.2	79.3	76.0	83.2	113.1	124.8	135.5	146.6	167.8	189.0
Local/Municipal	30.3	28.0	30.6	30.4	34.9	50.4	52.8	62.2	89.7	N/A
TOTAL	--	--	--	--	244.5	292.7	298.0	307.0	403.6	--

Sources: • Transport Canada [26]
• Saskatchewan Highways & Transportation [7]
• Saskatchewan Rural Affairs [8]
• Project Management Sector, Dept. of Northern Saskatchewan
• Statistics Canada [27] [64]

Notes: • Federal expenditures include grants and subsidies to other levels of governments and crown corporations.
• Double-counting is eliminated through subtractions of transfer payments received by either the provincial or the local/municipal governments.

Table B.8 Annual Consolidated Government Transportation Expenditures in the Province of Saskatchewan - by Level of Government
(in millions of constant 1971 dollars)

Fiscal Year	70-71	71-72	72-73	73-74	74-75	75-76	76-77	77-78	78-79	79-80
Federal	N/A	N/A	N/A	N/A	45.9	56.9	47.3	36.5	51.6	60.0
Provincial	79.2	75.9	58.6	47.3	53.7	60.4	58.4	54.5	59.2	65.1
Local/Municipal	30.3	26.9	23.4	16.8	16.5	23.3	13.5	23.4	31.9	N/A
TOTAL	--	--	--	--	116.1	140.6	119.2	114.4	142.7	--

Sources: • Transport Canada [26]
• Saskatchewan Highways & Transportation [7]
• Saskatchewan Rural Affairs [8]
• Project Management Sector, Dept. of Northern Saskatchewan
• Statistics Canada [20] [27] [64]

Notes: • Federal expenditures include grants and subsidies to other levels of governments and crown corporations.
• Double-counting is eliminated through subtractions of transfer payments received by either the provincial or the local/municipal governments.

Table B.9 Annual Consolidated Government Transportation Expenditures in the Province of Alberta
- by Level of Government
(in millions of current dollars)

Fiscal Year	70-71	71-72	72-73	73-74	74-75	75-76	76-77	77-78	78-79	79-80
Federal	N/A	N/A	N/A	N/A	109.8	130.1	171.4	156.0	164.6	144.5
Provincial	92.7	112.6	101.4	129.1	218.7	282.8	229.4	284.1	351.6	482.1
Local/Municipal	82.4	70.8	86.6	90.0	134.5	140.9	203.9	262.9	215.2	N/A
TOTAL	--	--	--	--	463.0	553.8	604.7	703.0	731.4	--

Sources: • Transport Canada [26]
• Alberta Transportation [4] [5]
• Statistics Canada [27] [64]

Notes: • Federal expenditures include grants and subsidies to other levels of governments and crown corporations.
• Double-counting is eliminated through subtractions of transfer payments received by either the provincial or the local/municipal governments.

Table B.10 Annual Consolidated Government Transportation Expenditures in the Province of Alberta
- by Level of Government
(in millions of constant 1971 dollars)

Fiscal Year	70-71	71-72	72-73	73-74	74-75	75-76	76-77	77-78	78-79	79-80
Federal	N/A	N/A	N/A	N/A	52.4	64.9	76.9	60.7	57.6	45.1
Provincial	92.7	113.2	78.8	69.9	104.3	141.1	102.9	110.5	123.0	150.4
Local/Municipal	82.4	71.2	67.4	48.7	64.1	70.2	91.5	98.9	75.3	N/A
TOTAL	--	--	--	--	220.8	276.2	271.3	270.1	255.9	--

Sources: • Transport Canada [26]
• Alberta Transportation [4] [5]
• Statistics Canada [20] [27] [64]

Notes: • Federal expenditures include grants and subsidies to other levels of governments and crown corporations.
• Double-counting is eliminated through subtractions of transfer payments received by either the provincial or the local/municipal governments.

Table B.11 Total Value of New Construction Work on Transport Infrastructure - by Province
(in millions of current dollars)

Fiscal Year	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980
Manitoba	93.4	134.5	121.9	83.5	98.3	114.4	141.8	170.0	188.1	169.0
Saskatchewan	127.5	144.8	151.6	136.6	152.1	158.1	192.7	190.1	244.7	270.3
Alberta	185.7	176.9	219.6	313.8	394.5	411.3	418.0	492.2	601.3	813.7
TOTAL	406.6	456.2	493.1	533.9	644.9	683.8	752.5	852.3	1034.1	1253.0

Source: • Statistics Canada [19]

Table B.12 Total Value of New Construction Work on Transport Infrastructure - by Province
(in millions of constant 1971 dollars)

Fiscal Year	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980
Manitoba	93.4	120.9	96.5	50.1	57.0	57.9	69.3	75.2	75.2	61.0
Saskatchewan	127.5	138.7	117.0	77.7	72.3	76.5	83.1	70.7	86.3	93.0
Alberta	185.7	177.8	170.7	169.9	188.1	205.1	187.5	191.5	210.4	254.0
TOTAL	406.6	437.4	384.2	297.7	317.4	339.5	339.9	337.4	371.9	408.0

Sources: • Statistics Canada [19] [20]

Table B.13 Total Value of All Work Performed on Transport Infrastructure - by Province

(in millions of current dollars)

Fiscal Year	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980
Manitoba	123.2	165.7	162.1	136.1	156.2	183.7	212.1	225.7	284.4	247.0
Saskatchewan	161.5	181.4	193.9	179.7	202.9	213.6	253.4	273.5	335.3	363.1
Alberta	250.7	227.0	277.1	380.6	477.8	494.5	528.9	634.7	816.0	1073.7
TOTAL	535.4	574.1	633.1	696.4	836.9	891.8	994.4	1133.9	1435.7	1683.8

Source: ● Statistics Canada [19]

Notes: ● All work includes private and public, capital and repair/maintenance expenditures.
 ● Expenditures do not include government grants, subsidies, etc.

Table B.14 Total Value of All Work Performed on Transport Infrastructure - by Province

(in millions of constant 1971 dollars)

Fiscal Year	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980
Manitoba	123.2	148.9	128.3	81.6	90.5	93.0	103.6	99.9	113.9	89.1
Saskatchewan	161.5	173.8	149.6	102.2	96.4	103.4	109.3	101.7	118.3	125.0
Alberta	250.7	228.1	215.1	206.1	227.8	246.6	237.3	247.0	285.5	335.1
TOTAL	535.4	550.8	493.0	389.9	414.7	443.0	450.2	448.6	517.7	549.2

Sources: ● Statistics Canada [19] [20]

Notes: ● All work includes private and public, capital and repair/maintenance expenditures.
 ● Expenditures do not include government grants, subsidies, etc.

APPENDIX C
FEDERAL GOVERNMENT TRANSPORTATION EXPENDITURES

Table C.1 Federal Government Transportation Expenditures - by Province

(in millions of current dollars)

Fiscal Year	74-75	75-76	76-77	77-78	78-79	79-80
Manitoba	75.9	92.1	100.1	97.2	119.9	124.4
Saskatchewan	96.5	117.5	109.7	98.2	146.1	174.5
Alberta	109.8	130.1	171.4	156.0	164.6	144.5
TOTAL	282.2	339.7	381.2	351.4	430.6	443.4

Source: • Transport Canada [26]

Notes: • Expenditures include subsidies and grants to crown corporations.
 • Refer to [26] for detailed allocation methodology.

Table C.2 Federal Government Transportation Expenditures - by Province

(in millions of constant 1971 dollars)

Fiscal Year	74-75	75-76	76-77	77-78	78-79	79-80
Manitoba	44.0	46.6	48.9	43.0	48.0	44.9
Saskatchewan	45.9	56.9	47.3	36.5	51.6	60.0
Alberta	52.4	64.9	76.9	60.7	57.6	45.1
TOTAL	142.3	168.4	173.1	140.2	157.2	150.1

Sources: • Transport Canada [26]
 • Statistics Canada [20]

Table C.3 Federal Government Transportation Expenditures - by Province

(in millions of constant 1974 dollars)

Fiscal Year	74-75	75-76	76-77	77-78	78-79	79-80
Manitoba	75.9	80.4	84.3	74.2	82.7	77.4
Saskatchewan	96.5	119.7	99.5	76.8	108.5	126.4
Alberta	109.8	136.1	161.2	127.2	120.8	94.6
TOTAL	282.2	336.2	345.0	278.2	312.0	298.4

Sources: • Transport Canada [26]
 • Statistics Canada [20]

Table C.4 Federal Government Transportation Expenditures - by Province
(in current dollars per capita)

Fiscal Year	74-75	75-76	76-77	77-78	78-79	79-80
Manitoba	74.9	90.2	97.3	94.1	116.3	120.9
Saskatchewan	106.4	127.4	117.1	103.6	152.3	179.9
Alberta	61.8	70.8	90.4	79.9	81.3	69.4
TOTAL	243.1	288.4	304.8	277.6	349.9	370.2

Sources: • Transport Canada [26]
• Statistics Canada [68]

Table C.5 Federal Government Transportation Expenditures - by Province
(in constant 1974 dollars per capita)

Fiscal Year	74-75	75-76	76-77	77-78	78-79	79-80
Manitoba	74.9	78.7	81.9	71.8	80.2	75.2
Saskatchewan	106.4	129.8	106.2	81.0	113.1	130.3
Alberta	61.8	74.1	85.0	65.1	59.7	45.4
TOTAL	243.1	282.6	273.1	217.9	253.0	250.9

Sources: • Transport Canada [26]
• Statistics Canada [20] [68]

Table C.6 Total Federal Government Transportation Expenditures - by Agency

(in millions of current dollars)

Fiscal Year	74-75	75-76	76-77	77-78	78-79	79-80
Transport Canada	157.4	167.5	222.2	209.7	270.9	267.0
Canadian Transport Commission	112.4	153.7	138.0	117.0	139.7	138.7
Dept of Indian & Northern Affairs	5.9	7.1	7.4	10.8	8.0	19.7
Public Works Canada	1.1	1.3	1.6	1.6	2.6	9.2
Dept. of Regional Economic Expansion	5.4	10.1	12.0	12.3	9.4	8.8
TOTAL	282.2	339.7	381.2	351.4	430.6	443.4

Source: ● Transport Canada [26]

- Notes:
- Complete information is unavailable from DINA, PWC and DREE for 1974/75.
 - 1979/80 figures are estimates only.
 - Expenditures for TC and CTC include federal grants, contributions and subsidies.
 - Expenditures for DREE do not include grants under the Northlands Agreements.
 - Expenditures under \$50,000 are excluded.

Table C.7 Total Federal Government Transportation Expenditures - by Agency

(in millions of constant 1974 dollars)

Fiscal Year	74-75	75-76	76-77	77-78	78-79	79-80
Transport Canada	157.4	165.5	201.7	166.6	195.5	177.8
Canadian Transport Commission	112.4	153.0	124.7	92.1	102.1	95.9
Dept of Indian & Northern Affairs	5.9	6.7	6.7	8.6	5.7	13.0
Public Works Canada	1.1	1.2	1.4	1.2	1.9	5.8
Dept. of Regional Economic Expansion	5.4	9.8	10.7	9.6	6.9	5.8
TOTAL	282.2	336.2	345.2	278.1	312.1	298.3

Sources: ● Transport Canada [26]
● Statistics Canada [20]

- Notes:
- Complete information is unavailable from DINA, PWC and DREE for 1974/75.
 - 1979/80 figures are estimates only.
 - Expenditures for TC and CTC include federal grants, contributions and subsidies.
 - Expenditures for DREE do not include grants under the Northlands Agreements.
 - Expenditures under \$50,000 are excluded.

Table C.8 Federal Government Transportation Expenditures in the Province of Manitoba - by Agency

(in millions of current dollars)

Fiscal Year	74-75	75-76	76-77	77-78	78-79	79-80
Transport Canada	45.9	51.9	66.3	64.1	89.4	91.8
Canadian Transport Commission	24.1	31.5	26.2	24.9	24.2	14.5
Dept. of Indian & Northern Affairs	2.5	3.9	2.8	2.9	2.5	4.1
Public Works Canada	0.5	0.7	1.0	0.7	1.1	8.2
Dept. of Regional Economic Expansion	2.9	4.1	3.8	4.6	2.7	5.8
TOTAL	75.9	92.1	100.1	97.2	119.9	124.4

Source: • Transport Canada [26]

- Notes:
- Complete information is unavailable from DINA, PWC and DREE for 1974/75.
 - 1979/80 figures are estimates only.
 - Expenditures for TC and CTC include federal grants, contributions and subsidies.
 - Expenditures for DREE do not include grants under the Northlands Agreements.
 - Expenditures under \$50,000 are excluded.

Table C.9 Federal Government Transportation Expenditures in the Province of Manitoba - by Agency

(in millions of constant 1974 dollars)

Fiscal Year	74-75	75-76	76-77	77-78	78-79	79-80
Transport Canada	45.9	45.3	55.9	48.9	61.7	57.1
Canadian Transport Commission	24.1	27.5	22.1	19.0	16.7	9.0
Dept. of Indian & Northern Affairs	2.5	3.4	2.4	2.2	1.7	2.6
Public Works Canada	0.5	0.6	0.8	0.5	0.8	5.1
Dept. of Regional Economic Expansion	2.9	3.6	3.2	3.5	1.9	3.6
TOTAL	75.9	80.4	84.4	74.1	82.8	77.4

Sources: • Transport Canada [26]
• Statistics Canada [20]

- Notes:
- Complete information is unavailable from DINA, PWC and DREE for 1974/75.
 - 1979/80 figures are estimates only.
 - Expenditures for TC and CTC include federal grants, contributions and subsidies.
 - Expenditures for DREE do not include grants under the Northlands Agreements.
 - Expenditures under \$50,000 are excluded.

Table C.10 Federal Government Transportation Expenditures in the Province of Saskatchewan

- by Agency

(in millions of current dollars)

Fiscal Year	74-75	75-76	76-77	77-78	78-79	79-80
Transport Canada	30.3	26.7	24.7	32.2	70.0	87.6
Canadian Transport Commission	65.2	85.7	78.1	61.0	72.2	80.7
Dept. of Indian & Northern Affairs	1.0	1.5	1.4	2.0	1.0	3.5
Public Works Canada	-	0.1	-	-	0.1	-
Dept. of Regional Economic Expansion	-	3.5	5.5	3.0	2.8	2.7
TOTAL	96.5	117.5	109.7	98.2	146.1	174.5

Source: • Transport Canada [26]

- Notes:
- Complete information is unavailable from DINA, PWC and DREE for 1974/75.
 - 1979/80 figures are estimates only.
 - Expenditures for TC and CTC include federal grants, contributions and subsidies.
 - Expenditures for DREE do not include grants under the Northlands Agreements.
 - Expenditures under \$50,000 are excluded.

Table C.11 Federal Government Transportation Expenditures in the Province of Saskatchewan

- by Agency

(in millions of constant 1974 dollars)

Fiscal Year	74-75	75-76	76-77	77-78	78-79	79-80
Transport Canada	30.3	27.2	22.4	25.2	52.0	63.4
Canadian Transport Commission	65.2	87.3	70.9	47.7	53.6	58.4
Dept. of Indian & Northern Affairs	1.0	1.5	1.3	1.6	0.7	2.5
Public Works Canada	-	0.1	-	-	0.1	-
Dept. of Regional Economic Expansion	-	3.6	5.0	2.3	2.1	2.0
TOTAL	96.5	119.7	99.6	76.8	108.5	126.3

Sources: • Transport Canada [26]
• Statistics Canada [20]

- Notes:
- Complete information is unavailable from DINA, PWC and DREE for 1974/75.
 - 1979/80 figures are estimates only.
 - Expenditures for TC and CTC include federal grants, contributions and subsidies.
 - Expenditures for DREE do not include grants under the Northlands Agreements.
 - Expenditures under \$50,000 are excluded.

Table C.12 Federal Government Transportation Expenditures in the Province of Alberta

- by Agency

(in millions of current dollars)

Fiscal Year	74-75	75-76	76-77	77-78	78-79	79-80
Transport Canada	81.2	88.9	131.2	113.4	111.5	87.6
Canadian Transport Commission	23.1	36.5	33.7	31.1	43.3	43.5
Dept. of Indian & Northern Affairs	2.4	1.7	3.2	5.9	4.5	12.1
Public Works Canada	0.6	0.5	0.6	0.9	1.4	1.0
Dept. of Regional Economic Expansion	2.5	2.5	2.7	4.7	3.9	0.3
TOTAL	109.8	130.1	171.4	156.0	164.6	144.5

Source: • Transport Canada [26]

- Notes:
- Complete information is unavailable from DINA, PWC and DREE for 1974/75.
 - 1979/80 figures are estimates only.
 - Expenditures for TC and CTC include federal grants, contributions and subsidies.
 - Expenditures for DREE do not include grants under the Northlands Agreements.
 - Expenditures under \$50,000 are excluded.

