Appendix 3 -
Changes in the Maine Economy From Strategic Investments in the Transportation System

Maine Department of Transportation
and
Maine Center for Business and Economic Research
University of Southern Maine

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Executive Summary

This study estimates the changes in the Maine economy which could result from a series of investments in the highway, transit, and freight (port and rail) elements of the Maine transportation system. These investments are part of the Department of Transportation's Long Range Plan. The contemplated investments may be summarized as follows:

- A total of $1.7 billion over 26 years would be invested. Highway investments would comprise the bulk of these expenditures at $1.47 billion (84%). Transit investments would total $122.0 million (7%), and investments in Maine's rail networks and ports would total $147.2 million (8%).

- The state share of this amount is assumed to be 35% of the total for road and 20% for transit investments. The state would be responsible for all of the costs of the rail and port investments. This would total $348.3 million over the period for all three components. Federal funds would make up the rest.

- Annual investment spending would average $139.0 million (both state and federal funds), although this would vary significantly in some years when major projects for transit or ports are undertaken.

- Investments would be made throughout the state, with Cumberland and eastern Maine (Penobscot, Piscataquis, Hancock, and Washington) counties accounting for 56% of investments.

The state share of this increased spending on transportation is assumed to be paid for by raising taxes in the amounts needed each year. Increased taxes are paid both by businesses and households. This "pay-as-you-go" assumption is unlikely to reflect actual practice by the Legislature, but represents a very conservative assumption regarding financing.

These investments will result in significant improvements in the transportation system. By 2030, the highway and transit investments will result in the saving of more than 43.3 million vehicle miles traveled and more than 16.4 million vehicles hours traveled (VHT). There will also be a reduction of nearly 2% in the proportion of travel subject to congestion. Freight investments are estimated to result in an annual increase in traffic of 3% leading after ten years to a 1% reduction in the cost of moving goods to and from Maine over the rail and through ports.

In addition to the investment analysis, an alternative scenario for highway funding is examined. Under this scenario, spending on highway improvements would remain at current levels through the period to 2030. The result would be that economic and population growth would significantly increase highway congestion. By 2030 under this scenario, vehicle hours traveled in Maine would increase by more than 28.2 million.

Changes in the efficiency of the transportation networks were analyzed by first estimating the economic value as changes in costs to businesses and households. Improvements in transportation efficiency lower costs to businesses that rely on transportation to both ship goods out and bring goods into Maine. Improvements also allow households to shift spending on vehicles to other goods and services. Deterioration in the efficiency of transportation results in higher costs for businesses and more spending on vehicles by households.

This analysis was undertaken using an economic model called TREDIS, which is specifically designed to examine the economic impacts of transportation. The economic changes from transportation change were then input to a large scale econometric model of the Maine economy developed for USM by Regional Economic Models Inc. The REMI model produced estimates of changes in employment and gross state product (GSP).

The results of this analysis showed the following:

- Together, investments in highways, transit, and freight transportation will yield an annual average gain of 1,442 jobs over the period from 2007-2030. By 2030, the Maine economy will have 2,538 additional jobs. The Maine Gross State Product is estimated to increase by more than $2.5 billion over the period, or $107 million per year. By 2030, the GSP will be $198 million higher than it would have been in the baseline forecast.

- Highway investments will account for the bulk of the job gains; by 2030 employment growth resulting from highway investments will total almost 2,000. In contrast, if no investments in highways are made and funding is held at current levels, the Maine economy would be more than 5,800 jobs smaller. The difference between the investments and highways is more than 7,800 jobs and $524 million in GSP in 2030.

- A comparison of the increase in gross state product with the state expenditures on transportation investments over the period shows that the Maine GSP will increase by a present value of $3.65 for every present value dollar of investments (using a 5% discount rate).

- All regions of the state will see employment and GSP gains, with Cumberland County, eastern Maine, and western Maine (Androscoggin, Franklin, and Oxford counties) showing the largest gains.

The analysis of economic impacts is limited by available data and the long time horizon used in the study. In addition, readers are cautioned that economic impacts represent only a part of the economic assessment needed to fully evaluate investment options. A full cost-benefit analysis, which would account for the economic value of increased safety and the value of time saved, was beyond the scope of this study.

The results of the study indicate that transportation system improvements of the types envisioned by MaineDOT in their long range plan are likely to yield significant improvements in the Maine economy.

Acknowledgements

This study was undertaken by the Center for Business and Economic Research at the University of Southern Maine in cooperation with the Maine Department of Transportation. Dr. Charles Colgan, Associate Director of CBER and Professor of Public Policy and Management in the Muskie School of Public Service at USM was the Principal Investigator for the project and author of this report.

Dr. Bruce H. Andrews, Director of CBER and Professor of Quantitative Business Management in the USM School of Business served as Project Director for USM.

Gerry Audibert of the Bureau of Planning in the Maine Department of Transportation served as Project Director for MaineDOT. Ed Hanscom of the Bureau of Planning provided data on highway

projects and conducted the analysis using the MaineDOT statewide traffic model. Anna Price of the Office of Passenger Transportation and Rob Elder of the Office of Freight Transportation served as lead contacts for the study in these two areas.

Glen Weisbrod of the Economic Development Research Group of Boston provided permission for the use of the TREDIS model for the analysis in this study. Brian Baird of EDRG served as technical advisor for the TREDIS analysis.

1. Introduction

Maine's transportation system has long been understood to be an important element in the success of the Maine economy. But the ability of that system to continue to contribute to the economy is under increasing question as the demands on the system grow and the funding available from the motor fuels tax and the federal government faces severe constraints.

This report examines the economic impacts of investments in the highway, freight (ports and rail) and passenger transit components of the Maine transportation system. The purpose is to explore the changes in the levels of economic activity in Maine over the period from 2009-2030 that could result from different decisions about how much and where to invest in improving these components.

The analysis was undertaken by a partnership between the Maine Department of Transportation and the Center for Business and Economic Research (CBER) at the University of Southern Maine. As part of its Long Range Plan, the Department developed a set of investment scenarios for each element in the system and, for those scenarios affecting highway travel, the statewide traffic model was used to estimate changes in vehicle miles and hours traveled. These scenarios were then used by CBER to translate changes in transportation into changes in the costs of transportation for businesses and households and then into changes in the overall economy that affects employment and the total output of goods and services in Maine. Details of the scenarios and analysis are provided in sections 2 and 3 below. The results are presented in section 4.

This study examines the economic impacts of transportation system investments, but this is only one economic perspective on how transportation improvements affect people. There is an important distinction between economic *impacts* and economic *benefits*:

- Economic *impacts* are changes in the level of economic activity, and are measured by changes in employment, income, and the output of goods and services.

- Economic *benefits* (sometimes called "social benefits") are changes in the values of goods and services. Values are measured as the difference between what people are willing to pay for transportation and what they actually pay (for consumers) and the difference between the value a business actually receives for its goods and services and the minimum amount it wishes to receive. The most important economic benefits of transportation are the values of time saved and the value of safety.