Table C.13 Federal Government Transportation Expenditures in the Province of Alberta

- by Agency

(in millions of constant 1974 dollars)

Fiscal Year	74-75	75-76	76-77	77-78	78-79	79-80
Transport Canada	81.2	93.0	123.4	92.5	81.8	57.3
Canadian Transport Commission	23.1	38.2	31.7	25.4	31.8	28.5
Dept. of Indian & Northern Affairs	2.4	1.8	3.0	4.8	3.3	7.9
Public Works Canada	0.6	0.5	0.6	0.7	1.0	0.7
Dept. of Regional Economic Expansion	2.5	2.6	2.5	3.8	2.9	0.2
TOTAL	109.8	136.1	161.2	127.2	120.8	94.6

Sources: • Transport Canada [26]
• Statistics Canada [20]

- Notes:
- Complete information is unavailable from DINA, PWC and DREE for 1974/75.
 - 1979/80 figures are estimates only.
 - Expenditures for TC and CTC include federal grants, contributions and subsidies.
 - Expenditures for DREE do not include grants under the Northlands Agreements.
 - Expenditures under \$50,000 are excluded.

Table C.14 Total Federal Government Transportation Expenditures - by Mode
(in millions of current dollars)

Fiscal Year	74-75	75-76	76-77	77-78	78-79	79-80
Highway	66.8	46.2	79.3	79.3	139.5	111.2
Air	79.0	109.0	148.7	133.7	126.6	117.2
Marine	6.3	6.9	6.1	6.2	10.2	16.3
Rail	130.1	177.6	147.1	132.2	154.2	198.7
TOTAL	282.2	339.7	381.2	351.4	430.5	443.4

Source: ● Transport Canada [26]

Notes: ● "Highway" includes roadways, bridges and related facilities.
 ● Expenditures include grants, subsidies and contributions where allocation is possible.
 ● Expenditures also include capital, operating and maintenance, administrative expenses, and payments to crown corporations.
 ● 1979/80 figures are estimates only.
 ● Refer to [26] for detailed methodological procedure.

Table C.15 Total Federal Government Transportation Expenditures - by Mode
(in millions of constant 1974 dollars)

Fiscal Year	74-75	75-76	76-77	77-78	78-79	79-80
Highway	66.8	44.7	71.9	62.8	101.3	75.8
Air	79.0	109.0	135.1	106.5	91.1	76.3
Marine	6.3	6.1	5.2	4.7	7.1	10.2
Rail	130.1	176.3	132.8	104.0	112.5	136.0
TOTAL	322.2	336.1	345.0	278.0	312.0	298.3

Sources: ● Transport Canada [26]
 ● Statistics Canada [20]

Notes: ● "Highway" includes roadways, bridges and related facilities.
 ● Expenditures include grants, subsidies and contributions where allocation is possible.
 ● Expenditures also include capital, operating and maintenance, administrative expenses, and payments to crown corporations.
 ● 1979/80 figures are estimates only.
 ● Refer to [26] for detailed methodological procedure.

Table C.16 Federal Government Transportation Expenditures in the Province of Manitoba - by Mode
(in millions of current dollars)

Fiscal Year	74-75	75-76	76-77	77-78	78-79	79-80
Highway	19.2	18.6	20.5	21.9	35.3	29.4
Air	20.9	27.7	44.8	40.0	45.0	43.6
Marine	5.8	6.3	5.5	5.3	9.3	15.4
Rail	30.0	39.5	29.3	30.0	30.3	36.0
TOTAL	75.9	92.1	100.1	97.2	119.9	124.4

Source: • Transport Canada [26]

Notes: • "Highway" includes roadways, bridges and related facilities.
 • Expenditures include grants, subsidies and contributions where allocation is possible.
 • Expenditures also include capital, operating and maintenance, administrative expenses and payments to crown corporations.
 • 1979/80 figures are estimates only
 • Refer to [26] for detailed methodological procedure.

Table C.17 Federal Government Transportation Expenditures in the Province of Manitoba - by Mode
(in millions of constant 1974 dollars)

Fiscal Year	74-75	75-76	76-77	77-78	78-79	79-80
Highway	19.2	16.2	17.3	16.7	24.4	18.3
Air	20.9	24.2	37.7	30.5	31.1	27.1
Marine	5.8	5.5	4.6	4.0	6.4	9.6
Rail	30.0	34.5	24.7	22.9	20.9	22.4
TOTAL	75.9	80.4	84.3	74.1	82.8	77.4

Sources: • Transport Canada [26]
 • Statistics Canada [20]

Notes: • "Highway" includes roadways, bridges and related facilities.
 • Expenditures include grants, subsidies and contributions where allocation is possible.
 • Expenditures also include capital, operating and maintenance, administrative expenses and payments to crown corporations.
 • 1979/80 figures are estimates only
 • Refer to [26] for detailed methodological procedure.

Table C.18 Federal Government Transportation Expenditures in the Province of Saskatchewan

- by Mode

(in millions of current dollars)

Fiscal Year	74-75	75-76	76-77	77-78	78-79	79-80
Highway	17.2	13.8	19.0	20.6	55.3	56.7
Air	8.2	9.9	9.6	11.5	13.9	14.9
Marine	-	0.1	-	-	0.1	-
Rail	71.1	93.7	81.1	66.1	76.8	102.9
TOTAL	96.5	117.5	109.7	98.2	146.1	174.5

Source: • Transport Canada [26]

- Notes:
- "Highway" includes roadways, bridges and related facilities.
 - Expenditures include grants, subsidies and contributions where allocation is possible.
 - Expenditures also include capital, operating and maintenance, administrative expenses and payments to crown corporations.
 - 1979/80 figures are estimates only
 - Refer to [26] for detailed methodological procedure.

Table C.19 Federal Government Transportation Expenditures in the Province of Saskatchewan

- by Mode

(in millions of constant 1974 dollars)

Fiscal Year	74-75	75-76	76-77	77-78	78-79	79-80
Highway	17.2	14.1	17.2	16.1	38.2	41.1
Air	8.2	10.1	8.7	9.0	9.6	10.8
Marine	-	0.1	-	-	0.1	-
Rail	71.1	95.4	73.6	51.7	53.0	74.5
TOTAL	96.5	119.7	99.5	76.8	100.9	126.4

Sources: • Transport Canada [26]
 • Statistics Canada [20]

- Notes:
- "Highway" includes roadways, bridges and related facilities.
 - Expenditures include grants, subsidies and contributions where allocation is possible.
 - Expenditures also include capital, operating and maintenance, administrative expenses and payments to crown corporations.
 - 1979/80 figures are estimates only
 - Refer to [26] for detailed methodological procedure.

Table C.20 Federal Government Transportation Expenditures in the Province of Alberta - by Mode
(in millions of current dollars)

Fiscal Year	74-75	75-76	76-77	77-78	78-79	79-80
Highway	30.4	13.8	39.8	36.8	48.9	25.1
Air	49.9	71.4	94.3	82.2	67.7	58.7
Marine	0.5	0.5	0.6	0.9	0.8	0.9
Rail	29.0	44.4	36.7	36.1	47.2	59.8
TOTAL	109.8	130.1	171.4	156.0	164.6	144.5

Source: • Transport Canada [26]

- Notes:
- "Highway" includes roadways, bridges and related facilities.
 - Expenditures include grants, subsidies and contributions where allocation is possible
 - Expenditures also include capital, operating and maintenance, administrative expenses, and payments to crown corporations.
 - 1979/80 figures are estimates only
 - Refer to [26] for detailed methodological procedure.

Table C.21 Federal Government Transportation Expenditures in the Province of Alberta - by Mode
(in millions of constant 1974 dollars)

Fiscal Year	74-75	75-76	76-77	77-78	78-79	79-80
Highway	30.4	14.4	37.4	30.0	35.9	16.4
Air	49.9	74.7	88.7	67.0	49.7	38.4
Marine	0.5	0.5	0.6	0.7	0.6	0.6
Rail	29.0	46.4	34.5	29.4	34.6	39.1
TOTAL	109.8	136.0	161.2	127.1	120.8	94.5

Sources: • Transport Canada [26]
• Statistics Canada [20]

- Notes:
- "Highway" includes roadways, bridges and related facilities.
 - Expenditures include grants, subsidies and contributions where allocation is possible.
 - Expenditures also include capital, operating and maintenance, administrative expenses and payments to crown corporations.
 - 1979/80 figures are estimates only
 - Refer to [26] for detailed methodological procedure.

Table C.22 Total Federal Contributions - by Program

(in millions of current dollars)

Fiscal Year	74-75	75-76	76-77	77-78	78-79	79-80
Highway Strengthening Program	17.64	23.81	27.99	31.31	31.40	5.55
Northlands Agreement	3.99	13.67	14.67	21.13	6.95	13.14
Others	4.20	7.58	7.76	9.77	13.91	5.52

Sources : ● Manitoba Dept. of Highways & Transportation [9]
 ● Saskatchewan Highways & Transportation [7]
 ● Alberta Transportation [4] [5]

Notes: ● 1979-80 data does not include contributions to Alberta due to changes in reporting procedures by Alberta transportation.
 ● "Others" include Airport Subsidies and Railway Grade Crossing Fund.

Table C.23 Total Federal Contributions - by Program

(in millions of constant 1974 dollars)

Fiscal Year	74-75	75-76	76-77	77-78	78-79	79-80
Highway Strengthening Program	17.64	22.87	24.89	24.50	22.47	4.02
Northlands Agreement	3.99	13.36	13.15	16.76	4.96	8.56
Others	4.20	6.98	6.69	7.54	9.84	3.47

Sources : ● Manitoba Dept. of Highways & Transportation [9]
 ● Saskatchewan Highways & Transportation [7]
 ● Alberta Transportation [4] [5]
 ● Statistics Canada [20]

Notes: ● 1979-80 data does not include contributions to Alberta due to changes in reporting procedures by Alberta transportation.
 ● "Others" include Airport Subsidies and Railway Grade Crossing Fund.

Table C.24 Federal Contributions to the Province of Manitoba - by Program
(in millions of current dollars)

Fiscal Year	74-75	75-76	76-77	77-78	78-79	79-80
Highway Strengthening Program	8.37	10.80	12.09	13.89	14.53	-
Northlands Agreement	3.99	4.76	5.08	5.92	3.84	9.43
Others	3.80	5.50	6.20	7.90	8.70	5.10
TOTAL	16.16	21.06	23.37	27.71	27.07	14.53

Sources: • Manitoba Highways and Transportation
• Dept. of Regional Economic Expansion
• Transport Canada [26]

Notes: • Federal program year may overlap two Manitoba fiscal years.
• "Others" include Airport Subsidies and Railway Grade Crossing Fund.

Table C.25 Federal Contributions to the Province of Manitoba - by Program
(in millions of constant 1974 dollars)

Fiscal Year	74-75	75-76	76-77	77-78	78-79	79-80
Highway Strengthening Program	8.37	9.42	10.19	10.60	10.03	-
Northlands Agreement	3.99	4.15	4.28	4.52	2.65	5.87
Others	3.80	4.80	5.22	6.03	6.00	3.17
TOTAL	16.16	18.37	19.69	21.15	18.68	9.04

Sources: • Manitoba Highways and Transportation
• Dept. of Regional Economic Expansion
• Transport Canada [26]
• Statistics Canada [20]

Notes: • Federal program year may overlap two Manitoba fiscal years.
• "Others" include Airport Subsidies and Railway Grade Crossing Fund.

Table C.26 Federal Contributions to the Province of Saskatchewan - by Program
(in millions of current dollars)

Fiscal Year	74-75	75-76	76-77	77-78	78-79	79-80
Highway Strengthening Program	4.24	5.94	7.80	9.37	7.67	5.55
Northlands Agreement	-	3.91	4.59	5.21	3.11	3.71
Others	-	-	0.14	0.47	1.14	0.42
TOTAL	4.24	9.85	12.53	15.05	11.92	9.68

Source: • Saskatchewan Highways and Transportation [7]

Notes: • Federal program year may overlap two Saskatchewan fiscal years.
• "Others" include Airport Subsidies and Railway Grade Crossing Fund.

Table C.27 Federal Contributions to the Province of Saskatchewan - by Program
(in millions of constant 1974 dollars)

Fiscal Year	74-75	75-76	76-77	77-78	78-79	79-80
Highway Strengthening Program	4.24	6.05	7.08	7.33	5.69	4.02
Northlands Agreement	-	3.98	4.17	4.08	2.31	2.69
Others	-	-	0.13	0.37	0.85	0.30
TOTAL	4.24	10.03	11.38	11.78	8.85	7.01

Sources: • Saskatchewan Highways and Transportation [7]
• Statistics Canada [20]

Notes: • Federal program year may overlap two Saskatchewan fiscal years.
• "Others" include Airport Subsidies and Railway Grade Crossing Fund.

Table C.28 Federal Contributions to the Province of Alberta - by Program
(in millions of current dollars)

Fiscal Year	74-75	75-76	76-77	77-78	78-79
Highway Strengthening Program	5.03	7.07	8.10	8.05	9.20
Northlands Agreement	-	5.00	5.00	10.00	-
Others	0.40	2.08	1.42	1.40	4.07
TOTAL	5.43	14.15	14.52	19.45	13.27

Sources: ● Alberta Transportation [4] [5]

Notes: ● Federal program year may overlap two Alberta fiscal years.
● "Others" include Airport Subsidies and Railway Grade Crossing Fund.

Table C.29 Federal Contributions to the Province of Alberta - by Program
(in millions of constant 1974 dollars)

Fiscal Year	74-75	75-76	76-77	77-78	78-79
Highway Strengthening Program	5.03	7.40	7.62	6.57	6.75
Northlands Agreement	-	5.23	4.70	8.16	-
Others	0.40	2.18	1.34	1.14	2.99
TOTAL	5.43	14.81	13.66	15.87	9.74

Sources: ● Alberta Transportation [4] [5]
● Statistics Canada [20]

Notes: ● Federal program year may overlap two Alberta fiscal years.
● "Others" include Airport Subsidies and Railway Grade Crossing Fund.

APPENDIX D

PROVINCIAL GOVERNMENT TRANSPORTATION EXPENDITURES

Table D.1.1 Annual Expenditures on Transport Infrastructure by the Manitoba Department of Highways and Transportation - by Function
(in millions of current dollars)

Fiscal Year	70-71	71-72	72-73	73-74	74-75	75-76	76-77	77-78	78-79	79-80
Capital Construction	30.18	31.68	41.51	44.45	50.32	61.10	68.27	75.34	86.11	80.67
Maintenance	8.78	14.17	14.97	16.49	19.91	22.40	25.07	28.29	31.67	33.94
Aids & Grants	3.47	3.82	4.61	5.08	8.29	11.51	14.74	21.87	16.14	3.93
Administration & Others	4.83	5.56	5.50	6.73	6.67	8.71	10.50	21.35	22.48	37.07
TOTAL	47.26	55.23	66.59	72.75	85.19	103.72	118.58	146.85	156.40	155.61

Source: • Manitoba Dept. of Highways and Transportation [9]

Table D.1.2 Annual Expenditures on Transport Infrastructure by the Manitoba Department of Highways and Transportation - by Function
(in millions of constant 1971 dollars)

Fiscal Year	70-71	71-72	72-73	73-74	74-75	75-76	76-77	77-78	78-79	79-80
Capital Construction	30.18	28.46	32.87	26.65	29.17	30.92	33.35	33.34	34.44	29.10
Maintenance	8.78	12.73	11.86	9.89	11.54	11.34	12.25	12.52	12.67	12.24
Aids & Grants	3.47	3.43	3.65	3.04	4.81	5.82	7.20	9.68	6.46	1.42
Administration & Others	4.83	5.00	4.35	4.04	3.87	4.41	5.13	9.45	8.99	13.37
TOTAL	47.26	49.62	52.73	43.62	49.39	52.49	57.93	64.99	62.56	56.13

Sources: • Manitoba Dept. of Highways & Transportation [9]
• Statistics Canada [20]

Table D.2.1 Annual Expenditures on Transport Infrastructure by Saskatchewan Highways and
Transportation - by Function
(in millions of current dollars)

Fiscal Year	70-71	71-72	72-73	73-74	74-75	75-76	76-77	77-78	78-79	79-80
Capital Construction	48.43	47.00	42.82	45.30	64.74	71.45	77.62	77.10	103.22	101.96
Maintenance	13.11	13.24	13.15	17.24	24.12	29.91	34.60	42.93	43.88	42.93
Aids & Grants	4.07	3.64		3.78	4.18	4.71				
Administration & Others	2.47	3.05	7.39	3.15	3.72	4.10	11.10	12.39	13.41	13.21
TOTAL	68.08	66.93	63.36	69.47	96.76	110.17	123.32	132.42	160.51	158.10

Source: • Saskatchewan Highways & Transportation [7]

Table D.2.2 Annual Expenditures on Transport Infrastructure by Saskatchewan Highways and
Transportation - by Function
(in millions of constant 1971 dollars)

Fiscal Year	70-71	71-72	72-73	73-74	74-75	75-76	76-77	77-78	78-79	79-80
Capital Construction	48.43	45.01	33.04	25.77	30.77	34.58	33.47	28.67	36.42	35.90
Maintenance	13.11	12.69	10.15	9.80	11.47	14.48	14.92	15.97	15.48	14.77
Aids & Grants	4.07	3.49		2.15	1.99	2.28				
Administration & Others	2.47	2.92	5.71	1.80	1.77	1.98	4.78	4.61	4.73	4.55
TOTAL	68.08	64.11	48.90	39.52	46.00	53.32	53.17	49.25	56.63	54.14

Sources: • Saskatchewan Highways and Transportation [7]
• Statistics Canada [20]

Table D.2.3 Annual Grant Payments Provided by Saskatchewan Rural Affairs
for Municipal Transport Infrastructure Developments
(in millions of current dollars)

Fiscal Year	70-71	71-72	72-73	73-74	74-75	75-76	76-77	77-78	78-79	79-80
Conditional Grants	10.02	10.07	9.92	10.03	14.00	14.12	11.78	14.58	14.73	19.80
Unconditional Grants	2.50	2.46	2.78	3.02	3.62	5.15	5.26	4.73	9.71	12.05
TOTAL	12.52	12.53	12.70	13.05	17.62	19.27	17.04	19.31	24.44	31.85

Source: • Saskatchewan Rural Affairs [8]

Note : • Definitions of "Conditional grants" and "Unconditional Grants" can be found in Section II.3.3

Table D.2.4 Annual Grant Payments Provided by Saskatchewan Rural Affairs
for Municipal Transport Infrastructure Developments
(in millions of constant 1971 dollars)

Fiscal Year	70-71	71-72	72-73	73-74	74-75	75-76	76-77	77-78	78-79	79-80
Conditional Grants	10.02	9.65	7.65	5.71	6.65	6.83	5.08	5.42	5.20	6.81
Unconditional Grants	2.50	2.36	2.15	1.72	1.72	2.49	2.27	1.76	3.43	4.15
TOTAL	12.52	12.01	9.80	7.43	8.37	9.32	7.35	7.18	8.63	10.96

Sources: • Saskatchewan Rural Affairs [8]
• Statistics Canada [20]

Note : • Definitions of "Conditional grants" and "Unconditional Grants" can be found in Section II.3.3

Table D.2.5 Annual Expenditures on Transport Infrastructure by the Department
of Northern Saskatchewan - by Function
(in millions of current dollars)

Fiscal Year	73-74	74-75	75-76	76-77	77-78	78-79	79-80
Capital Construction	0.69	2.90	3.60	4.22	4.39	4.58	4.09
Maintenance	-	-	0.65	1.04	1.14	1.60	2.02
TOTAL	0.69	2.90	4.25	5.26	5.53	6.18	6.11

Source: • Project Management Sector, Dept. of Northern Saskatchewan

Table D.2.6 Annual Expenditures on Transport Infrastructure by the Department
of Northern Saskatchewan - by Function
(in millions of constant 1973 dollars)

Fiscal Year	73-74	74-75	75-76	76-77	77-78	78-79	79-80
Capital Construction	0.69	2.42	3.06	3.20	2.87	2.84	2.47
Maintenance	-	-	0.55	0.79	0.75	0.99	1.22
TOTAL	0.69	2.42	3.61	3.99	3.62	3.83	3.69

Sources: • Project Management Sector, Dept. of Northern Saskatchewan
• Statistics Canada [20]

Table D.3.1 Annual Expenditures on Transport Infrastructure by Alberta Transportation - by Function
(in millions of current dollars)

Fiscal Year	70-71	71-72	72-73	73-74	74-75	75-76	76-77	77-78	78-79	79-80
Capital Construction	48.76	59.39	63.28	78.17	138.99	180.31	185.52	196.58	259.07	272.27
Maintenance	13.88	15.19	11.94	15.79	17.49	30.88	31.96	41.66	47.86	51.07
Aids & Grants	26.41	31.71	19.37	26.62	54.26	81.24	39.05	65.56	68.06	153.10
Administration & Others	5.09	6.29	6.86	9.04	15.77	2.07	4.52	5.85	7.82	7.48
TOTAL	94.14	112.58	101.45	129.62	226.51	294.50	261.05	309.65	382.81	483.92

Sources: • Alberta Transportation [4] [5]

Table D.3.2 Annual Expenditures on Transport Infrastructure by Alberta Transportation - by Function
(in millions of constant 1971 dollars)

Fiscal Year	70-71	71-72	72-73	73-74	74-75	75-76	76-77	77-78	78-79	79-80
Capital Construction	48.76	59.68	49.20	42.32	66.28	89.93	83.23	76.49	90.65	84.98
Maintenance	13.88	15.26	9.29	8.55	8.34	15.40	14.34	16.21	16.75	15.94
Aids & Grants	26.41	31.86	15.07	14.41	25.88	40.52	17.52	25.51	23.82	47.78
Administration & Others	5.09	6.32	5.33	4.90	7.52	1.03	2.03	2.28	2.74	2.34
TOTAL	94.14	113.12	78.89	70.18	108.02	146.88	117.12	120.49	133.96	151.04

Sources: • Alberta Transportation [4] [5]
• Statistics Canada [20]

Table D.4.1 Gross Provincial Government Transportation Expenditures- by Province

(in millions of current dollars)

Fiscal Year	70-71	71-72	72-73	73-74	74-75	75-76	76-77	77-78	78-79	79-80
Manitoba	47.26	55.23	66.59	72.75	85.19	103.72	118.58	146.85	156.40	155.61
Saskatchewan	80.60	79.46	76.06	83.21	117.28	133.69	145.62	157.26	191.13	196.06
Alberta	94.14	112.58	101.45	129.62	226.51	294.50	261.05	309.65	382.81	483.92
TOTAL	222.00	247.27	244.10	285.58	428.98	531.91	525.25	613.76	730.34	835.59

- Sources:
- Manitoba Dept. of Highways and Transportation [9]
 - Saskatchewan Highways and Transportation [7]
 - Saskatchewan Rural Affairs [8]
 - Project Management Sector, Dept. of Northern Saskatchewan
 - Alberta Transportation [4] [5]

Table D.4.2 Gross Provincial Government Transportation Expenditures - by Province

(in millions of constant 1971 dollars)

Fiscal Year	70-71	71-72	72-73	73-74	74-75	75-76	76-77	77-78	78-79	79-80
Manitoba	47.26	49.62	52.72	43.62	49.39	52.49	57.93	64.98	62.56	56.14
Saskatchewan	80.60	76.11	58.69	47.33	55.74	64.71	62.79	58.48	67.44	67.47
Alberta	94.14	113.15	78.89	70.18	108.02	146.88	117.12	120.49	133.94	151.04
TOTAL	222.00	238.88	190.30	161.13	213.15	264.08	237.84	243.95	263.94	274.65

- Sources:
- Manitoba Dept. of Highways and Transportation [9]
 - Saskatchewan Highways and Transportation [7]
 - Saskatchewan Rural Affairs [8]
 - Project Management Sector, Dept. of Northern Saskatchewan
 - Alberta Transportation [4] [5]
 - Statistics Canada [20]

Table D.4.3 Gross Provincial Government Transportation Expenditures by Province
(in current dollars per capita)

Fiscal Year	70-71	71-72	72-73	73-74	74-75	75-76	76-77	77-78	78-79	79-80
Manitoba	47.79	55.79	66.86	72.32	84.10	101.59	115.24	142.16	151.70	151.22
Saskatchewan	87.23	86.94	84.14	92.46	129.31	145.00	155.41	165.89	199.30	202.12
Alberta	57.61	67.94	60.07	75.23	127.40	160.32	137.68	158.55	189.14	232.32

- Sources: • Manitoba Dept. of Highways and Transportation [9]
 • Saskatchewan Highways and Transportation [7]
 • Saskatchewan Rural Affairs [8]
 • Project Management Sector, Dept. of Northern Saskatchewan
 • Alberta Transportation [4] [5]
 • Statistics Canada [68]

Table D.4.4 Gross Provincial Government Transportation Expenditures by Province
(in constant 1971 dollars per capita)

Fiscal Year	70-71	71-72	72-73	73-74	74-75	75-76	76-77	77-78	78-79	79-80
Manitoba	47.79	50.12	52.93	43.36	48.76	51.41	56.30	62.90	60.68	54.56
Saskatchewan	87.23	83.27	64.92	52.59	61.46	70.18	67.01	61.69	70.32	69.56
Alberta	57.61	68.29	46.71	40.73	60.75	79.96	61.77	61.69	66.18	72.51

- Sources: • Manitoba Dept. of Highways and Transportation [9]
 • Saskatchewan Highways and Transportation [7]
 • Saskatchewan Rural Affairs [8]
 • Project Management Sector, Dept. of Northern Saskatchewan
 • Alberta Transportation [4] [5]
 • Statistics Canada [20] [68]

Table D.4.5 Annual Capital Expenditures on Transport Infrastructure by Provincial Governments
(in millions of current dollars)

Fiscal Year	70-71	71-72	72-73	73-74	74-75	75-76	76-77	77-78	78-79	79-80
Manitoba	30.18	31.68	41.51	44.45	50.32	61.10	68.27	75.34	86.11	80.67
Saskatchewan	60.95	59.53	55.52	59.04	85.26	94.32	98.88	100.80	132.24	137.90
Alberta	48.76	59.39	63.28	78.17	138.99	180.31	185.52	196.58	259.07	272.27

- Sources: • Manitoba Dept. of Highways and Transportation [9]
 • Saskatchewan Highways and Transportation [7]
 • Saskatchewan Rural Affairs [8]
 • Project Management Sector, Dept. of Northern Saskatchewan
 • Alberta Transportation [4] [5]

Table D.4.6 Annual Capital Expenditures on Transport Infrastructure by Provincial Governments
(in millions of constant 1971 dollars)

Fiscal Year	70-71	71-72	72-73	73-74	74-75	75-76	76-77	77-78	78-79	79-80
Manitoba	30.18	28.46	32.87	26.65	29.17	30.92	33.35	33.34	34.44	29.10
Saskatchewan	60.95	57.02	42.84	33.58	40.52	45.65	42.64	37.49	46.66	47.45
Alberta	48.76	59.69	49.21	42.32	66.28	89.93	83.23	76.49	90.65	84.98
TOTAL	139.89	145.17	124.92	102.55	135.97	166.50	159.22	147.32	171.75	161.53

- Sources: • Manitoba Dept. of Highways and Transportation [9]
 • Saskatchewan Highways and Transportation [7]
 • Saskatchewan Rural Affairs [8]
 • Project Management Sector, Dept. of Northern Saskatchewan
 • Alberta Transportation [4] [5]
 • Statistics Canada [20]

APPENDIX E

LOCAL/MUNICIPAL GOVERNMENT TRANSPORTATION EXPENDITURES

Table E. 1 Annual Expenditures on Transport Infrastructure by Municipal Governments
 - by Province
 (in millions of current dollars)

Fiscal Year	1971	1972	1973	1974	1975	1976	1977	1978	1979
Manitoba	38.55	35.42	35.67	37.86	48.22	63.30	77.36	69.66	78.24
Saskatchewan	44.57	42.13	46.07	48.06	56.38	76.05	80.28	90.37	98.47
Alberta	100.57	93.98	100.33	114.31	185.76	199.47	223.74	298.33	306.21

Source: • Statistics Canada [50]

Table E. 2 Annual Expenditures on Transport Infrastructure by Municipal Governments
 - by Province
 (in millions of constant 1971 dollars)

Fiscal Year	1971	1972	1973	1974	1975	1976	1977	1978	1979
Manitoba	38.55	31.83	28.24	22.70	27.95	32.04	37.79	30.82	31.30
Saskatchewan	44.57	40.35	35.54	27.34	26.80	36.81	34.62	33.61	34.75
Alberta	100.57	94.45	78.02	61.89	88.58	99.48	100.38	116.08	107.14

Sources: • Statistics Canada [20] [50]

Table E. 3 Annual Expenditures on Transport Infrastructure by the City of Winnipeg - by Function
(in millions of current dollars)

Fiscal Year	1972	1973	1974	1975	1976	1977	1978	1979	1980
New/Capacity-Improvement Projects	2.70	5.82	4.47	7.34	20.60	13.40	7.99	21.52	12.25
Non-Improvement Maintenance Work	2.37	4.18	1.73	6.27	2.09	6.90	5.76	7.95	8.84
TOTAL	5.07	10.00	6.20	13.61	22.69	20.30	13.75	29.47	21.09

Source: • City of Winnipeg [14]

- Notes:
- The City of Winnipeg considers both New/Capacity-Improvement projects and maintenance as capital work.
 - Maintenance includes reconstruction (with no improvement to capacity of existing structure), resurfacing, and street lighting.
 - New/Capacity Improvement expenditures include land acquisition for future development.
 - All figures represent allocations approved by the Municipal Board. Actual expenditure figures are unavailable but amounts shown are claimed to be reasonable approximations.

Table E. 4 Annual Expenditures on Transport Infrastructure by the City of Winnipeg - by Function
(in millions of constant 1971 dollars)

Fiscal Year	1972	1973	1974	1975	1976	1977	1978	1979	1980
New/Capacity-Improvement Projects	2.43	4.61	2.68	4.26	10.43	6.55	3.54	8.61	4.42
Non-Improvement Maintenance Work	2.13	3.31	1.04	3.63	1.06	3.37	2.55	3.18	3.19
TOTAL	4.56	7.92	3.72	7.89	11.49	9.92	6.09	11.79	7.61

Sources: • City of Winnipeg [14]
• Statistics Canada [20]

- Notes:
- The City of Winnipeg considers both New/Capacity-Improvement projects and maintenance as capital work.
 - Maintenance includes reconstruction (with no improvement to capacity of existing structure), resurfacing, and street lighting.
 - New/Capacity Improvement expenditures include land acquisition for future development.
 - All figures represent allocations approved by the Municipal Board. Actual expenditure figures are unavailable but amounts shown are claimed to be reasonable approximations.

Table E. 5 Annual Expenditures on Transport Infrastructure by the City of Regina - by Function
(in millions of current dollars)

Fiscal Year	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980
Capital	0.75	N/A	1.75	3.89	8.00	7.04	6.28	4.00	6.84	12.00
General	4.56	5.05	5.34	7.80	9.70	9.53	10.22	11.65	12.94	16.03
TOTAL	5.31	--	7.09	11.69	17.70	16.57	16.50	15.65	19.78	28.03

Source: • City of Regina [29]

Note: • General expenditures include operation and maintenance, administration and other expenses.

Table E. 6 Annual Expenditures on Transport Infrastructure by the City of Regina - by Function
(in millions of constant 1971 dollars)

Fiscal Year	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980
Capital	0.75	N/A	1.35	2.21	3.80	3.41	2.71	1.49	2.41	4.13
General	4.56	4.84	4.12	4.44	4.61	4.61	4.41	4.33	4.57	5.52
TOTAL	5.31	--	5.47	6.65	8.41	8.02	7.12	5.82	6.98	9.65

Sources: • City of Regina [29]
• Statistics Canada [20]

Note: • General expenditures include operation and maintenance, administration and other expenses.