Safety provides perhaps the clearest distinction between impacts and benefits. Safe travel is clearly something that is desirable (it has a high value), and it has long been shown that people are willing to pay for increased safety. But unsafe roads actually increase the economic activity of the health care industry and its employees (doctors, hospitals, etc.). Investments that increase safety actually reduce the economic activity associated with health care, auto repair, etc., but it would obviously be an error to avoid making safety improvements on the grounds that the economy would be smaller.

The implication is that transportation improvements may be economically justified on the grounds of economic benefits exceeding the costs, but may show little or no economic impacts. This study, which examines only economic impacts, provides only a part of the economic picture needed to fully assess transportation investments.

This is particularly the case with two components of the transportation system, one of which is examined here and one of which is not. Public transit investments often have large economic benefits, particularly when they can affect the value of time saved in transportation. They also have economic impacts, which are estimated here, but these are probably smaller than the economic benefits. Air transportation improvements, which are not examined in this study, also have large economic benefits, but current data systems make it very difficult to estimate economic impacts from air transportation improvements. This lack of data is the reason why the economic impacts from air transportation improvements are not examined here.

2. Approach to Analysis

The analysis proceeded in three stages. First, the Department of Transportation identified a series of investments in the highway, transit, and freight transportation systems and estimated what effects those would have on the flow of vehicles, goods, and services in Maine. Second, the changes affecting the road network (highways and transit) were analyzed using an economic impact model specially designed for assessing transportation projects. This model, called TREDIS, was developed by the Economic Development Research Group of Boston, and was used with their permission. Finally, the economic changes were analyzed using a general econometric model of the Maine economy developed by Regional Economic Models Inc. (REMI) of Amherst, MA and maintained at the University of Southern Maine.

For the analysis of highway projects, three scenarios are examined.

Strategic Investment

The first is a "strategic investment" scenario designed to make key improvements to the transportation system that will result in the year 2030 in a network that is significantly more efficient.

Constant Performance

The second is a "constant performance" scenario, in which the Department invests just enough in transportation to keep the system at the current level of efficiency. There are no gains in efficiency, but also no deterioration from current levels. This "constant performance" scenario is assumed to be equal to the baseline forecast of the Maine economy in the REMI model. The baseline forecast against which changes in transportation are measured is assumed to be one in which the transportation system is neutral with respect to the rate of growth.

Constant Funding

The third is a "constant funding" scenario in which current levels of funding are maintained; this results in significant deterioration in the system's efficiency as measured by significant growth in vehicle hours and miles traveled.

3. Strategic Transportation Improvements

This section describes the types of investments that are analyzed, as defined by the Maine Department of Transportation. All of the programs and projects included in this analysis are also included in the Long Range Plan which MaineDOT is currently developing in consultation with public and private organizations throughout the state. Bridge repair and replacement, a significant part of the Long Range Plan's highway expenditure components are not included in this analysis.

Regions

The analysis was conducted for seven regions within Maine. These regions were identified by the MaineDOT as consistent (with some adjustments) to the regions that are used in the Department's planning activities. These regions are:

Cumberland	Cumberland County
York	York County
Western	Androscoggin-Franklin-Oxford counties
Kennebec	Kennebec-Somerset counties
Midcoast	Sagadahoc-Lincoln-Knox-Waldo counties
Eastern	Penobscot-Piscataquis-Hancock-Washington counties
Aroostook	Aroostook County

Highways

The highway investment scenarios encompassed highway improvement strategies designed to improve mobility or preserve existing mobility on the arterial highway network. Success in achieving Long Range Plan mobility goals on the highway system is, in part, measured in terms of minimizing vehicle-hours of delay for a given amount of vehicle-miles traveled, in other words, managing network congestion. The highway improvement strategies used to manage congestion include the following:

- Access management on existing arterial highways
- New auxiliary (turning) lanes on existing arterial highways
- New passing lanes on existing arterial highways
- New through lanes on existing arterial highways
- New through lanes on controlled access highways (incl. new locations)

Another highway improvement strategy for improving mobility was the reconstruction of collector roads perennially posted to prohibit use by heavy trucks during the spring thaw.

Highway investments not factored into the Economic Analysis include the following:

- Highway safety projects
- Bridge replacement and rehabilitation projects
- Highway reconstruction and rehabilitation projects
- Pavement preservation projects

Transit

Transit projects analyzed include a wide variety of improvements in passenger rail, transit, bicycle and pedestrian trails, ferries and park & ride lots. Table 1 shows the transit investments in each region by year over the planning horizon. The transit investments will be comprised of two types of investment.

1. Expansion of Bus Services. This includes expansion of existing bus services in urban areas as well as summer "explorer areas" in tourist areas.

2. New transit facilities and services. This includes new rail service, new park and ride lots, and terminal facilities.

To examine the economic impacts of transit investments, vehicle miles not traveled in an automobile as well as vehicle hours of travel saved were estimated. Expenditures on vehicles not made because of reduced auto use shifted to consumption of other goods and services. It was assumed that most of the effect of transit would be on commuting activities, except in the case of transit facilities primarily for tourists. In this case, the vehicle savings become additional spending on food, lodging, and other retail goods.

In the development of the impacts from transit investments, only the construction impacts on the Maine economy are considered. New train or bus equipment originates outside of Maine and so has little impact on the Maine economy.

Freight

The Rail data included continuation of the Industrial Rail Access Program, the Section 130 Rail At-Grade Crossings Safety Program, Montréal Maine and Atlantic track rehabilitation and ongoing State-owned track maintenance programs. It also included a new Freight Rail Interchange Program, upgrades and purchases and rehab of the Mountain Division line and the Lewiston Lower Road lines.

The Port data included new channel dredging and a new or expanded container facility at Searsport (including equipment such as cranes and warehouses). It also included a new facility at Eastport, and a complete rehabilitation of the International Marine Terminal in Portland.

This section discusses the way in which these effects are estimated, using the TREDIS model. These estimates are then used as inputs to the general econometric model of the Maine economy (the REMI model) which calculates the overall changes in economic activity.

Construction

Total construction costs for all investments were estimated by MaineDOT, and a schedule of investment projects over the period 2007-2030 was specified. It should be emphasized that the construction value estimates are based on best professional judgment from information currently available, and should not be considered detailed project cost estimates. Similarly, the schedules of investments, particularly for transit and freight, are based on long range planning assumptions that are obviously subject to substantial modifications in the future.