Table E. 7 Annual Expenditures on Transport Infrastructure by the City of Saskatoon - by Function
(in millions of current dollars)

Fiscal Year	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980
Capital Construction	0.57	1.31	1.63	2.10	4.43	6.18	6.62	7.26	14.23	18.62
Maintenance	1.66	1.67	1.86	2.40	2.88	3.22	2.70	5.00	6.78	6.90
Others	1.06	0.80	0.84	0.61	1.60	1.87	2.08	2.91	2.28	5.08
TOTAL	3.29	3.78	4.33	5.11	8.91	11.27	12.40	15.17	23.29	30.60

Source: ● Fiscal Planning & Analysis Office, City of Saskatoon

Note: ● Others include transit capital expenditures and operating grants.

Table E. 8 Annual Expenditures on Transport Infrastructure by the City of Saskatoon - by Function
(in millions of constant 1971 dollars)

Fiscal Year	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980
Capital Construction	0.57	1.25	1.26	1.19	2.11	2.99	2.85	2.70	5.02	6.41
Maintenance	1.66	1.60	1.44	1.37	1.37	1.56	1.60	1.86	2.39	2.37
Others	1.06	0.77	0.65	0.35	0.76	0.91	0.90	1.08	0.80	1.75
TOTAL	3.29	3.62	3.35	2.91	4.24	5.46	5.35	5.64	8.21	10.53

Sources: ● Fiscal Planning & Analysis Office, City of Saskatoon
● Statistics Canada [20]

Note: ● Others include transit capital expenditures and operating grants.

Table E. 9 Annual Expenditures on Transport Infrastructure by the City of Edmonton - by Function
(in millions of current dollars)

Fiscal Year	70-71	71-72	72-73	73-74	74-75	75-76	76-77	77-78	78-79	79-80
Capital Construction	13.38	15.69	16.19	19.89	39.39	44.59	33.92	38.48	52.23	51.14
Capital Grants	-	-	-	-	7.31	9.06	15.18	16.99	25.43	28.63
Operation & Maintenance	1.13	1.27	1.41	1.75	2.72	3.00	3.66	3.01	4.55	5.65
Administration	0.66	0.74	0.82	0.75	1.02	0.65	0.84	0.94	1.03	1.22
TOTAL	15.17	17.70	18.42	22.39	50.44	57.30	53.60	59.42	83.24	86.64

Source: • Engineering Construction Branch, City of Edmonton

Note: • Capital grants are funds provided by the Alberta Government to the City for specific (primarily new) capital construction projects.

Table E.10 Annual Expenditures on Transport Infrastructure by the City of Edmonton - by Function
(in millions of constant 1971 dollars)

Fiscal Year	70-71	71-72	72-73	73-74	74-75	75-76	76-77	77-78	78-79	79-80
Capital Construction	13.38	15.76	12.59	10.77	18.78	22.24	15.22	14.97	18.27	15.96
Capital Grants	-	-	-	-	3.49	4.52	6.81	6.61	8.90	8.94
Operation & Maintenance	1.13	1.27	1.10	0.95	1.30	1.50	1.64	1.17	1.59	1.76
Administration	0.66	0.75	0.64	0.41	0.49	0.33	0.38	0.36	0.36	0.38
TOTAL	15.17	17.78	14.33	12.13	24.06	28.59	24.05	23.11	29.12	27.04

Sources: • Engineering Construction Branch, City of Edmonton
• Statistics Canada [20]

Note: • Capital grants are funds provided by the Alberta Government to the City for specific (primarily new) capital construction projects.

APPENDIX F
INTER-GOVERNMENT TRANSFER PAYMENTS
RELATING TO TRANSPORTATION

Table F. 1 Total Federal-Provincial-Local Inter-Government Transfer Payments Relating to Transportation and Infrastructure Development
(in millions of current dollars)

Fiscal Year	1971	1972	1973	1974	1975	1976	1977	1978	1979
Manitoba	13.41	15.13	16.87	19.70	31.96	39.37	41.64	66.20	61.02
Saskatchewan	15.70	14.30	15.68	17.68	25.74	36.75	35.75	38.12	31.43
Alberta	19.54	23.23	13.81	24.88	59.09	70.26	51.41	62.06	122.14
TOTAL	48.65	52.66	46.36	62.26	116.79	146.38	128.80	166.38	214.59

Sources: • Statistics Canada [27] [64]

Table F. 2 Total Federal-Provincial-Local Inter-Government Transfer Payments Relating to Transportation and Infrastructure Development
(in millions of constant 1971 dollars)

Fiscal Year	1971	1972	1973	1974	1975	1976	1977	1978	1979
Manitoba	13.41	13.59	13.36	11.81	18.53	19.92	20.34	29.74	24.41
Saskatchewan	15.70	13.70	12.10	10.06	12.23	17.79	15.42	14.18	11.09
Alberta	19.54	23.35	10.74	13.47	28.18	35.04	23.06	24.15	42.74
TOTAL	48.65	50.64	36.20	35.34	58.94	72.75	58.82	68.07	78.24

Sources: • Statistics Canada [20] [27] [64]

Table F. 3 Federal-to-Provincial Transfer Payments Relating to Transportation and Infrastructure Development
(in millions of current dollars)

Fiscal Year	1971	1972	1973	1974	1975	1976	1977	1978	1979
Manitoba	0.95	-	0.18	-	8.56	10.94	15.65	14.59	11.38
Saskatchewan	1.39	0.21	0.13	-	4.24	8.87	10.09	10.74	23.33
Alberta	1.40	-	0.12	0.53	7.78	11.65	31.66	25.63	31.21

Source: • Statistics Canada [27]

Note : • Transfer payments include all grants and subsidies.

Table F. 4 Federal-to-Provincial Transfer Payments Relating to Transportation and Infrastructure Development
(in millions of constant 1971 dollars)

Fiscal Year	1971	1972	1973	1974	1975	1976	1977	1978	1979
Manitoba	0.95	-	0.14	-	4.96	5.53	7.65	6.46	4.55
Saskatchewan	1.39	0.20	0.10	-	2.02	4.30	4.35	4.00	8.23
Alberta	1.40	-	0.09	0.29	3.71	5.81	14.20	9.97	10.92

Sources: • Statistics Canada [20] [27]

Note : • Transfer payments include all grants and subsidies.

Table F. 5 Provincial-to-Local Transfer Payments Relating to Transportation and Infrastructure Development
(in millions of current dollars)

Fiscal Year	1971	1972	1973	1974	1975	1976	1977	1978	1979
Manitoba	11.84	14.71	16.12	18.77	22.95	27.50	25.07	50.70	47.91
Saskatchewan	13.43	13.58	15.14	17.46	21.38	24.44	25.08	26.75	7.05
Alberta	17.79	22.51	12.88	23.44	50.48	57.28	17.35	35.03	89.17

Source: • Statistics Canada [64]

Table F. 6 Provincial-to-Local Transfer Payments Relating to Transportation and Infrastructure Development
(in millions of constant 1971 dollars)

Fiscal Year	1971	1972	1973	1974	1975	1976	1977	1978	1979
Manitoba	11.84	13.22	12.76	11.25	13.31	13.92	12.25	22.43	19.17
Saskatchewan	13.43	13.01	11.68	9.30	10.16	11.83	10.81	9.95	2.49
Alberta	17.79	22.62	10.02	12.69	24.07	28.57	7.79	16.63	31.20

Sources: • Statistics Canada [20] [64]

Table F. 7 Federal-to-Local Transfer Payments Relating to Transportation and Infrastructure Development
(in millions of current dollars)

Fiscal Year	1971	1972	1973	1974	1975	1976	1977	1978	1979
Manitoba	0.62	0.42	0.57	0.93	0.45	0.93	0.92	0.91	1.73
Saskatchewan	0.88	0.51	0.41	0.22	0.12	3.44	0.58	0.63	1.05
Alberta	0.35	0.72	0.81	0.91	0.83	1.33	2.40	1.40	1.76

Source: • Statistics Canada [26]

Table F. 8 Federal-to-Local Transfer Payments Relating to Transportation and Infrastructure Development
(in millions of constant 1971 dollars)

Fiscal Year	1971	1972	1973	1974	1975	1976	1977	1978	1979
Manitoba	0.62	0.38	0.45	0.56	0.26	0.47	0.45	0.40	1.69
Saskatchewan	0.88	0.49	0.32	1.22	0.06	1.67	0.25	0.23	0.37
Alberta	0.35	0.72	0.63	0.49	0.39	0.66	1.07	0.55	0.62

Sources: • Statistics Canada [20] [26]

APPENDIX G
UTILIZATION AND ECONOMIC INDICATORS

Table G.1 Provincial Population Estimates

(in millions)

Fiscal Year	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980
Manitoba	0.989	0.990	0.996	1.006	1.013	1.021	1.029	1.033	1.031	1.029
Saskatchewan	0.924	0.914	0.904	0.900	0.907	0.922	0.937	0.948	0.959	0.970
Alberta	1.634	1.657	1.689	1.723	1.778	1.837	1.896	1.953	2.024	2.083

Source: • Statistics Canada [68]

Note : • Annual figures are the averages of quarterly estimates.

Table G.2 Total Provincial Road Motor Vehicle Registrations

(in millions of registrations)

Fiscal Year	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980
Manitoba	0.419	0.428	0.472	0.509	0.536	0.569	0.603	0.628	0.646	0.656
Saskatchewan	0.465	0.496	0.524	0.569	0.613	0.653	0.654	0.723	0.683	0.684
Alberta	0.813	0.864	0.934	1.035	1.073	1.168	1.275	1.413	1.530	1.659

Source: • Statistics Canada [71]

Note: • Figures include all private and public vehicles.

Table G.3 Estimated Total Annual Distance Travelled by For-hireCarriers - by Province of Domicile

(in millions of kilometers)

Fiscal Year	1975	1976	1977	1978	1979
Manitoba	170.6	149.8	148.8	167.9	169.9
Saskatchewan	36.6	57.2	74.7	79.1	86.1
Alberta	279.8	375.1	394.4	445.6	469.0

Source: • Statistics Canada [59]

Note: • Figures shown are distances effected by common and contract carriers by province of domicile; hence, they are not necessarily actual distances travelled within each of these provinces.

Table G.4 Estimated Total In-bound Tonnage of Freight Carried by For-hire Carriers

(in millions of tonnes)

Fiscal Year	1973	1974	1975	1976	1977	1978	1979	1980
Manitoba	2.46	2.80	2.98	3.58	3.25	3.35	4.14	4.38
Saskatchewan	3.38	3.45	3.67	4.14	4.03	4.67	4.81	4.96
Alberta	8.14	8.17	10.24	11.59	11.98	13.27	19.19	18.30

Source: • Statistics Canada [31]

Table G.5 Estimated Total Out-bound Tonnage of Freight Carried by For-hire Carriers

(in millions of tonnes)

Fiscal Year	1973	1974	1975	1976	1977	1978	1979	1980
Manitoba	2.30	2.83	3.07	3.58	3.29	3.21	4.15	4.70
Saskatchewan	3.30	3.19	3.33	3.24	3.87	4.67	4.24	4.25
Alberta	8.80	8.56	10.22	12.49	11.55	13.46	19.71	18.63

Source: • Statistics Canada [31]

Table G.6 Gross General Expenditures by Various Levels of Government

(in billions of current dollars)

Fiscal Year	70-71	71-72	72-73	73-74	74-75	75-76	76-77	77-78	78-79	79-80
Government of Canada	15.73	18.22	20.91	24.28	30.89	36.84	41.21	45.96	50.59	57.18
Government of Manitoba	0.63	0.71	0.80	0.95	1.15	1.41	1.62	1.91	1.85	N/A
Government of Saskatchewan	0.56	0.62	0.70	0.80	1.08	1.32	1.58	1.82	1.95	N/A
Government of Alberta	1.23	1.42	1.48	1.74	2.36	3.00	3.72	4.15	4.81	N/A
Manitoba Municipal Governments	0.34	0.40	0.43	0.45	0.57	0.70	0.81	0.84	0.92	N/A
Saskatchewan Municipal Governments	0.31	0.38	0.41	0.42	0.52	0.64	0.76	0.81	0.94	N/A
Alberta Municipal Governments	0.72	0.86	0.91	1.02	1.31	1.69	1.96	2.29	2.68	N/A

Sources: • Statistics Canada [27] [50] [64]

Table G.7 Gross General Expenditures by Various Levels of Government

(in billions of constant 1971 dollars)

Fiscal Year	70-71	71-72	72-73	73-74	74-75	75-76	76-77	77-78	78-79	79-80
Government of Canada	15.73	17.00	17.96	17.97	19.80	20.85	21.28	21.92	22.26	22.26
Government of Manitoba	0.63	0.66	0.69	0.70	0.74	0.80	0.84	0.91	0.81	N/A
Government of Saskatchewan	0.56	0.58	0.60	0.59	0.69	0.75	0.82	0.87	0.86	N/A
Government of Alberta	1.23	1.32	1.27	1.29	1.51	1.70	1.92	1.98	2.12	N/A
Manitoba Municipal Governments	0.34	0.37	0.37	0.33	0.37	0.40	0.42	0.40	0.40	N/A
Saskatchewan Municipal Governments	0.31	0.35	0.35	0.31	0.33	0.36	0.39	0.39	0.41	N/A
Alberta Municipal Governments	0.72	0.80	0.78	0.75	0.84	0.96	1.01	1.09	1.18	N/A

Sources: • Statistics Canada [27] [50] [64] [77]

Table G.8 Total Private and Public Investments in Capital Construction - by Province
(in billions of current dollars)

Fiscal Year	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980
Manitoba	0.58	0.61	0.75	0.81	0.86	1.02	1.15	1.27	1.16	1.06
Saskatchewan	0.39	0.43	0.54	0.71	0.88	1.16	1.32	1.39	1.70	1.84
Alberta	1.48	1.65	1.92	2.35	3.33	4.50	5.51	6.58	8.16	10.13

Source: • Statistics Canada [64]

Table G.9 Total Private and Public Investments in Capital Construction - by Province
(in billions of constant 1971 dollars)

Fiscal Year	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980
Manitoba	0.58	0.55	0.59	0.49	0.50	0.52	0.56	0.56	0.46	0.38
Saskatchewan	0.39	0.41	0.42	0.40	0.42	0.56	0.57	0.52	0.60	0.63
Alberta	1.48	1.66	1.49	1.27	1.59	2.24	2.47	2.56	2.86	3.16

Sources: • Statistics Canada [20] [64]

REGRESSION ANALYSIS

FORWARD SELECTION PROCEDURE FOR DEPENDENT VARIABLE Y

STEP	VARIABLE ENTERED	R SQUARE	C(P)	DF	SUM OF SQUARES	MEAN SQUARE	F	PROB>F
STEP 1	VARIABLE X7 ENTERED	0.91251338	1.33630570					
	REGRESSION	1	14234.68747975	14234.68747975	135.59	0.0001		
	ERROR	13	1364.74129358	104.98009951				
	TOTAL	14	15599.42877333					
	B VALUE	STD ERROR	TYPE II SS	F	PROB>F			
	INTERCEPT	42.42306466						
	X7	34.52760625	2.96514538	14234.68747975	135.59	0.0001		
STEP 2	VARIABLE X1 ENTERED	0.92080947	2.16649076					
	REGRESSION	2	14364.10181092	7182.05090546	69.77	0.0001		
	ERROR	12	1235.32696242	102.94391353				
	TOTAL	14	15599.42877333					
	B VALUE	STD ERROR	TYPE II SS	F	PROB>F			
	INTERCEPT	17.04988104						
	X1	33.98671524	30.31226185	129.41433116	1.26	0.2841		
	X7	18.27324892	14.79139461	157.11366805	1.53	0.2403		
STEP 3	VARIABLE X3 ENTERED	0.92977858	2.90177605					
	REGRESSION	3	14504.01471784	4834.67157261	48.55	0.0001		
	ERROR	11	1095.41405550	99.58309595				
	TOTAL	14	15599.42877333					
	B VALUE	STD ERROR	TYPE II SS	F	PROB>F			
	INTERCEPT	6.22369375						
	X1	52.23632832	33.55418582	241.34455170	2.42	0.1478		
	X3	-0.08297541	0.07000247	139.91290692	1.40	0.2609		
	X7	22.23691902	14.92731520	220.98940176	2.22	0.1644		
STEP 4	VARIABLE X6 ENTERED	0.93597726	4.02771345					
	REGRESSION	4	14600.71054814	3650.17763703	36.55	0.0001		
	ERROR	10	998.71822519	99.87182252				
	TOTAL	14	15599.42877333					
	B VALUE	STD ERROR	TYPE II SS	F	PROB>F			
	INTERCEPT	22.38351596						
	X1	70.00122694	38.14583866	336.32561446	3.37	0.0964		
	X3	-0.07637037	0.07042452	117.44781301	1.18	0.3036		
	X6	-57.63248254	58.57131054	96.69583030	0.97	0.3483		
	X7	45.30945173	27.80822567	265.13925449	2.65	0.1343		

NO OTHER VARIABLES MET THE 0.5000 SIGNIFICANCE LEVEL FOR ENTRY INTO THE MODEL.

REGRESSION ANALYSIS

FORWARD SELECTION PROCEDURE FOR DEPENDENT VARIABLE MY

STEP	VARIABLE ENTERED	R SQUARE	C(P)	DF	SUM OF SQUARES	MEAN SQUARE	F	PROB>F
STEP 1	VARIABLE MX1 ENTERED	0.92243535	.					
	REGRESSION			1	159.35705326	159.35705326	35.68	0.0094
	ERROR			3	13.39982674	4.46660891		
	TOTAL			4	172.75688000			
	B VALUE				STD ERROR	TYPE II SS	F	PROB>F
	INTERCEPT	-722.81566861						
	MX1	760.95930233			127.39862755	159.35705326	35.68	0.0094
STEP 2	VARIABLE MX3 ENTERED	0.99485593	.					
	REGRESSION			2	171.86820573	85.93410286	193.40	0.0051
	ERROR			2	0.88867427	0.44433714		
	TOTAL			4	172.75688000			
	B VALUE				STD ERROR	TYPE II SS	F	PROB>F
	INTERCEPT	-755.32730944						
	MX1	767.56514050			40.20132998	161.98032050	364.54	0.0027
	MX3	0.15946725			0.03005240	12.51115247	28.16	0.0337
STEP 3	VARIABLE MX6 ENTERED	0.99955076	.					
	REGRESSION			3	172.67927008	57.55975669	741.65	0.0270
	ERROR			1	0.07760992	0.07760992		
	TOTAL			4	172.75688000			
	B VALUE				STD ERROR	TYPE II SS	F	PROB>F
	INTERCEPT	-671.72877789						
	MX1	673.53431683			33.59086121	31.20286235	402.05	0.0317
	MX3	0.16486581			0.01267030	13.14028403	169.31	0.0488
	MX6	14.57237432			4.50776525	0.81106435	10.45	0.1910
STEP 4	VARIABLE MX7 ENTERED	1.00000000	.					
	REGRESSION			4	172.75688000	43.18922000	999999.99	0.0001
	ERROR			0	0.00000000	0.00000000		
	TOTAL			4	172.75688000			
	B VALUE				STD ERROR	TYPE II SS	F	PROB>F
	INTERCEPT	-622.45879731						
	MX1	624.76063153			0	8.63737478	999999.99	0.0001
	MX3	0.15138273			0	5.19547309	999999.99	0.0001
	MX6	23.85067481			0	0.41490549	999999.99	0.0001
	MX7	-9.01823275			0	0.07760992	999999.99	0.0001

NO OTHER VARIABLES MET THE 0.5000 SIGNIFICANCE LEVEL FOR ENTRY INTO THE MODEL.

REGRESSION ANALYSIS

FORWARD SELECTION PROCEDURE FOR DEPENDENT VARIABLE SY

STEP 1 VARIABLE SX7 ENTERED

R SQUARE = 0.85796259 C(P) = .

	DF	SUM OF SQUARES	MEAN SQUARE	F	PROB>F
REGRESSION	1	76.35753789	76.35753789	18.12	0.0238
ERROR	3	12.64114211	4.21371404		
TOTAL	4	88.99868000			
B VALUE		STD ERROR	TYPE II SS	F	PROB>F
INTERCEPT	28.43347336				
SX7	62.54405738	14.69239592	76.35753789	18.12	0.0238

STEP 2 VARIABLE SX6 ENTERED

R SQUARE = 0.93489845 C(P) = .

	DF	SUM OF SQUARES	MEAN SQUARE	F	PROB>F
REGRESSION	2	83.20472811	41.60236405	14.36	0.0651
ERROR	2	5.79395189	2.89697595		
TOTAL	4	88.99868000			
B VALUE		STD ERROR	TYPE II SS	F	PROB>F
INTERCEPT	37.71506392				
SX6	-23.84216973	15.50822250	6.84719022	2.36	0.2640
SX7	80.79211146	17.00870164	65.36427971	22.56	0.0416

STEP 3 VARIABLE SX5 ENTERED

R SQUARE = 0.99920369 C(P) = .

	DF	SUM OF SQUARES	MEAN SQUARE	F	PROB>F
REGRESSION	3	88.92780963	29.64260321	418.27	0.0359
ERROR	1	0.07087037	0.07087037		
TOTAL	4	88.99868000			
B VALUE		STD ERROR	TYPE II SS	F	PROB>F
INTERCEPT	92.28180320				
SX5	31.21369968	3.47346253	5.72308153	80.75	0.0706
SX6	-346.21124259	35.95516335	6.57089419	92.72	0.0659
SX7	234.13810979	17.27047601	13.02567606	183.80	0.0469

STEP 4 VARIABLE SX1 ENTERED

R SQUARE = 1.00000000 C(P) = .

	DF	SUM OF SQUARES	MEAN SQUARE	F	PROB>F
REGRESSION	4	88.99868000	22.24967000	999999.99	0.0001
ERROR	0	0.00000000	0.00000000		
TOTAL	4	88.99868000			
B VALUE		STD ERROR	TYPE II SS	F	PROB>F
INTERCEPT	7.84192552				
SX1	90.77202544	0	0.07087037	999999.99	0.0001
SX5	20.58764759	0	0.24035038	999999.99	0.0001
SX6	-257.59400544	0	0.51417982	999999.99	0.0001
SX7	177.97820163	0	0.65028206	999999.99	0.0001

NO OTHER VARIABLES MET THE 0.000 SIGNIFICANCE LEVEL FOR ENTRY INTO THE MODEL.

REGRESSION ANALYSIS

FORWARD SELECTION PROCEDURE FOR DEPENDENT VARIABLE AY

STEP 1 VARIABLE AX5 ENTERED

R SQUARE = 0.21887520 C(P) = .

	DF	SUM OF SQUARES	MEAN SQUARE	F	PROB>F
REGRESSION	1	202.32657519	202.32657519	0.84	0.4268
ERROR	3	722.06582481	240.68860827		
TOTAL	4	924.39240000			
B VALUE		STD ERROR	TYPE II SS	F	PROB>F
INTERCEPT	99.32080901				
AX5	1.93305584	2.10836453	202.32657519	0.84	0.4268

STEP 2 VARIABLE AX4 ENTERED

R SQUARE = 0.76588361 C(P) = .

	DF	SUM OF SQUARES	MEAN SQUARE	F	PROB>F
REGRESSION	2	707.97698438	353.98849219	3.27	0.2341
ERROR	2	216.41541562	108.20770781		
TOTAL	4	924.39240000			
B VALUE		STD ERROR	TYPE II SS	F	PROB>F
INTERCEPT	113.38779544				
AX4	-24.54012467	11.35221694	505.65040919	4.67	0.1632
AX5	25.00793541	10.76760000	583.68166013	5.39	0.1459

STEP 3 VARIABLE AX7 ENTERED

R SQUARE = 0.90450274 C(P) = .

	DF	SUM OF SQUARES	MEAN SQUARE	F	PROB>F
REGRESSION	3	836.11545533	278.70515178	3.16	0.3871
ERROR	1	88.27694467	88.27694467		
TOTAL	4	924.39240000			
B VALUE		STD ERROR	TYPE II SS	F	PROB>F
INTERCEPT	96.01321714				
AX4	-28.22141452	10.69915462	614.19449773	6.96	0.2307
AX5	26.41239294	9.79514707	641.86082602	7.27	0.2261
AX7	20.14755960	16.72269724	128.13847095	1.45	0.4410

STEP 4 VARIABLE AX2 ENTERED

R SQUARE = 1.00000000 C(P) = .

	DF	SUM OF SQUARES	MEAN SQUARE	F	PROB>F
REGRESSION	4	924.39240000	231.09810000	999999.99	0.0001
ERROR	0	0.00000000	0.00000000		
TOTAL	4	924.39240000			
B VALUE		STD ERROR	TYPE II SS	F	PROB>F
INTERCEPT	144.11174453				
AX2	-103.14351005	0	88.27694467	999999.99	0.0001
AX4	-20.67734702	0	220.22390666	999999.99	0.0001
AX5	21.57361517	0	344.22242081	999999.99	0.0001
AX7	42.75530676	0	204.07195321	999999.99	0.0001

NO OTHER VARIABLES MET THE 0.5000 SIGNIFICANCE LEVEL FOR ENTRY INTO THE MODEL.

APPENDIX H
CASE STUDIES

H.1 HIGHWAY STRENGTHENING PROGRAM

The 5-year Highway Strengthening Program was initiated in the summer of 1974 with the objective of effecting a more efficient freight-transport system through uniformity and consistency in weight and dimension regulations throughout and in adjacent to the Prairie provinces.

Under the terms of agreement outlined in the memorandums of understanding between the federal and the three Prairie governments respecting the Highway Strengthening Program [55] [56] [57],

- the federal government agreed to make five successive annual payments of \$6.43 million to Manitoba, \$4.24 million to Saskatchewan, and \$5.03 million to Alberta. The first payment would start on October 1, 1974 and subsequent instalments would be payable quarterly and include indexed adjustments based on asphaltic pavement costs. The contributions were to be expended on strengthening a designated network of primary highways (Tables H.1.1 to H.1.3 inclusive);
- the provincial governments agreed to increase the allowable axle and gross vehicle weights on designated portions of the primary highway system. The new regulations would be in effect on August 1, 1974 and would remain for a period of not less than five years.

Table H.1.4 presents annual federal contributions (which included index-adjusted payments) to the provinces under the Program. Allocations by fiscal years varied due to difference in accounting and reporting procedures used by the provincial governments. The original package, without indexed adjustments, would cost \$78.5 million. However, indexed adjustments escalated the final subsidies to \$138.2 million.

As far as pre-implementation evaluation is concerned, no Transport Canada-commissioned studies could be documented¹. Some Transport Canada officials have privately conceded that the Program was more a result of

¹ The only available document was an internal report prepared by the Manitoba Department of Highways [24] which estimated the incremental costs associated with increased axle and gross vehicle weights on Manitoba highways.

political concessions¹ than engineering and/or economic justifications².

Although the memorandums have referred to "the expected benefits to be gained", a Transport Canada internal memo, dated April 30, 1976, stated that "... there has been little or no tangible evidence of general economic advantages resulting from these agreements, although some benefits probably have been experienced by the trucking industry." A Manitoba Highways official indicated there were positive benefits but could not produce any substantial evidence to that effect. In early 1974, before signing the agreements, Saskatchewan predicted the major beneficiaries would be the distributors of petroleum products but two-thirds of their deliveries were off the designated primary highway system. In a letter to the Canadian Automobile Association, a Transport Canada official wrote: "Another benefit ... is that the Program will permit up to 15% fewer trucks to carry the same volume of freight [and hence reduce the exposure rate of trucks in accidents]." Two studies, "Alberta Highway Benefit Study" and "Truck Transportation in Saskatchewan", reportedly investigated the potential and actual benefits of the Program. However, there were no indications that the federal government ever had any access to these two studies.

The fact that the federal government did not negotiate an extension for this Program³ upon expiry in the summer of 1979 might suggest one of the following:

- The federal government felt that the objective of the Program had been fulfilled and that the highway network had been sufficiently upgraded during the initial five-year period, therefore an extension would be unnecessary. At best, however, this is a rather optimistic and unlikely conclusion. Private communications with Alberta Transportation officials revealed that additional fundings (through an extension) would be required to complete the work outlined in the memorandums.

¹ Although federal elections took place in July, 1974, any relationships between the Highway Strengthening Program and the elections would be highly speculative.

² An illustrative example is the agreed maximum allowable gross vehicle weight (at 110,000 lb.) which could not accommodate several normal axle configurations [55], although they were in line with the new axle weight restrictions. In view of the facts that the purpose of this Program was to achieve "harmonization of these regulations" with adjacent jurisdictions and that Ontario, in 1974, already had higher allowable weights than those agreed-upon in the memorandums, it would seem that the 110,000-lb. limit was ill-conceived.

³ Clause 8.2 of the memorandums stated: "It is the Federal Government's policy to ... enter into negotiations for the second phase of this program at an early date."

- The federal government felt the Program had not materialized any substantial benefit to warrant further investments. As indicated, the federal government was unable to determine any positive impacts resulting from the Program. Further, the Program was plagued with mismanagement; due to a lack of financial accounting and reporting requirements, the federal government was uncertain whether the contributions had been fully expended, nor whether the funds had been expended on highways designated in the memorandums. Table H.1.5 shows the provincial expenditures under the Program, as reported by Manitoba and Alberta¹. Transport Canada was unable to verify these figures, but an official has stated that only Alberta had spent the entire federal subsidies on designated highways within the 5-year period².

In summary, the Program did not involve any systematic and rational pre-implementation evaluation studies and, during the life of the Program, it suffered from a lack of stringent control over provincial expenditures. Although the federal contribution amounted to \$138.2 million, i.e. an increase of more than 76% from the original estimate, it did not result in any tangible benefits to the general economy. Ironically, the Highway Strengthening Program (because of its dubitable achievement) probably led to a revamped federal approach, at least on the part₃ of Transport Canada, to participating in future, joint development programs.

¹ Actual expenditures were unavailable from Saskatchewan, although SHT claimed to have spent at least as much as it had received from the federal government.

² Although the Program was intended as a 50/50 cost-sharing venture, the memorandums did not specify the provincial share, and there was no evidence that shows matching efforts by either Manitoba or Saskatchewan.

³ The current Federal-Provincial Atlantic Provinces Strengthening/Improvement Program, for example, entails much stringent financial control and requires engineering and economic evaluation before commencement and after termination of the Program.

Table H.1.1 Defined Highway Systems in Manitoba

- Provincial Trunk Highway 1 (also known as the Trans Canada Highway) from the Manitoba/Ontario border to the east junction with Provincial Trunk Highway 100 and from the west junction with Provincial Trunk Highway 100 to the Manitoba/Saskatchewan border.
- Provincial Trunk Highway 1A from its junction with Eighteenth Street in the City of Brandon to its junction with Provincial Trunk Highways 1 and 10.
- Provincial Trunk Highway 4 (also known as the Yellowhead Highway) from its junction with Provincial Trunk Highway 1 to the Manitoba/Saskatchewan border.
- Provincial Trunk Highway 5 from its junction with Provincial Trunk Highway 4 to the north junction of Provincial Trunk Highway 10.
- Provincial Trunk Highway 8 from its junction with Provincial Trunk Highway 101 to its junction with Provincial Road 229.
- Provincial Trunk Highway 9 from its junction with Provincial Trunk Highway 101 to the south junction of Provincial Trunk Highway 9A.
- Provincial Trunk Highway 9A from its junction with Provincial Trunk Highway 9 to the east junction of Manitoba Avenue in the Town of Selkirk.
- Provincial Trunk Highway 10 from the Manitoba/US border to its junction with Victoria Avenue in the City of Brandon, and from the east junction of Provincial Trunk Highway 1 to the south junction of Provincial Trunk Highway 4, and from the north junction of Provincial Trunk Highway 5 to the Manitoba/Saskatchewan boundary.
- Provincial Trunk Highway 12 from the Manitoba/US border to its junction with Provincial Trunk Highway 1.
- Provincial Trunk Highway 29 from the Manitoba/US border to its junction with Provincial Trunk Highway 75.
- Provincial Trunk Highway 44 from Provincial Trunk Highway 59 to the north junction of Provincial Trunk Highway 11.
- Provincial Trunk Highway 59 from Provincial Trunk Highway 101 to the north junction of Provincial Trunk Highway 12.
- Provincial Trunk Highway 75 from the Manitoba/US border to Provincial Trunk Highway 100.
- Provincial Trunk Highway 100 from the east junction with Provincial Trunk Highway 1 to the west junction with Provincial Trunk Highway 1.
- Provincial Trunk Highway 101 from the east junction of Provincial Trunk Highway 1 to the west junction of Provincial Trunk Highway 1.