REGION	2009	2010	2011	2012	2014	2015	2016-20	2022	2024	2026	2028	2030
Cumberland	Rail Portland-Yarmouth	Rail Yarmouth-Brunswick				Rail Yarmouth to Auburn						
		Brunswick Bus	Connection to ME Eastern RR			Park & Ride Lot	Park & Ride Lot	Park & Ride Lot	Park & Ride Lot	Park & Ride Lot	Park & Ride Lott	
			Freeport Bus									
	Fixed Route Bus Expansion											
York						Go Maine Van Pool Expansion						
Western ME							Rail Yarmouth to Auburn					Auburn Intermodal Facility
												Intercity Bus Service
Kennebec		KV Transit										
		Augusta Intermodal				3 Park & Ride Lots						
Midcoast						6 Park & Ride Lots						Boothbay Explorer
												Marine Highway Facility
												Ferries
Eastern ME		Trenton-Ellsworth Isld Expl		Intermodal Ellsworth		Intercity Bus to Bar Harbor						
						Acadia Gateway Center						
Aroostook						Intercity Bus to St. John Valley						

Table 1 Schedule of Transit Investments

4. Direct Economic Effects of Transportation Investments

The investments outlined in section 2 will affect the Maine economy in several different ways. Some of these clearly boost economic activity in Maine, but others have the opposite effect. Both positive and negative effects must be estimated and it is the net effect that must be determined through economic analysis.

The major positive effects are:

- Increased spending on construction
- Reduced costs to firms importing and exporting goods into and from Maine (whether domestic or international goods)
- Shifting household consumption away from spending on vehicles to spending on other goods and services

The major negative effects are:

- Reduced spending by households and tourists on vehicle related services which affects firms in these industries negatively, but the funding shifts to other goods and services.
- Increased taxes to pay for the state share of the transportation investments.
- Increased transportation costs to businesses and households resulting from deterioration in the system in the "constant funding" scenario.

This section discusses the way in which these direct effects are estimated, using the TREDIS model. These estimates are then used as inputs to the general econometric model of the Maine economy (the REMI model) which calculates the overall changes in economic activity.

Construction

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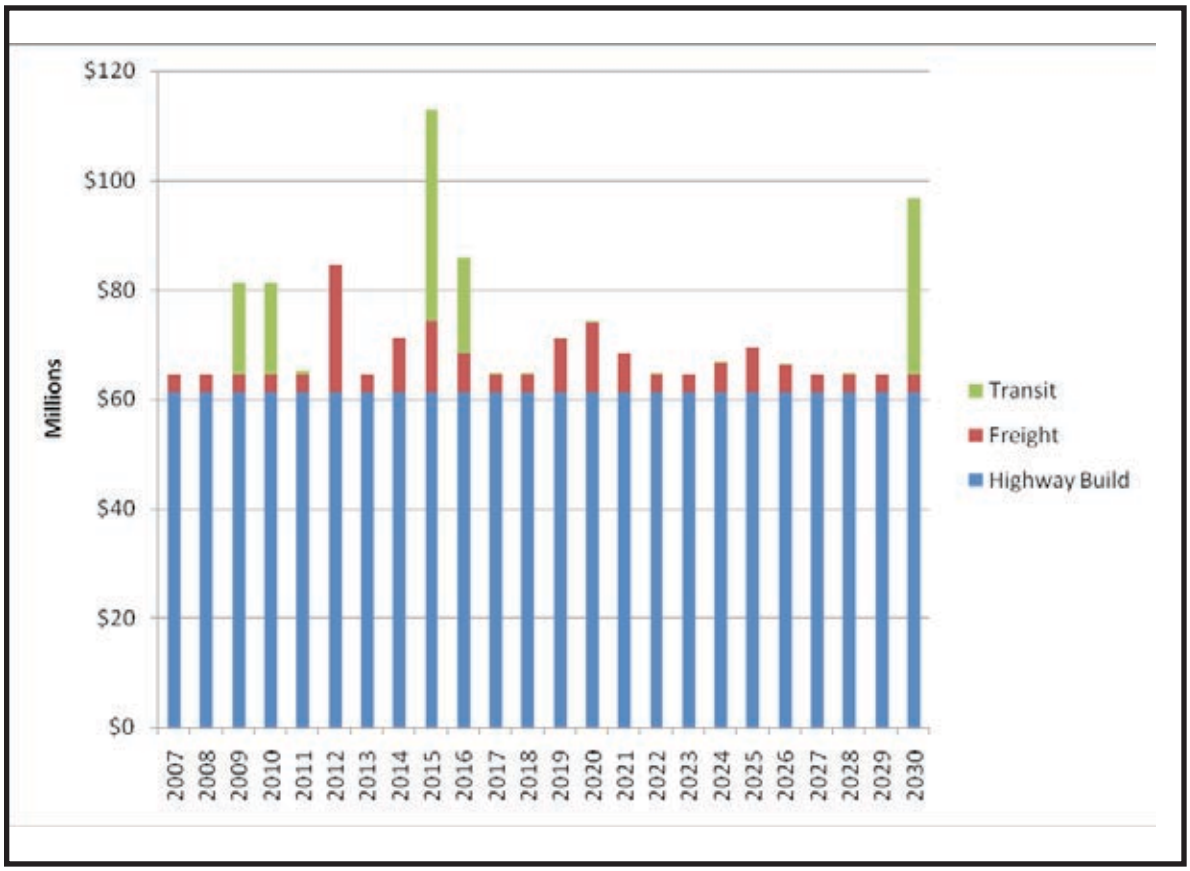

Figure 1 Construction Expenditures by Transportation System Component 2007-2030

Figure 1 shows the distribution of construction spending across the period examined. It is assumed that highway expenditures will be made on a constant basis throughout the period at a level of $61.34 million per year. This is total spending comprised of both federal and state shares.

Transit investments occur beginning in 2009 and consist of several major projects. Freight rail projects are undertaken on a fairly constant basis throughout the period, with major port projects at Portland and Searsport comprising the period large increases in this component.

All together over the period, the highway investment will total $1.472 billion (82% of the total) with transit totaling $184.3 million (10%) and freight totaling $147.3 million (8%). Spending on strategic investments will average $75.1 million per year.

Table 2 shows the total amounts over the period for each of the seven analysis regions, and the proportion of the statewide total that would be spent in each area. These figures include all projects in highway, transit, and freight

	Total Expenditures	Percent
Cumberland	$234.20	38.6%
York	$57.01	9.4%
Western	$111.04	18.3%
Kennebec	$60.35	10.0%
Midcoast	$78.91	13.0%
Eastern	$55.69	9.2%
Aroostook	$8.90	1.5%

Table 2 Distribution of Construction Expenditures by Region

It should be noted that in the scenario which examines the effects of constant spending levels, less construction spending will take place than would be the case in the baseline (constant performance) scenario. This is because the baseline, or constant performance, scenario assumes some growth in transportation spending to accommodate population and traffic growth. MaineDOT estimates that the constant performance spending will equal $492 million over the period 2007-2030, while the constant funding scenario will mean $412 million over the same period, a difference of $80 million. Construction spending is reduced by this amount on an annual basis in the analysis of the constant spending scenario.

Taxes to Support State Share of Construction Spending

The construction expenditures must be paid for, and thus taxes must be raised (or other spending cut)[1] to pay the state share of these expenditures. The analysis of taxes necessarily involves some rather significant assumptions, for no one can reasonably predict what actions the Legislature may take. While the motor fuels tax (both federal and state) has historically provided the vast bulk of funding for the construction and maintenance of highways, the role of motor fuel taxes is likely to change in the future as more fuel efficient vehicles reduce demand for traditional diesel and gasoline. Transit funding comes from a variety of tax and user fees, while freight system funding is derived from a complex mix of revenue sources.

[1]Assumptions about how spending might change are inevitably even more complex than assumptions about taxes and so are not used here.

To estimate the taxes necessary to pay for construction of transportation system improvements, it is first necessary to calculate what share Maine taxpayers will be directly responsible for. For highways, it is assumed that 35% on average will be the state share. For the construction costs of transit investments, it is assumed Maine taxpayers will pay for 20% of the construction. Freight system improvements are assumed to be paid entirely from state funds. This may vary from project to project and year to year, but represents an approximate historic average.

Two additional assumptions are needed: how will projects be financed, and what will be the distribution of taxes.

MaineDOT finances construction using a combination of current period revenues and bond financing, in which highway fund revenues are used to repay bond holders. Bonds permit the same revenues to generate additional expenditures sooner (and thus avoid inflation), though at the higher cost of paying interest to the lenders (bond holders). The exact mix of current revenues and bonds depends on a large number of factors which vary from time to time, and make it impossible to accurately forecast the way in which construction will be financed into the future.

The analysis in this study therefore uses a pay-as-you-go assumption. Whatever the construction expenditures will be in a given year, it is assumed that the Legislature will authorize raising that amount in taxes. This is in some respects an unrealistic assumption. The Legislature rarely raises taxes and almost never in the small increments that are implied in this analysis. But this approach does recognize that the state share must be paid for somehow, and permits a simple approach that does not require predictions about how legislatures will choose to approach financing and tax policy twenty years from now.

It also yields conservative estimates of the economic impacts of investments. That is, the restraining influences of tax increases are *overstated* in this approach, and thus the economic impacts from construction are *understated*.

The precise allocation of taxes in this analysis was done as follows: The total state share in each year was divided between the costs to be paid by businesses in the fuel tax and that paid by households. No data is available on this split, so businesses were assumed to pay 25% of the increased costs in the form of the fuel tax, with the balance going to households. The increase in the fuel tax was expressed as an increase in the production costs of the truck and courier industry, which was then passed on to consumers of these transportation services. The increase in production costs was estimate at 0.01% per year based on the proportion of total costs in the trucking industry derived from fuel.

The household share was treated as an increase in the share of personal income going to taxes in the REMI model. The total statewide amount to be paid by households was allocated among the regions based on each region's share of Maine personal income each year. On average, the share of personal income going to taxes was increased by $28 million per year.

Transportation Cost Changes to Industry

To estimate transportation cost savings to industry, the first step was to estimate the changes in vehicle hours traveled (VHT), vehicle miles traveled (VMT) and the percent of traffic subject to delays (congestion). This was done by MaineDOT using their statewide traffic demand model. These changes in transportation efficiency were then converted into changes in the costs of transportation by industry using the TREDIS model. The results are shown by region in **Table 3**.

The changes in **Table 3** reflect both highway and transit projects resulting in changes in VHT, VMT, and proportion of traffic subject to congestion. However, only highway improvements directly result in changes in industry costs. Over the period, the improvements in efficiency reduce costs to industry by almost $73 million.

	Change in Vehicle Miles Travelled in 2030 (Thousands)	Change in Vehicle Hours Travelled in 2030 (Thousands)	Change in Percent Travel Congested (2030)	Change in Industry Costs 2007-2030 (Millions)
Cumberland	-167.33	-5,902.67	-1.8%	-$21.43
York	0.00	-1,694.03	-1.6%	-$7.83
Western	-697.79	-1,964.12	-1.9%	-$10.71
Kennebec	-1,558.83	-2,326.05	-1.6%	-$11.56
Midcoast	0.00	-1,052.93	-1.0%	-$4.32
Eastern	-1,887.06	-2,011.10	-1.2%	-$14.87
Aroostook	0.00	-103.64	-0.6%	-$2.02
MAINE	-4,311.01	-15,054.53		-$72.73

Table 3 Changes in Travel Efficiency and Industry Costs-Strategic Investment Scenario

It is also necessary to identify the changes that may occur under the "constant funding" highway scenario (see Section 2). These are shown in **Table 4**. In this scenario, there is a substantial increase in vehicle hours traveled and in the congestion. These changes result in higher costs to industry totaling nearly $100 million over the period.

	Change in Vehicle Hours Travelled in 2030 (Thousands)	Change in Percent Travel Congested (2030)	Change in Industry Costs (Millions)
Cumberland	9,241.55	4.4%	$29.78
York	4,032.92	1.9%	$18.13
Western	3,539.91	2.8%	$12.74
Kennebec	3,635.24	0.6%	$10.35
Midcoast	2,827.07	0.7%	$9.26
Eastern	4,688.40	2.2%	$18.13
Aroostook	293.04	0.3%	$1.18
MAINE	28,258.12		$99.58

Table 4 Changes in Travel Efficiency and Industry Costs-Constant Funding Scenario

Reduced costs to industry also result from the contemplated improvements in the freight transportation system. Unfortunately it proved very difficult to estimate what these reductions in cost might be. The detailed data on freight movements and the costs of freight transportation needed to make accurate estimates of these potential cost changes are not available for Maine ports and rail systems, because private companies manage these systems and their cost and volume data are kept confidential.

For purposes of this analysis, the Office of Freight Transportation and CBER developed a set of assumptions based on past performance and the limited information available. It is assumed that as a result of the strategic investments made traffic at Maine ports and on the freight rail network will increase by an average of 3% per year through the analysis period. After ten years of increasing volume, port and rail operators are assumed to be able to achieve some economies of scale and scope that permit them to lower the costs of services to their customers by 1%. This is probably a somewhat conservative assumption, but rail and port operators already operate in a highly competitive environment in which large efficiency gains and price reductions are unlikely.

The increase in volume is analyzed as an increase in the output of the water and rail transportation industries, while the decrease in prices is analyzed as a reduction in the cost of these services to all users of the port and rail systems.

Changes in Household Consumption

Improvements in transportation efficiency result in changing patterns of spending by households. Less time spent on the road or shorter drives reduce spending on gasoline, oil, vehicle maintenance, and related services. These savings are typically reallocated by households to other categories of spending, essentially boosting the sales of a wide variety of goods and services producers (especially as it relates to tourists, who could then spend more on lodging, dining out and recreation). Similarly, a deteriorating transportation system requires more spending on vehicles and related goods and services and less on other things.

In Maine, where a high proportion of vehicle spending is on motor fuels and lubricants, all of which must be imported from outside the state, shifting patterns of consumption can have a definite effect on overall economic activity.