Source: [56]

Table H.1.2 Defined Highway Systems in Saskatchewan

- No. 1 highway from the Saskatchewan/Manitoba border to the Saskatchewan/Alberta border.
- No. 3 highway from Melfort to Prince Albert.
- No. 5 highway from Saskatoon to the Saskatchewan/Alberta border.
- No. 6 highway from its south junction with No. 39 to Melfort.
- No. 7 highway from Saskatoon to the Saskatchewan/Alberta border.
- No. 9 highway from the international border to its junction with No. 22.
- No. 10 highway from Yorkton to its junction with No. 1 and connecting links.
- No. 11 highway from Regina to Prince Albert.
- No. 14 highway from the Saskatchewan/Manitoba border to Saskatoon.
- No. 22 highway from its junction with No. 9 to the potash mine east of Esterhazy.
- No. 39 highway from the international border to its south junction with No. 6.
- No. 47 highway from the international border to its junction with No. 39.
- No. 80 highway from its junction with No. 22 to the potash mine east of Esterhazy.

Source: [57]

Table H.1.3 Defined Highway System in Alberta

- Provincial Highway 1 (also known as the Trans Canada Highway) from the Alberta/Saskatchewan border to the entrance of the Banff National Park.
- Provincial Highway 16 (also known as the Yellowhead Highway) from the Alberta/Saskatchewan border to the entrance of the Jasper National Park.
- Provincial Highway 3 from its junction with Provincial Highway 1 at Medicine Hat to the Alberta/British Columbia border.
- Provincial Highway 4 from the Alberta/Montana (U.S.A.) boundary at Coutts to Lethbridge.
- Provincial Highway 2 from Fort MacLeod to Edmonton, from its intersection with Provincial Highway 34, north of the Little Smoky River to its intersection with Provincial Highway 35 north of Grimshaw and from north of Grande Prairie to the Alberta/British Columbia border.
- Provincial Highway 43 from its intersection with Provincial Highway 16 west of Edmonton to its junction with Provincial Highway 34 at Valleyview.
- Provincial Highway 34 between its junctions with Provincial Highway 2 north of the Little Smoky River and north of Grande Prairie.
- Provincial Highway 35 from its junction with Provincial Highway 2 north of Grimshaw to the Alberta/Northwest Territories border.
- Provincial Highway 9 from the Alberta/Saskatchewan border to its junction with Provincial Highway 1 east of Calgary.

Source: [55]

Table H.1.4 Federal Contributions under the Federal-Provincial Highway
Strengthening Program - by Province
(in millions of current dollars)

Fiscal Year	74-75	75-76	76-77	77-78	78-79	79-80	Provincial Total
Manitoba	8.87	10.80	12.09	13.89	14.53	-	60.18
Saskatchewan	4.24	5.94	7.80	9.37	7.67	5.55	40.57
Alberta	5.03	7.07	8.10	8.05	9.20	N/A	37.45
Annual Total	18.14	23.81	27.99	31.31	31.40	5.55	138.20

Sources: • Manitoba Dept. of Highways & Transportation [9]
• Saskatchewan Highways & Transportation [7]
• Alberta Transportation [4] [5]

Table H.1.5 Provincial Expenditures under the Federal-Provincial Highway Strengthening Program
(in millions of current dollars)

Fiscal Year	74-75	75-76	76-77	77-78	78-79	79-80	80-81	Provincial Total
Manitoba	1.21	8.52	14.67	15.21	17.74	13.74	10.48	81.57
Saskatchewan	Actual expenditures were not available							
Alberta	14.20	22.25	18.67	23.87	18.24	-	-	97.23

Sources: • Manitoba Dept. of Highways & Transportation [9]
• Contracts Engineering Branch, Alberta Transportation

H.2 GRANDE PRAIRIE - GRANDE CACHE CORRIDOR

Due to accelerated economic development in the western region of Alberta (Figure H.2.1), "it became apparent that the question of future [transport infrastructure] development strategies ... had resolved itself down into the definition of alternative locations for a North/South highway corridor" [32] in the Grande Prairie-Grande Cache area.

Figure H.2.2 shows the alternative highway corridors under consideration. The four routes represented only general locations, although many specific roadway alignments were available and used for evaluation.

Incorporated in the analysis were four potential impact elements:

- economic factor: this basically involved benefit-cost analysis on a province-wide scale, based on cost calculations and traffic flow data. It was supposed to provide "a provincial economic perspective on the consequences of road development in the study area".
- resource factor: this included considerations of resource development, effects on the forestry industry, and environmental impacts on resources in the area.
- regional factor: this put the proposed corridor in a more broad-based, regional context. The factor encompassed traffic, economic, social and environmental considerations relevant to ambient areas.
- recreation factor: due to the importance of the recreation industry in the area, this was regarded as an issue warranting closer examination. This factor consisted of both wilderness-oriented activities and tourist developments.

The findings are presented in Figure H.2.3. It is apparent that all four alternatives would have negative impacts on the economic and resource factors. These alternatives, however, were found to be beneficial to the regional as well as to the recreational aspects of the area.

Weightings, based on an identification of development priorities for the area, were applied to these findings. The Eastern Corridor, because of its highest overall positive rating, was selected as the most desirable alternative.

After the study was completed in 1978, several significant changes took place, and hence necessitated a re-evaluation of all these alternatives

in 1980. Because certain environmental information had never been brought to light during the initial study, the Eastern Corridor was dropped in favor of the East-Central Corridor. The delay in implementation, according to an AT official, was unnecessary and was a direct result of lack of cooperation from other provincial government agencies, an occurrence frequently associated with multi-departmental transport studies.

The technique used in the study was benefit-cost analysis, and the alternative routes were ranked by simple plus or minus method [32]. This was consistent with AT's departmental guidelines on evaluation (see Section II.3.5). This project, however, exemplified the lack of coordination between departments in the same government; it also demonstrated that one department had little appreciation of how the other departments carried out transport-investment evaluation. Bryan [12] indicates that this type of conflict would be counterproductive and lead to inefficiency in the decision-making process.

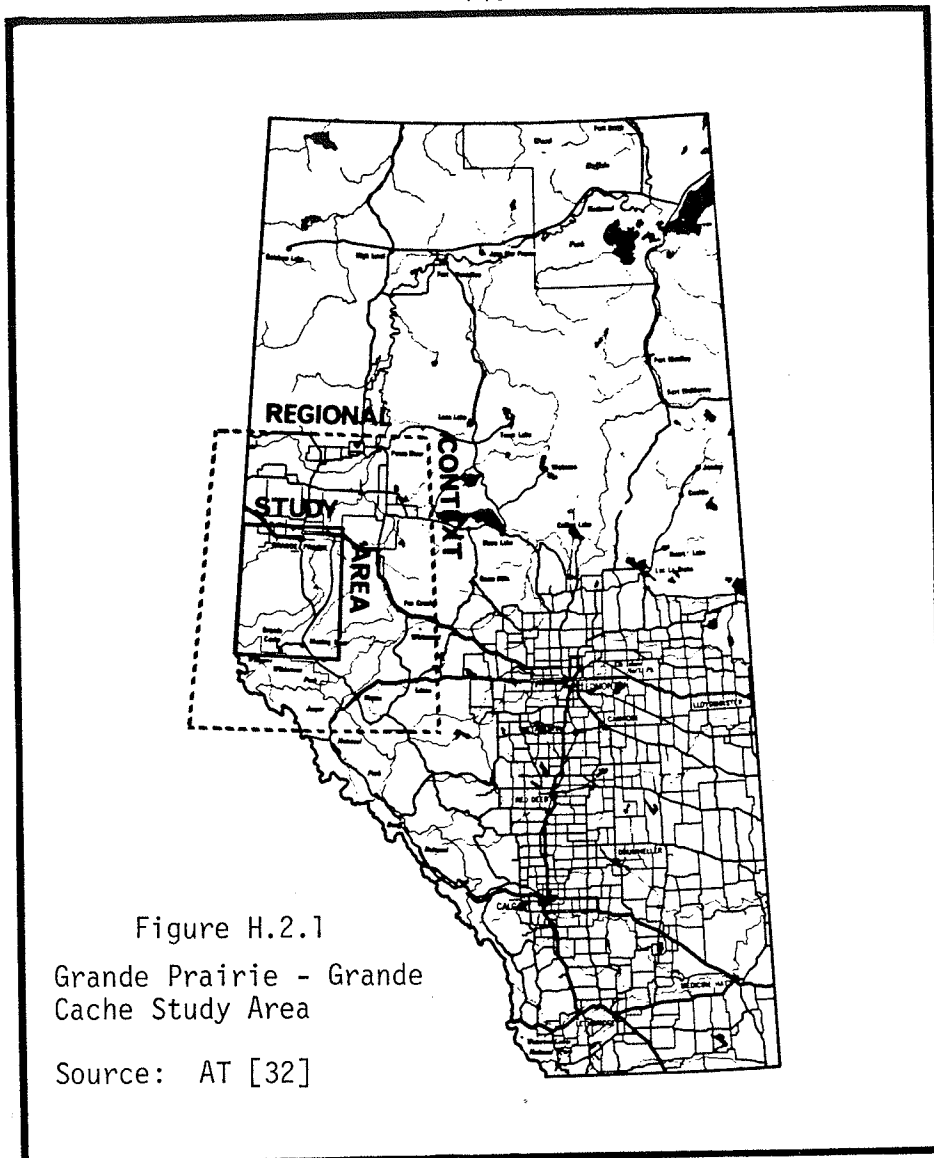


Figure H.2.1
Grande Prairie - Grande
Cache Study Area
Source: AT [32]

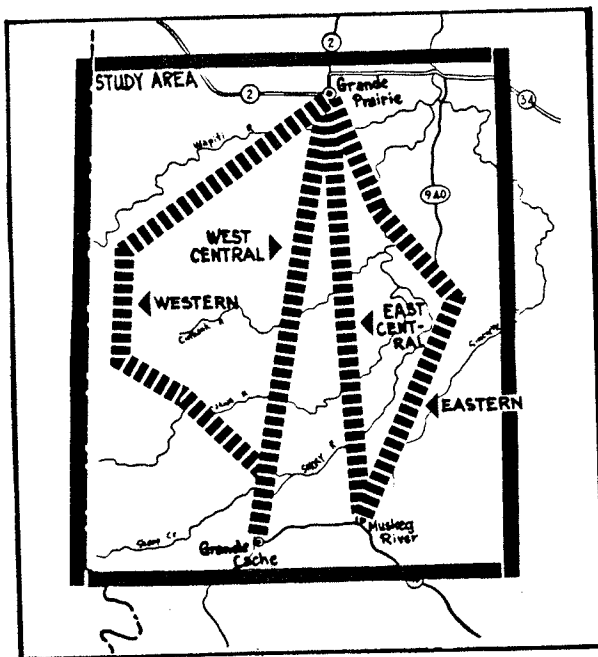


Figure H.2.2 Alternative Corridors
Source: AT [32]

	CORRIDORS			
	Eastern	East-Central	West-Central	Western
Economic Factor	-	-	-	-
Resource Factor	-	-	-	-
Regional Factor	+	+	+	+
Recreation Factor	+	/	/	+
Conclusion	+	+	-	/
Ranking	1	2	4	3

Figure H.2.3 Ranking of
Alternatives
Source: AT [32]

H.3 CITY OF WINNIPEG: KILDONAN CORRIDOR

The Kildonan Corridor was pre-selected as a top-priority project by the Council of the City of Winnipeg, on the basis of forecasted traffic growth in that area.

The evaluation study [61], undertaken by a private consulting firm, was limited to alternative selection. The alternatives investigated were:

- Small Bridge Concept;
- Springfield Road: Four-lane Divided;
- Springfield Road-Kildonan Corridor: One-way Pair;
- Inkster-Concordia Connection;
- Springfield Road-Bergen Cut-off Extension;
- Kildonan Corridor Alignment.

These alternatives are illustrated in Figure H.3.1.

Evaluation was conducted with the following criteria:

- capital cost;
- operational efficiency;
- environmental impact;
- community impact.

Capital cost estimates were prepared for comparative purposes only and did not include property acquisition costs, site preparation costs, and relocation costs. The environmental impact considered in the study was the potential noise level experienced by surrounding residential units.

The results of this evaluation are presented in Table H.3.1. Due to the distinct advantages of the Kildonan Corridor Alignment (K.C.A.) option over the other alternatives, the K.C.A. was selected for further planning/design analysis, and was finally recommended to the City Council for approval.

Because of the negative response from local residents and a high price-tag (estimated at approximately \$45 million in 1982 dollars), this project was shelved indefinitely by the City Council.

Evaluation conducted in this project was similar to the objective achievement evaluation method recommended in a report prepared for the City by the IBI Group in 1978 [80]. The report also outlined the three procedures within this evaluation framework: rating the performance of the alternatives, weighting the importance of the criteria, and conducting a sensitivity analysis respecting changes in weighting. However, the Kildonan Corridor Study only fulfilled one of these three requirements; there was no weighting of the above criteria and hence no sensitivity analysis. This inconsistency might be accounted for

by one or both of the following: (i) the Kildonan Corridor project did not warrant such an extensive evaluation approach, as proposed in the IBI report, and (ii) the IBI recommendations had not been adopted by the City and/or the consultants hired by the City. Based on the comprehensive nature of the recommendations, it is felt that the IBI approach was better suited to evaluating long-term transportation strategies.

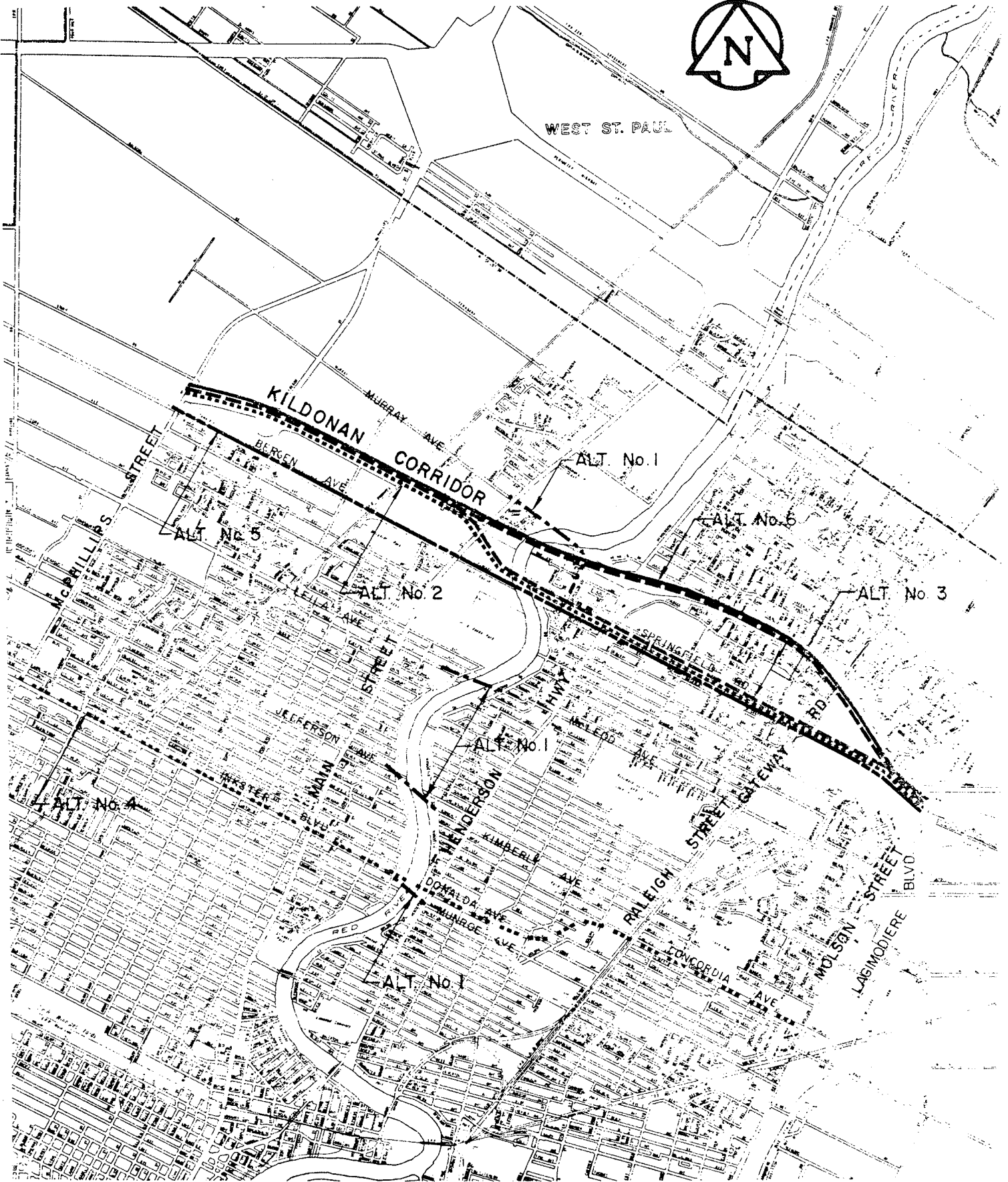


Figure H.3.1 Alternative Routes in the Kildonan Corridor Study

Source: COW [61]