Region	Reduced Spending on Vehicles from Strategic Investments	Increased Spending on Vehicles if System Deterioration Occurs
Cumberland	-$546.59	$1,050.98
York	-$217.92	$639.82
Western	-$262.97	$449.54
Kennebec	-$211.25	$365.18
Midcoast	-$106.13	$326.86
Eastern	-$293.43	$639.82
Aroostook	-$32.11	$41.66
MAINE	-$1,670.40	$3,513.85

Table 5 Changes in Household Consumption Present Value @5% 2009-2030

Table 5 shows the changes in household consumption estimated by TREDIS based on the estimated changes in vehicle hours traveled (VHT), vehicle miles traveled (VMT), and percent of traffic subject to congestion. The column "reduced spending on vehicles from strategic investments" shows the decline in spending on vehicles; this same amount is then allocated to all other consumption sectors to estimate economic impacts.

The opposite interpretation is placed on the column "increased spending on vehicles"; this increase resulting from deterioration in the highway network is offset by an equal decrease in spending on all other consumption sectors.

Tourist Expenditures

Part of the investments in transit will be for improved bicycle transportation facilities throughout the state. The economic impacts of these improvements are assumed to be derived from increased bicycle tourism activities. An estimate of additional spending of $17.65 million over the study period is used for these tourism activities, distributed among the regions based on population.

5. Economic Impacts of Transportation Investments

Overall Economic Impacts

Figure 2 shows the estimated statewide employment impacts from the strategic investments identified in the areas of highways, transit and freight. Over the period from 2007-2030, the Maine economy will show an average increase of 1,467 jobs in comparison with the baseline "constant performance" scenario. On average, the economy will be $113 million per year larger in terms of the gross state product, the total value of goods and services produced in Maine. Over the twenty-six year period, the state economy will be a total of $2.7 billion larger than it would have been.

In 2030, the economy will have added 2,465 jobs compared with the baseline scenario, and will be producing $195 million more in Gross State Product compared with the baseline scenario. **Table 6** presents a summary of these estimates.

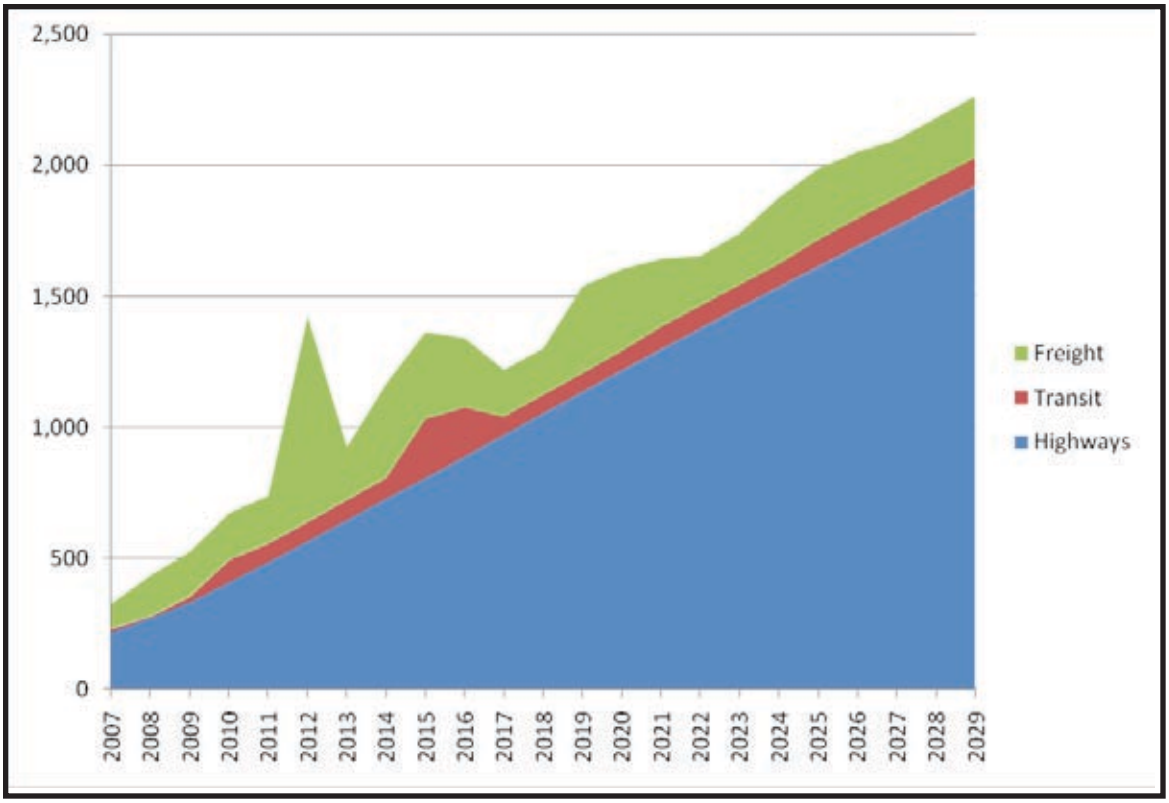

Figure 2 Employment Impacts from Strategic Investments

	Annual Average Change		Change in 2030	
	Employment	Gross State Product (Millions)	Employment	Gross State Product (Millions)
Highways	1,094	$59.09	1,996	$132.47
Transit	86	$3.92	226	$10.04
Freight	254	$44.81	242	$56.08
Total	1,442	$107.82	2,538	$198.59

Table 6 Changes in Employment and Gross State Product by Component

Figure 3 shows several features of the assumptions used in this analysis. The changes in highway performance (changes in VHT, VMT, and proportion of traffic subject to congestion) were specified for the year 2030, and it was assumed that continuous investments throughout the period would result in a constant rate of improvement in highway network efficiency. Thus the increase in highway-related employment shows a constant rate of change over the period.

In contrast, both freight and transit investments are much more driven by the construction activity for large projects such as the major investments at the Port of Portland and Searsport in the case of freight and the major passenger rail projects for transit. The result is a much more irregular pattern of change until all projects have been completed.

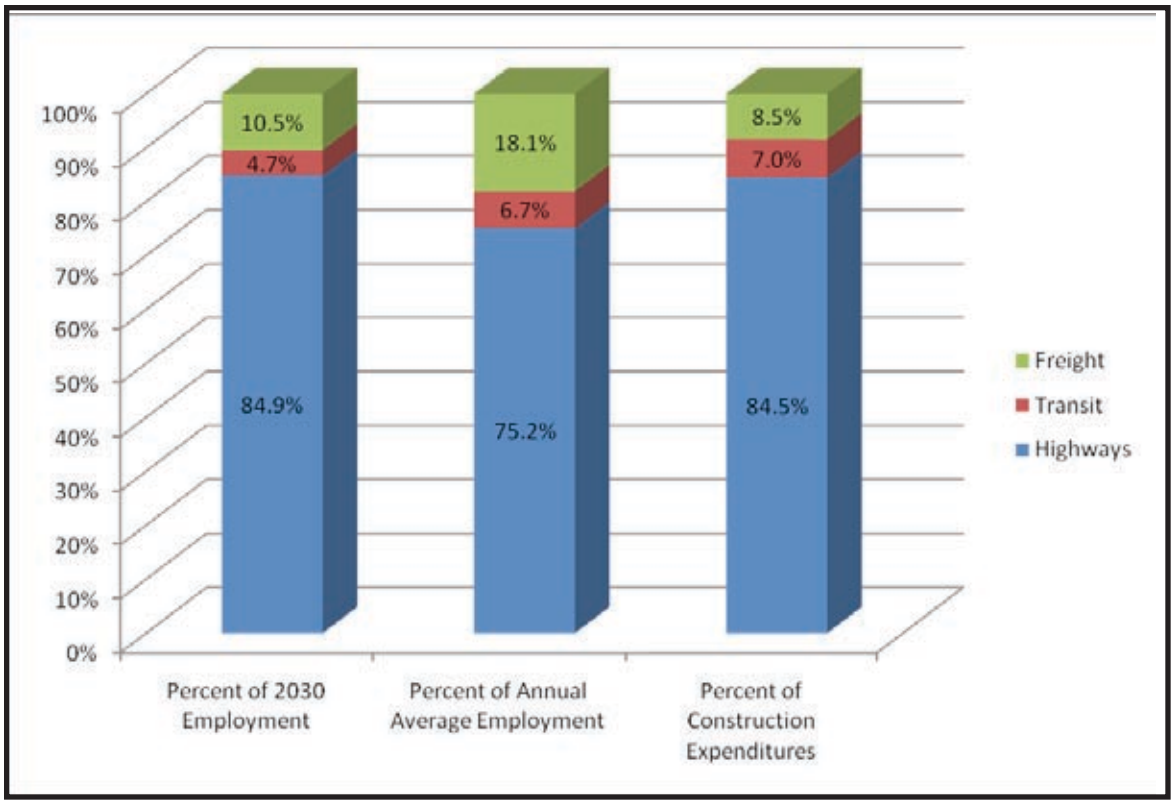

Figure 3 Comparison of Construction Expenditures and Employment Impacts by Component

Figure 3 compares the distribution of employment impacts with the distribution of construction expenditures for the three components of the transportation system. A comparison is made to both the annual average employment impacts and the estimated impacts in 2030. Highway improvements comprise about 84% of the spending, and about the same proportion of impacts in 2030, but a somewhat lower proportion (75%) of annual average employment impacts. This is due to the long build-up time in the improvements in highways. Transit comprises about 7% of expenditures and a slightly smaller proportion of employment gains; as noted earlier, transit improvements are more likely to be larger in terms of economic benefits than economic impacts. Freight transportation in ports and rail make up 8% of expenditures but nearly 10% of employment impacts and, partly due to the smaller share of highway impacts, over 18% of average annual employment impacts.

Economic Impacts of Strategic Investment v. Constant Funding of Highways

As discussed above, the analysis of highways involves three scenarios: a constant funding scenario, a constant performance scenario (equal to the baseline REMI forecast), and a strategic investment scenario. **Figure 4** shows the employment impacts from these three scenarios. The constant performance is shown on the horizontal axis at zero since it is equal to the baseline scenario. The strategic investment scenario shows constant job growth, while the constant funding scenario shows constant job decreases as the highway network becomes more and more congested.

Over the 2007-2030 period, the strategic highway investment scenario yields an annual average of an additional 1,094 jobs, while the constant funding highway scenario shows an annual average decline of 2,973 jobs. By 2030, the strategic investment scenario has produced 1,996 additional jobs compared to the constant performance-baseline scenario, while the constant funding has resulted in a fall of 5,835 jobs. Over the entire period, the strategic investment scenario yields a total of $1.42 billion in additional GSP, while the constant funding scenario results in a reduction of $4.07 billion in GSP.

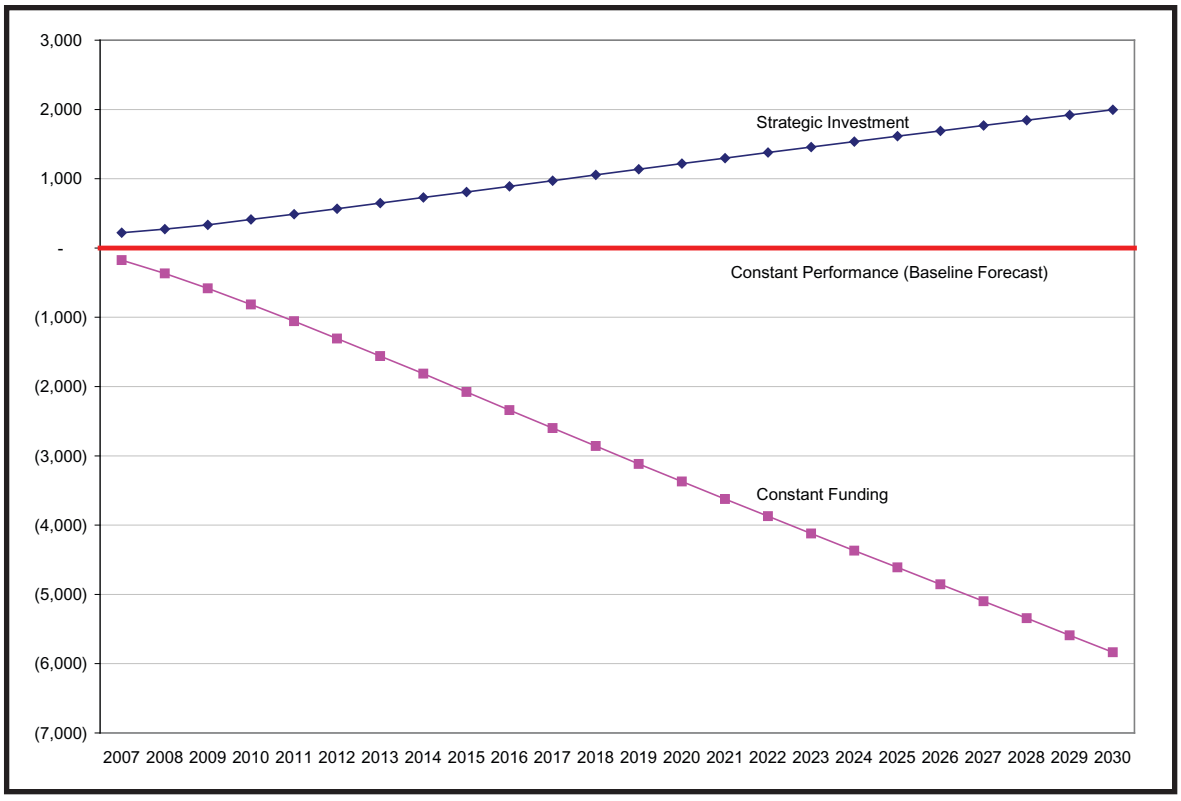

Figure 4 Employment Impacts from Three Highway Investment Scenarios

Economic Impacts by Region

Figure 5 shows the employment gains from all strategic transportation investments by region for the period from 2007-2030. The spikes in the different regions are the result of construction employment growth associated with major transit and port projects. These projects are timed at various stages through the forecast horizon as discussed above.