	<u>Alternative 1</u> Small Bridges Concept	<u>Alternative 2</u> Springfield Road Four Lane Divided	<u>Alternative 3</u> Springfield Road - Kildonan Corridor One Way Pair	<u>Alternative 4 (1)</u> Inkster-Concordia Connection	<u>Alternative 5</u> Springfield Road- Bergen Cut-off Extension	<u>Alternative 6</u> Kildonan Corridor
Capital Cost	\$34,500,000	\$28,900,000	\$31,300,000	\$23,000,000	\$27,900,000	\$27,200,000
Operational Efficiency	Existing residential Street geometry and cross-section are sub-standard. Desirable river crossing locations for cross river trip demand.	R.O.W. too narrow for service road plus four lane divided arterial. Termination of service road at Henderson and Raleigh difficult without additional property acquisition.	Additional major inter-section on Main St. as a result of split one way pair. Difficult to sign Additional major intersection on Henderson Hwy.	Uncontrolled access to residential streets Preferred river crossing location with respect to cross river trip demand.	R.O.W. too narrow for frontage road plus four lane divided arterial. Termination of service road at Henderson and Raleigh difficult without additional property taken.	Controlled access route R.O.W. available for future inter-changes.
Noise Impact	Not calculated however estimated to be substantial on all routes	0 to 5 dBA 537 houses 5 to 10 dBA 294 houses 10 dBA plus 261 houses	0 to 5 dBA 955 houses 5 to 10 dBA 637 houses 10 dBA plus 296 houses	Not calculated however, estimated to be substantial on adjacent communities.	0 to 5 dBA 592 houses 5 to 10 dBA 316 houses 10 dBA plus 261 houses	0 to 5 dBA 529 houses 5 to 10 dBA 210 houses 10 dBA plus 103 houses
Opportunity For Mitigation	Narrow R.O.W.'s very limited opportunity	Narrow R.O.W. limited opportunity between Red River and Gateway Road	R.O.W. available however increased route length makes opportunity expensive.	No opportunity due to narrow R.O.W. and requirement to maintain access to adjacent property.	Narrow R.O.W. limited opportunity between Red River and Gateway Road	Right-of-way sufficient width good opportunity.
Residential Property Displacement	123 Houses	2 Houses	NIL	160 Houses	2 Houses	NIL
Community Impact	Through traffic on residential streets changing the nature of present community setting.	Decreased access to schools and recreation facilities, loss of Kildonan Golf Course to the community.	Similar to Alternative 2.	The loss of large number of residential dwellings would dramatically change the nature of the community.	Similar to Alternative 2.	Access between communities restricted to intersections plus some loss of privacy.

(1) From Main Street to Gateway Road only.

Table H.3.1 Summary of the Evaluation Analysis

Source: COW [61]

H.4 CITY OF EDMONTON: SOUTH CORRIDOR LIGHT RAIL TRANSIT

The Edmonton South Corridor Light Rail Transit (LRT) was selected by the Rapid Transit Extension Study as the most desirable alternative to service the University of Alberta areas and to communities in, or adjacent to, Strathcona, Millwoods and Kaskitayo. The proposed system would link the large residential areas on the south side to the CBD as well as to the major sports facilities in the northeast area.

The evaluation process, that eventually led to the adoption of the South Corridor LRT system, was based on a cost-effectiveness analysis. Criteria used in the analysis included:

- total transit capital costs;
- transit operating costs;
- transit travel time;
- community impacts.

The cost-effectiveness analysis considered operating cost savings and travel-time savings as the "benefits", and capital outlays for the LRT system as the "costs". A benefit-cost ratio was then developed for each of the alternatives.

The imputed value of impacts on community was obtained by "determining the cost of avoiding the negative impacts with an alternative alignment" [75]. For instance, the additional costs in constructing a tunnel (instead of an at-grade alignment) to reduce community disruption would be the "value" of a negative impact.

Intangible impacts of the LRT system, e.g. its effects on urban and regional land-use patterns, were not incorporated in the analysis. This probably led to several negative submissions to the Utilities and Engineering Committee public hearings [76]. However, the position of the Administration remained unchanged and the LRT system was implemented. The 22-km LRT route and the estimated costs are shown in Figure H.4.1 and Table H.4.1, respectively.

Subsequent to the LRT project, the City of Edmonton carried out an extensive assessment of its long-term transportation requirements. This exercise resulted in a series of documents known as the Transportation System Plan (TSP). With reference to the City's transit system, the TSP commented:

"... extreme advocate positions developed at both the political and technical levels, promoting either transit or the automobile, ... led to a major down-scaling of roadway-oriented plans, and investment of large financial resources in the development and marketing of transit. Unfortunately, these

investments did not result in either the hoped-for shift to transit or reduced automobile ownership and usage." [82]

In order to approach transportation management and investments in a system-oriented manner, four alternative strategies were developed and evaluated:

- default strategy: it presented a scenario whereby the City defaulted on "its responsibility to provide a transportation system consistent with or supportive of its overall goals".
- auto-oriented strategy: it was a strategy with heavy emphasis on automobile travel, while maintaining a "skeleton" transit service.
- transit-oriented strategy: this was the exact opposite of the auto-oriented strategy. It advocated maximization of public transit services and minimization of roadway investment within the inner city.
- balanced strategy: this strategy discouraged the use of private automobile in the CBD by providing upgraded transit services.

Specific objectives were identified, measured (quantitatively and qualitatively), weighted, and ranked [81] for each of the strategies (Figure H.4.2 and Tables H.4.2 and H.4.3). The balanced strategy had the highest weighted score, followed closely by the transit-oriented strategy (Table H.4.4). The balanced strategy, therefore, was adopted as the most desirable alternative for long-term transportation planning. Figure H.4.3 is an example of the recommended public transportation network, evolving from this strategy.

The TSP, admitted by the Administration, was in reality no more than a philosophical document. The goals and objectives of TSP would change over time and would be vulnerable to factors external to the transportation planning process, which, of course, are common to all other long-term transport planning studies.

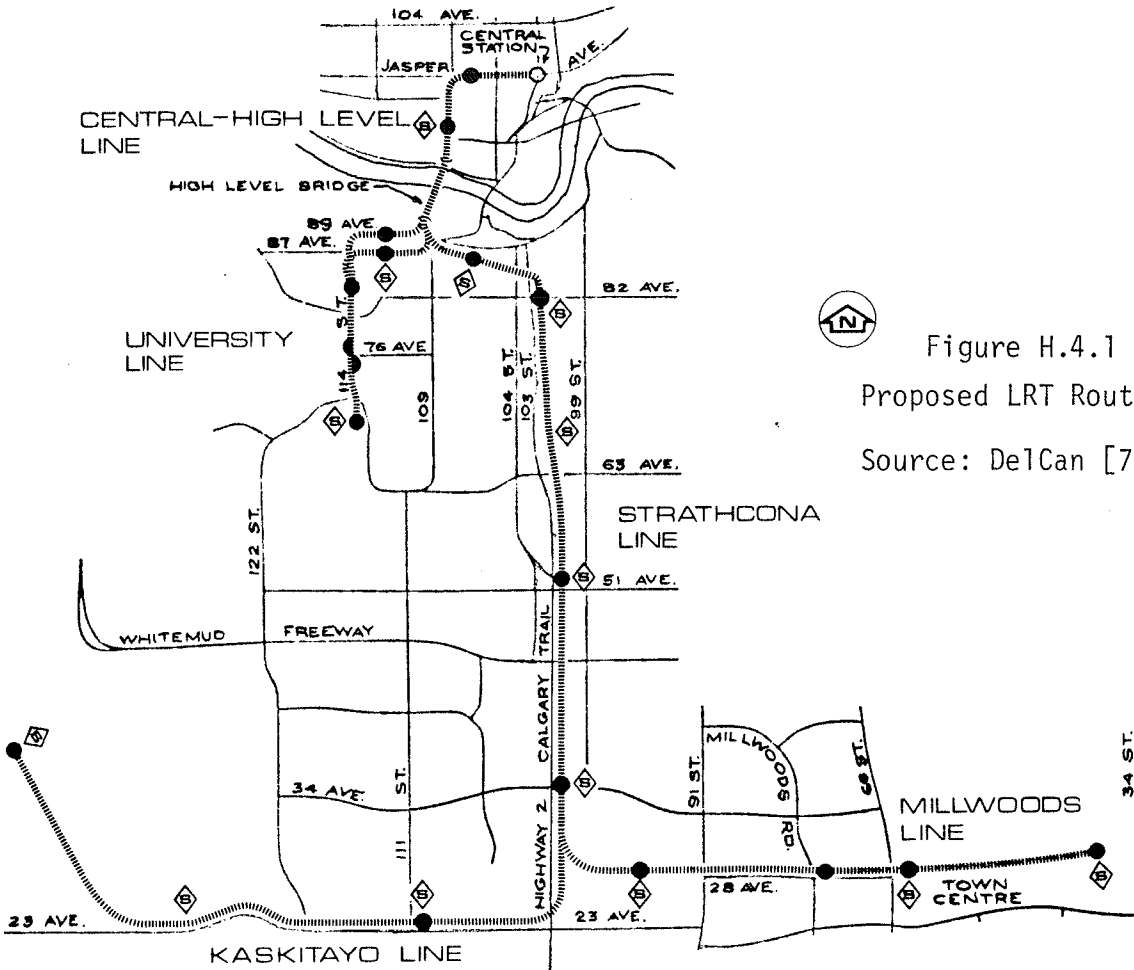


Figure H.4.1
Proposed LRT Routes
Source: De1Can [74]

Table H.4.1 Estimated Costs of the South Corridor LRT System

Source: De1Can [74]

1. Central-High Level Line	CP Rail Relocated	\$ 52,528,000
	CP Rail Remaining	\$ 62,694,000
2. University Line	89th Avenue, at-grade	\$ 22,973,000
	87th Avenue, underground	\$ 70,587,000
3. Strathcona Line	CP Rail Relocated	\$ 45,562,000
	CP Rail Remaining	\$ 53,613,000
4. Millwoods Line	Line only	\$ 46,372,000
	Yards and Shop Area	\$ 13,978,000
5. Kaskitayo Line	To Kaskitayo Station	\$ 12,981,000
Total Corridor Cost Range: Minimum		\$194,394,000
Maximum		\$260,225,000
Saving if CP Relocated		\$ 18,217,000
University Line at-grade/underground differential		\$ 47,614,000
Additional cost to extend Kaskitayo Line into Terwilligar Area		\$ 18,556,000

Notes:
 Cost expressed in terms 1979 dollars.
 Cost of LRT vehicles excluded.
 Strathcona Line costs based on local station at 107 Street.

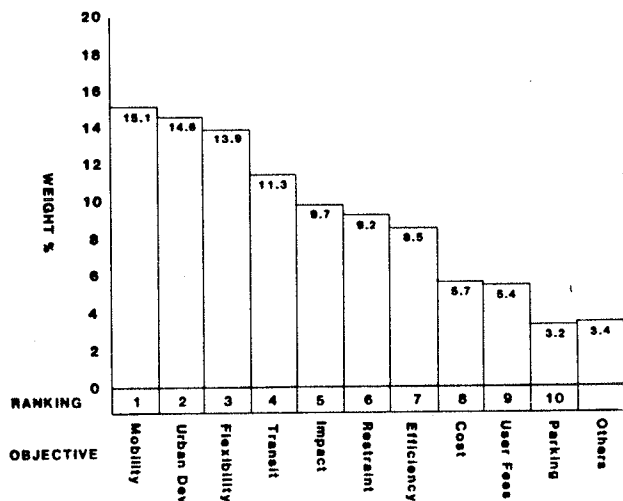


Figure H.4.2 Consensus Ranking and Weighting

Source: COE [82]

OBJECTIVE Measurement	ALTERNATIVE STRATEGY			
	DEFAULT	AUTO-ORIENTED	TRANSIT-ORIENTED	BALANCED
PARKING				
+Number of auto trips	115,588	118,015	114,478	110,327
USER FEES				
Qualitative: Parking fees	Market	Low	Market	High
Transit fares	Market	Market	Low	Low
COST				
Capital (\$1979 million) 1981 to 2001	1,208	1,452	1,111	1,295
Annual Operating (\$1979 million) 2001	81.09	87.14	92.11	97.88
EFFICIENCY				
Qualitative	Some	Least	More	Most
RESTRAINT				
+Transit modal split to downtown %	44.0	44.0	47.0	57.0
IMPACT				
Noise impact index	5617	5850	6384	5548
+AK pollutants emitted - tonnes	4.27	4.28	4.30	4.09
Daily energy requirement BTUx10 ⁶	43.80	45.14	42.43	41.74
TRANSIT				
Qualitative	Some	Least	Most	More
FLEXIBILITY				
+System transit modal split %	22.5	22.2	23.3	28.2
URBAN DEVELOPMENT				
Relative degree of GMP support	3	4	5.5	8
MOBILITY				
+Average transit travel time mins.	36.5	37.9	36.7	35.5
+Average auto travel time mins.	18.99	18.80	18.84	18.18
+Jobs within 30 mins. by transit %	23.1	20.8	23.4	22.8
+Jobs within 30 mins. by auto %	88.3	84.7	86.4	90.0

*Data refers to A.M. peak hour.

Table H.4.2 Performance Measurements of Alternative Strategies

Source: COE [82]

OBJECTIVE	ALTERNATIVE STRATEGIES			
	DEFAULT	AUTO-ORIENTED	TRANSIT-ORIENTED	BALANCED
PARKING	2	1	3	4
USER FEES	3	2	1	3
COST	1	3	1	4
EFFICIENCY	3	4	2	1
RESTRAINT	3	3	2	1
IMPACT	3	3	2	1
TRANSIT	3	4	1	2
FLEXIBILITY	3	4	2	1
URBAN DEVELOPMENT	4	3	2	1
MOBILITY	3	2	3	1

1 - Best Performance
4 - Worst Performance

Table H.4.3 Performance Ranking of Alternative Strategies

Source: COE [81]

OBJECTIVE	WEIGHT %	UNWEIGHTED SCORES OF ALTERNATIVE STRATEGIES			
		DEFAULT	AUTO-ORIENTED	TRANSIT-ORIENTED	BALANCED
PARKING	3.2	0.78	1.00	0.80	0.28
USER FEES	5.4	0.80	0.78	1.00	0.80
COST	5.7	1.00	0.80	1.00	0.28
EFFICIENCY	8.5	0.80	0.28	0.78	1.00
RESTRAINT	9.2	0.80	0.80	0.78	1.00
IMPACT	9.7	0.80	0.80	0.78	1.00
TRANSIT	11.3	0.80	0.28	1.00	0.78
FLEXIBILITY	13.9	0.80	0.28	0.78	1.00
URBAN DEVELOPMENT	14.8	0.28	0.80	0.78	1.00
MOBILITY	18.1	0.80	0.78	0.80	1.00
% TOTAL SCORE		48.31	48.81	73.48	84.40

NOTES: Performance Ranking 1 2 3 4
Unweighted Score 1.00 0.78 0.80 0.28

TOTAL SCORE for each alternative strategy = sum of (WEIGHT x UNWEIGHTED SCORE) for all objectives.
Maximum possible total score = 88.8%
due to exclusion of OTHER objectives

Table H.4.4 Comparison of Alternative Strategies

Source: COE [81]