	Annual Average Employment Change	% of State	Employment Change in 2030	Percent of State
Cumberland	338	22.0%	571	22.5%
York	172	11.2%	262	10.3%
Western	248	16.1%	625	24.6%
Kennebec	205	13.3%	314	12.4%
Midcoast	133	8.7%	158	6.2%
Eastern	397	25.8%	535	21.1%
Aroostook	45	3.0%	74	2.9%

Table 7 Change in Employment from Strategic Investments by Region: Annual Average and 2030

Table 7 shows the average annual employment change in each region and the estimated change in 2030, along with the proportion of the statewide employment change in each region.

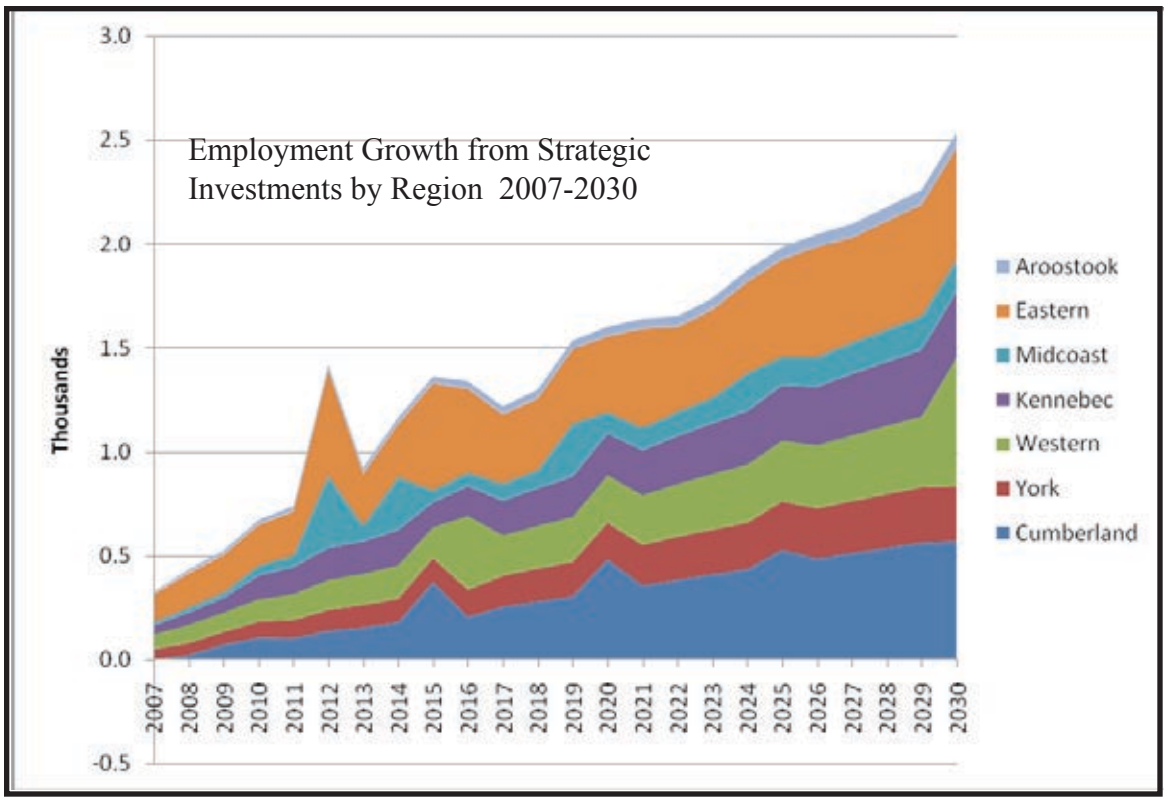

Figure 5 Employment Growth from Strategic Investments by Region 2007-2030

On an annual average basis, the Eastern region of Penobscot, Piscataquis, Hancock and Washington counties has the largest employment gain at 381, or 26% of the annual average statewide gain. This is due primarily to the large investments in highways to avoid posting roads with weight limits in the spring that is planned for this region. However, in 2030, Western Maine shows the largest gain in jobs among the seven regions, at 625, which is 25% of that year's employment growth.

The regional differences in job growth between the investment and constant funding scenarios for highways are shown in **Figure 6**. **Table 8** and **Table 9** show the distribution of employment and gains and losses in the two scenarios.

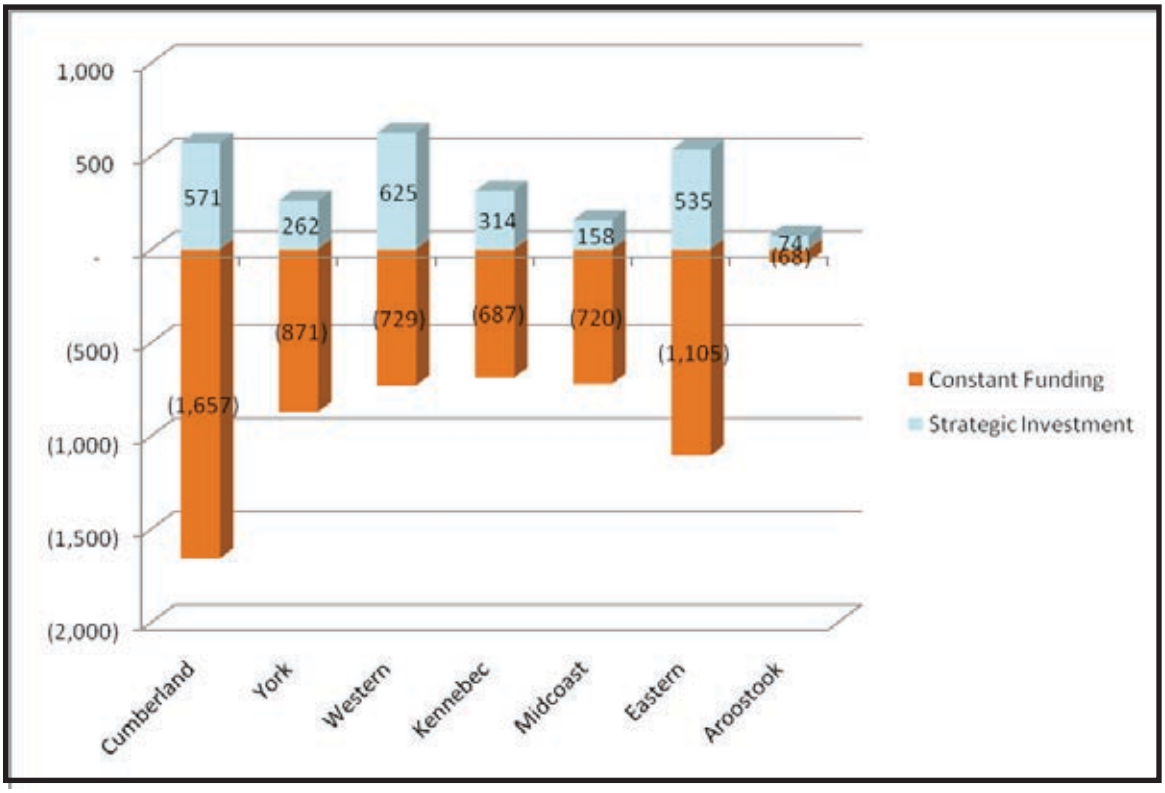

Figure 6 Employment Gains in 2030 from the Investment and Constant Funding Highway Scenarios

	Annual Average Employment Change	% of State	Employment Change in 2030	Percent of State
Cumberland	248	22.7%	519	26.0%
York	126	11.5%	229	11.5%
Western	190	17.4%	324	16.2%
Kennebec	158	14.5%	291	14.6%
Midcoast	72	6.6%	144	7.2%
Eastern	273	25.0%	434	21.7%
Aroostook	26	2.4%	56	2.8%

Table 8 Employment Gains from Highway Investments by Region

	Annual Average Employment Change	% of State	Employment Change in 2030	Percent of State
Cumberland	-835	28.1%	-1,657	28.4%
York	-447	15.0%	-871	14.9%
Western	-369	12.4%	-729	12.5%
Kennebec	-342	11.5%	-687	11.8%
Midcoast	-385	12.9%	-720	12.3%
Eastern	-561	18.9%	-1,105	18.9%
Aroostook	-34	1.1%	-68	1.2%

Table 9 Employment Losses from Highway Constant Funding

The effects of expected increases in congestion on the economy are clearly shown in this analysis. Cumberland County is the largest gainer of jobs by 2030 if strategic investments are made, with 26% of the estimated job gains. But if the highway system is allowed to deteriorate in performance, by 2030 Cumberland County will suffer more than 28% of the job losses.

Return on Investment Analysis

Given the magnitude of investments under consideration ($1.8 billion over 26 years), it is natural to ask what will be the return on that investment. A true return on investment analysis comparable to that which would be undertaken in the private sector requires a comparison of the economic benefits with the costs rather than the economic impacts[2]. However, it is possible to approximate a return on investment analysis by comparing the present value of the gains in gross state product (GSP) with the present value of the state share of construction expenditures.

[2]The reason involves technical issues in the measurement of costs and benefits which require that each change in values be assigned as either a cost or a benefit in the accounting. This is not done in economic impact analysis, where employment is counted as a positive impact, but is also a cost to the organization that hires the employee. An employee on a construction project is thus counted as both a cost and a benefit, which makes a meaningful comparison impossible. For this reason the proper return on investment analysis for public sector expenditures is cost-benefit analysis, not economic impact analysis. Such a cost benefit analysis was beyond the scope of the analysis called for in this study.

This is done in **Table 10**, which shows the present value of construction costs over the twenty-six year period and the present value of the net change in GSP from the strategic investments. The discount rate used is 5%, which approximates the State's long term cost of borrowing. The ratio of these calculations yields the dollars in net GSP gains per dollar of state expenditures on construction.

	Percent Value of State Share of Construction Costs	Percent Value of Gross State Product Gains	Dollars of GSP Gains per Dollar of Present Value Construction Costs
Highways	$297.26	$640.77	$2.16
Transit	$24.41	$43.89	$1.79
Freight	$86.81	$587.82	$6.76
Total	$348.89	$1,271.88	$3.65

Table 10 Return on Investment Analysis

Table 10 shows that there is a positive gain in the size of the value of goods and services produced in Maine for investments in each of the transportation system components. Overall, there is a gain of $3.65 per dollar invested. Freight investments show the highest gain per dollar invested, at $6.76. Transit investments show a gain in GSP of $1.79 per dollar, while highways show a net gain of $2.16.

It should be noted, however, that the large economic gain associated with investing in transit (compared with the gain from investing in highways) is heavily influenced by the timing of investments in these two sectors. Highway investments, as noted earlier, occur at a constant rate over the period, but take time to have their largest impacts. On the other hand, many of the major transit investments are made in the period 2020-2030. The mathematics of discount rates place a heavier emphasis on the up-front highway costs and a lighter emphasis on the more distant gains in GSP from those investments, while the costs of the later transit investments receive reduced emphasis.

Conclusions

There are some cautions that are in order for this analysis. Detailed data needed to conduct thorough analysis of many parts of the system are lacking either because it is unavailable from any source or because the effects of new approaches to transportation, such as commuter passenger rail north of Portland, are unknown. Throughout this analysis, the best judgment of Department of Transportation and CBER was used to provide realistic estimates. Whenever possible, assumptions of positive effects were understated and possible negative effects were overstated. This results in a conservative analysis of the financial impacts of investing in Maine's transportation infrastructure. In this case "conservative" means that care has been taken not to overstate the economic impacts. A more realistic financing approach that made more use of bonds would result in a somewhat higher dollar-of-gross-state-product-to-dollar invested ratio over the same period.

A second issue is that this analysis was conducted at a highly aggregate level across projects and regions. The results should not be interpreted as meaning that the economic impacts from every specific project will be positive to the extent implied here.

Finally, to return to a point made at the outset, there is a critical difference between economic benefits and economic impacts. A full economic evaluation of transportation investments requires both. There are very likely to be many projects considered which will have relatively small economic impacts but may have very large economic benefits in the form of increased safety or savings in the most valuable commodity of all: time.

Nonetheless, this analysis shows that the program of strategic investments currently being planned by the Maine Department of Transportation in the highway, transit, and freight systems of the state will have significant positive economic impacts on the Maine economy. This is the case even though very conservative assumptions about the economic effects of those changes are used, particularly with respect to the way in which taxes will be used to fund the state share of investments. Gains in employment and output (GSP) will be realized from investments in all three components, and will occur in all regions of the state.

Moreover, the costs to the economy of allowing the transportation system, particularly the highway network, to deteriorate are substantial. Growth in the economy and population over the next quarter century will put ever-increasing strain on the highways, resulting in much greater congestion on the highways which will bring significant increases in costs, that will result in significantly lower employment and output in 2030 than would occur if investments were made to just keep the system performing at its current level. The difference between gains from strategic investments in highways and losses from maintaining current funding amount to 7,800 jobs and more than $500 million in GSP over two decades.

The result of this analysis, therefore, is a very strong case for serious consideration of implementing the strategic investments under development by MaineDOT. While the results of this analysis show that implementation of the strategic investments being proposed will provide financial and employment advances for Maine, the results of this analysis clearly indicate that the continuation of status quo or constant performance levels of investment will yield significant and much greater losses to the state, both in employment and in the output of Maine's economy. In other words, the opportunities for important improvements in Maine's economy from carefully planned transportation investments are very real. But so are the risks of significant declines in the Maine economy if only current spending is maintained in the future.