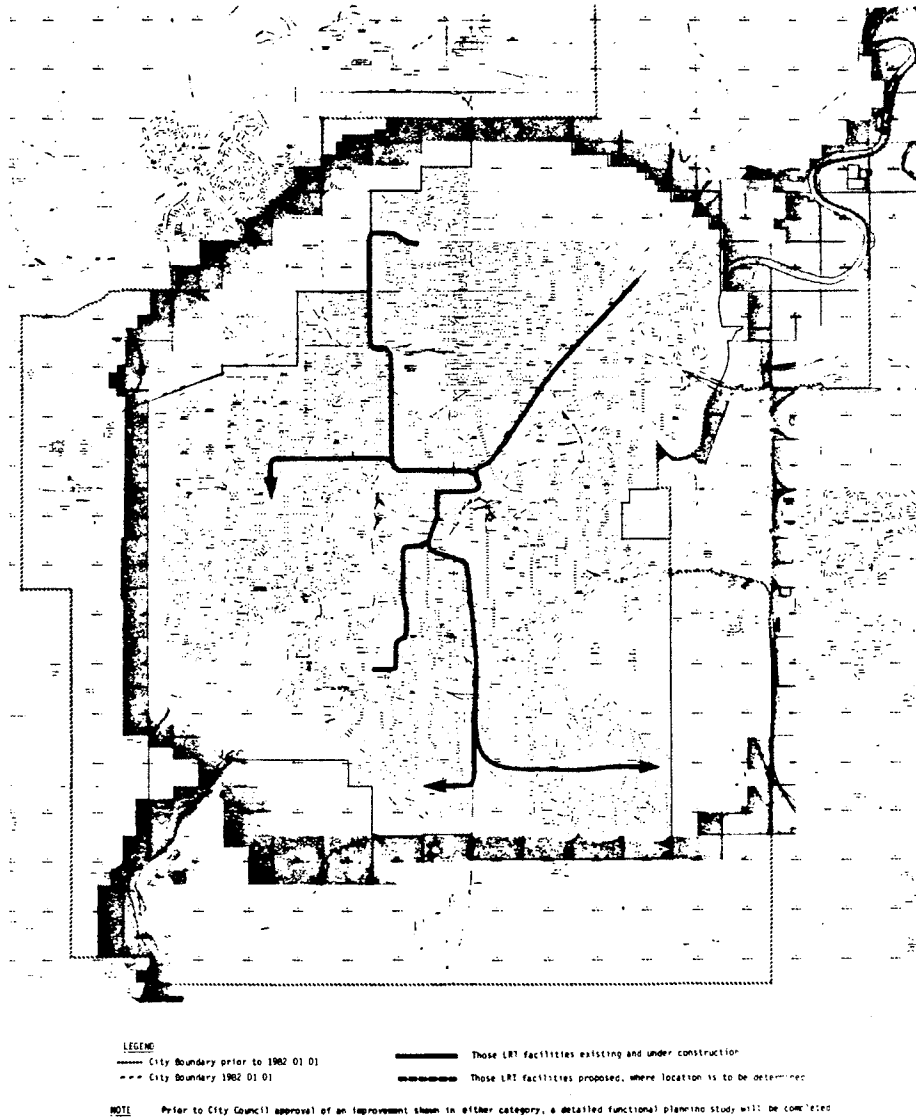


Figure H.4.3 Recommended Strategy Transit System

Source: COE [82]

REFERENCES AND BIBLIOGRAPHY

- [1] Adler, H.A., Economic Appraisal of Transport Project: A Manual with Case Studies (Bloomington, Ind.: Indiana University Press, 1971).
- [2] Adler, H.A., "Economic Evaluation of Transport Projects", Transport Investment and Economic Development, ed. Fromm, G. (Washington, D.C.: The Brookings Institution, 1965).
- [3] Allocation by Province of Expenditures by Transport Canada and the Canadian Transport Commission [1974/75-1978/79] (Ottawa: Strategic Planning Group, Transport Canada, 1978).
- [4] Annual Reports [1969-70 to 1974-75] (Edmonton: Alberta Department of Highways and Transport).
- [5] Annual Reports [1975-76 to 1979-80] (Edmonton: Alberta Transportation).
- [6] Annual Reports [1971 to 1981] (Ottawa: Canadian Transport Commission).
- [7] Annual Reports [1969-70 to 1979-80] (Regina: Saskatchewan Department of Highways and Transportation).
- [8] Annual Reports [1969-70 to 1979-80] (Regina: Saskatchewan Department of Rural Affairs).
- [9] Annual Reports [1969-70 to 1979-80] (Winnipeg: Manitoba Department of Highways and Transportation).
- [10] Benefit-Cost Analysis Guide (Ottawa: Planning Branch, Treasury Board Secretariat, 1976).
- [11] Brown, H., An Automated Procedure for Developing an Advance Highway Program, M.Sc. Thesis (Winnipeg: University of Manitoba, 1971).
- [12] Bryan, N., More Taxes and More Traffic (Toronto: Canadian Tax Foundation, 1972).
- [13] Canada-Manitoba Northlands Agreement 1976-81: Progress Report 1979-80 (Winnipeg: Governments of Canada and Manitoba).
- [14] Capital Estimates [1972 to 1980] (Winnipeg: City of Winnipeg).
- [15] Capital Stock and Investment in the Transport Services Industry: Air Transport (Ottawa: Economic and Regional Analysis Branch, Transport Canada, 1980).

- [16] Capital Stock and Investment in the Transport Services Industry: Rail Transport (Ottawa: Economic and Regional Analysis Branch, Transport Canada, 1980).
- [17] Chenery, H.B., "The Application of Investment Criteria", The Quarterly Journal of Economics, LXVII (February, 1953).
- [18] Consolidated Government Finance: Fiscal Year Ended Nearest to December 31 [1971 to 1978] Catalogue Number 68-202 (Ottawa: Statistics Canada).
- [19] Construction in Canada [1970 to 1980] Catalogue Number 64-201 (Ottawa: Statistics Canada).
- [20] Construction Statistics [May, 1982] Catalogue Number 64-003 (Ottawa: Statistics Canada).
- [21] Coomber, N.M., and Biswas, A.K., "Evaluation of Environmental Intangibles: Review of Techniques", Environmental Canada (June, 1972).
- [22] Day, D.S., and Hassan, M.U., Projecting the Long-Range Implications of Highway Improvement Strategies, A paper presented at the Annual Conference of the WACHO in Victoria, B.C. (April, 1982).
- [23] Eash, R.W., Civgin, M., and Haack, H., "An Investment Approach Toward Developing Priorities in Transportation Planning", Highway Research Record, No. 314 (Washington, D.C.: Highway Research Board, 1970).
- [24] Estimate of Costs Associated with Increased Axle and Gross Vehicle Weights on Manitoba Highways (Winnipeg: Manitoba Department of Highways, 1974).
- [25] Exchange of Information on Investment Criteria Applied to Transport Infrastructure Projects: Report by the ECMT Group of Experts on Investment Criteria (Paris: European Conference of Ministers of Transport, 1981).
- [26] Federal and Provincial Government Transportation Expenditures by Province (1974/75-1979/80) (Ottawa: Strategic Policy Branch, Transport Canada, 1981).
- [27] Federal Government Finance: Revenue and Expenditure, Assets and Liabilities [1971 to 1979] Catalogue Number 68-211 (Ottawa: Statistics Canada).
- [28] Ferguson, G.A., "Development of Transportation System Alternatives", Highway Research Record, No. 148 (Washington, D.C.: Highway Research Board, 1966).
- [29] Financial Reports/Statements [1970 to 1980] (Regina: City of Regina).

- [30] "Fiscal 82-83 Preview: A Report on Transportation Spending by the Senior Governments", RTAC (Roads and Transportation Association of Canada) News, Vol. 8, No. 2 (March-April 1982).
- [31] For-Hire Trucking Survey [1973 to 1980] Catalogue Number 53-224 (Ottawa: Statistics Canada).
- [32] Grand Prairie - Grande Cache Area Environmental Planning Study: Executive Summary (Edmonton: Alberta Transportation, 1978).
- [33] Guide on the Program Evaluation Function (Ottawa: Treasury Board of Canada, 1981).
- [34] Haritos, Z., On the Cost of Capital for Public Investment (Ottawa: Canadian Transport Commission, 1971).
- [35] Haritos, Z., Rational Road Pricing Policies in Canada (Ottawa: Canadian Transport Commission, 1973).
- [36] Harwitz, M., "Regional Development Policy", Transport Investment and Economic Development, ed. Fromm, G. (Washington, D.C.: The Brookings Institution, 1965).
- [37] Hassan, M.U., and Hopkins, C.R., Highway Programming and Investment Decision-Making in Saskatchewan, A paper presented at the Annual RTAC Conference in Halifax, Nova Scotia (September, 1982).
- [38] Hassan, M.U., and Said, G.M., "Management of Highway Investment in a Low Population Density Environment: The Saskatchewan Endeavour", RTAC Annual Conference Preprints (Ottawa: RTAC, 1980).
- [39] Hill, M., "A Method for the Evaluation of Transportation Plans", Highway Research Record, No. 180 (Washington, D.C.: Highway Research Board, 1967).
- [40] Hill, M.A., "A Goals-Achievement Matrix for Evaluating Alternative Plans", Journal of the American Institute of Planners, 34(1) (January, 1968).
- [41] Hochstein, S., "The New York City Westway - Non-Progress Through Public Participation", ITE Journal, Vol. 52, No. 5 (Washington, D.C.: Institute of Transportation Engineers, May, 1982).
- [42] Hopkins, C.R., and Hassan, M.U., "Quality-of-Service Index": The Concept and its Application in the Programming of Capital Improvements on a Rural Highway System, A paper presented at the Annual Conference of the WACHO in Victoria, B.C. (April, 1978).
- [43] Hutchinson, B.G., Interim Report on the Formulation of an Economic Evaluation Framework for Provincial Highway Investment (Ontario: Department of Highways, 1969).

- [44] Hutchinson, B.G., Principles of Urban Transport Systems Planning (Washington, D.C.: McGraw-Hill Book Company, 1974).
- [45] Hutchinson, B.G., "Structuring Urban Planning Decisions: The Use of Statistical Decision Theory", Centre for Environmental Studies (London, Ont., 1969).
- [46] Inglis, P.F., and Galarneau, J.R., Development of the Canadian Highway Data Base (Ottawa: 1982).
- [47] Irwin, N.A., "Criteria for Evaluating Alternative Transportation Systems", Highway Research Record, No. 148 (Washington, D.C.: Highway Research Board, 1966).
- [48] Juster, R.D., and Pecknold, W.M., "Improving the Process of Programming Transportation Investments", Transportation Research Record, No. 490 (Washington, D.C.: Transportation Research Board, 1976).
- [49] Lambert, W.G., An Efficient and Comprehensive Process for Identifying Roadway and Transit Needs Within Urban Areas, A paper presented at the Annual RTAC Conference in Halifax, Nova Scotia (September, 1982).
- [50] Local Government Finance: Revenue and Expenditure, Assets and Liabilities, Actual [1971 to 1978] Catalogue Number 68-204 (Ottawa: Statistics Canada).
- [51] Maass, A., "Benefit-Cost Analysis: Its Relevance to Public Investment Decisions", Quarterly Journal of Economics, Vol. 80, No. 2 (May, 1966).
- [52] Mak, K.K., and Jones, P.S., "Priority Analysis Procedures for Ranking Highway Improvement Projects", Transportation Research Record, No. 585 (Washington, D.C.: Transportation Research Board, 1976).
- [53] Manheim, M.L., Fundamentals of Transportation Systems Analysis, Volume I: Basic Concepts (Cambridge: Massachusetts Institute of Technology Press, 1979).
- [54] Melinishyn, W., Crowther, R., and O'Doherty, J., "Transportation Planning Improvement Priorities: Development of a Methodology", Highway Research Record, No. 458 (Washington, D.C.: Highway Research Board, 1973).
- [55] Memorandum of Understanding between Canada and Alberta Respecting the Increase of Axle and Gross Vehicle Weight and the Strengthening of Certain Primary Highways in the Province of Alberta (July, 1974).
- [56] Memorandum of Understanding between Canada and Manitoba Respecting the Increase of Axle and Gross Vehicle Weight and the Strengthening of Certain Primary Highways in the Province of Manitoba (July, 1974).

- [57] Memorandum of Understanding between Canada and Saskatchewan Respecting the Increase of Axle and Gross Vehicle Weight and the Strengthening of Certain Primary Highways in the Province of Saskatchewan (July, 1974).
- [58] Mitchell, B., and Mitchell, J., Benefit-Cost Analysis: A Selected Bibliography (Monticello, Ill.: Council of Planning Librarians, 1972).
- [59] Motor Carriers-Freight and Household Goods Movers [1975 to 1979] Catalogue Number 53-222 (Ottawa: Statistics Canada).
- [60] O'Flynn, J.A., "An Economic Evaluation Framework for Regional Highway Planning Studies", P.H.O. Report, No. RR132 (Ontario: Department of Highways, 1968).
- [61] Preliminary Design Study for the Kildonan Corridor: Executive Summary (Winnipeg: Streets and Transportation Department/Underwood McLellan Ltd., 1982).
- [62] Principles for the Evaluation of Programs by Federal Departments and Agencies (Ottawa: Treasury Board of Canada, 1981).
- [63] Private and Public Investment in Canada - Mid-year Review [1972 to 1981] Catalogue Number 61-206 (Ottawa: Statistics Canada).
- [64] Provincial Government Finance: Revenue and Expenditure [1970 to 1979] Catalogue Number 68-207 (Ottawa: Statistics Canada).
- [65] Public Accounts [1969-70 to 1979-80] (Edmonton: Alberta Department of Finance).
- [66] Public Accounts [1969-70 to 1979-80] (Regina: Saskatchewan Department of Finance).
- [67] Public Accounts [1969-70 to 1979-80] (Winnipeg: Manitoba Department of Finance).
- [68] Quarterly Estimates of Population for Canada and the Provinces [October, 1981] Catalogue Number 91-001 (Ottawa: Statistics Canada).
- [69] Report of the Municipal Road Surfacing Commission 1974-75 (Regina: Municipal Road Surfacing Commission, 1974).
- [70] Review and Assessment of Transportation System Evaluation Techniques in Canada (Ottawa: Roads and Transportation Association of Canada, 1978).
- [71] Road Motor Vehicles: Registrations [1971 to 1980] Catalogue Number 53-219 (Ottawa: Statistics Canada).

- [72] Rural Revenue-Sharing and the Escalator Index (Regina: Saskatchewan Rural Affairs, 1981).
- [73] Shortreed, J.H., and Crowther, R.F., "Programming Transportation Investment: A Priority-Planning Procedure", Transportation Research Record, No. 574 (Washington, D.C.: Transportation Research Board, 1976).
- [74] South Corridor Light Rail Transit: Functional Design Study (Edmonton: DelCan, 1979).
- [75] South Corridor Light Rail Transit: Public Participation Program Technical Appendix (Edmonton: Transportation Systems Design Department, 1979).
- [76] South Corridor Light Rail Transit: Review of Submissions to the Public Hearings (Edmonton: Transportation Systems Design Department, 1979).
- [77] System of National Accounts, National Income and Expenditure Accounts [Fourth Quarter 1979 & Second Quarter 1982] Catalogue Number 13-001 (Ottawa: Statistics Canada).
- [78] The Highway, Road, Street and Bridge Contracting Industry [1976 to 1980] Catalogue Number 64-206 (Ottawa: Statistics Canada).
- [79] Thomas, E.N., and Schofer, J.L., "Strategies for the Evaluation of Alternative Transportation Plans", National Cooperative Highway Research Program, Report No. 96 (Washington, D.C.: Highway Research Board, 1970).
- [80] Transportation System Measurement Characteristics (Winnipeg: IBI Group, 1978).
- [81] Transportation System Plan: Assessment of Alternative Strategies (Edmonton: Transportation Systems Design Department, 1982).
- [82] Transportation System Plan: Summary (Edmonton: Transportation Systems Design Department, 1982).
- [83] Transport Costs and Revenues in Canada 1969-1979 (Ottawa: Strategic Policy Directorate, Transport Canada, 1982).
- [84] Unconditional Revenue Sharing Grants for Rural Municipalities (Regina: Planning & Research Branch, Saskatchewan Rural Affairs, 1982).
- [85] Warnke, D.W., Terre, N.C., and Ameiss, A.P., "A Methodology for Determining Public Investment Criteria", Socio-economic Planning Sciences, Vol. 7, No. 4 (August, 1973).
- [86] White, J.A., Agee, M.H., and Case, K.E., Principles of Engineering Economic Analysis (New York: John Wiley & Sons, 1977).

- [87] Wilson, F.R., and Aboul-Ela, M.T., A Multiple-Criteria Evaluation Methodology for Transportation Investment Decision, A paper presented at the Annual RTAC Conference in Halifax, Nova Scotia (September, 1982).
- [88] Winfrey, R., Economic Analysis for Highways (Scranton, Pa.: International Textbook Co., 1969).
- [89] Wohl, M., Transportation Investment Planning: An Introduction for Engineers and Planners (Lexington, Ma.: D.C. Heath and Company, 1972).