

Appendix 5

Economic Screening Memorandum

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A. Introduction

This memorandum describes the process used to evaluate and screen identified transportation improvements on the basis of their potential impacts on the Aroostook County economy, as well as their effectiveness in meeting the project's purpose and need. The following screening methodology was applied to thirty-one (31) separate corridors to assist in identifying a preferred alternative. The methodology was first applied to 13 corridors (A through M), which were selected for detailed analysis from among more than 40 initial options that were developed during earlier phases of the DEIS. The economic screening was then applied to eleven segments (3 north, 5 central and 3 south) of the 13 initial corridors. From among the eleven segments, five composite corridors were selected for further evaluation, along with modifications of two (H and K) of the 13 original corridors. These corridors and corridor segments have been identified and mapped in other technical reports and are not described in detail below. To assist the reader, the labels applied to the 31 corridors in this memorandum are consistent with those used elsewhere.

The purpose of this technical memorandum is to document the methodology used to screen and rank the various corridors for economic performance and to summarize the results of the screening process. The general methodology used to complete the corridor screening is described in an earlier technical memorandum, "Aroostook County Transportation Study: DEIS Corridor Screening Analysis", prepared on June 12, 2001. That analysis describes the general process used to screen the corridors based on economic, transportation and environmental criteria. This memorandum elaborates upon the methods and results that specifically relate to the economic components of the screening process.

B. Summary of the Economic Screening Process

The economic screening methodology consisted of four steps.

Step 1

The Consultants reviewed the Statement of Project Purpose and Need and isolated those individual statements that addressed the economic purposes of the project. Of 17 screening criteria that were developed from the Project Statement of Purpose and Need, four specifically address economic issues. Those criteria are summarized below:

1. Maintain and expand the Aroostook County economy as it effects:
 - Population
 - Employment
 - Diversification of jobs
 - Income levels (and retail sales).
2. Enhance the marketability of Aroostook County's existing and potential economic assets, particularly existing industrial parks with potential for future expansion.
3. Improve commuter access to existing employment and retail/service centers within Aroostook County; and
4. Improve (freight) connections to markets within and outside of Aroostook County including New England, Canada and beyond.

In addition to these economic objectives, the Project Statement of Purpose and Need implies that the goal of achieving higher rates of economic development within Aroostook County should, to the extent possible, apply to all sub-regions within the study area. While equalizing the distribution of economic benefits throughout the study area may not be possible, corridors that benefited some parts of the study area at the expense of others were considered to be less attractive than those that did not adversely impact individual communities. For example, corridors that diverted through-traffic away from established commercial/retail areas were estimated to have the potential to cause a reduction in retail sales and employment within those affected communities. Therefore, corridors that caused traffic diversion were ranked lower than others that generated comparable county-wide economic benefits, but had less potential “dislocation” effects upon individual communities.

Step 2

The second step in the screening process involved developing methodologies to quantify and compare the corridors against the criteria described above. The elements within Criteria 1, specifically population, employment growth and diversification, income and retail sales, were generated as outputs from an economic model. Other methodologies were developed to address the remaining criteria. The attributes of the economic model and the methodologies used to generate the other criteria used in the analysis, are described in the following section.

Step 3

To compare the relative differences in economic performance among the corridors, the results were then indexed. For each factor assessed, the best corridor performance was indexed to 1.0 and all other corridor outcomes were referenced to that value, resulting in indices between 0 and 1. In the case of negative variables such as business dislocation effects, the worst performing corridor was indexed to -1.0 and less disruptive alternatives were indexed to a maximum value of zero. Consequently, corridors that caused internal dislocation of business activity within the region were adjusted downward in the comparative process.

Step 4

Finally, all corridors considered were compared by their construction cost and overall cost effectiveness. In this analysis, cost effectiveness was determined by first calculating the present dollar value of anticipated future economic benefits from each corridor, measured in terms of impact on gross regional product (GRP). GRP impacts for the corridors were generated using the economic model. The present value of future benefits was then compared to the present value of estimated construction costs for each corridor (exclusive of right-of-way acquisition costs). The measure compares the present value change in GRP resulting for each dollar of construction cost, and provides a basis for comparing corridors which have widely varying construction costs.

C. Screening Methodology

The following section describes the methodologies used to quantify the screening criteria that were developed to compare the impacts of the corridors and corridor segments on the Aroostook County economy. To address the criteria listed above, methodologies were developed to:

- Quantify measurable economic impacts such as changes in population, employment, income, retail sales and gross regional product;
- Quantify the economic value of shortened commuting times for workers traveling between employment and population centers;
- Measure the comparative effectiveness of each corridor to enhance transportation access to existing industrial parks and established industrial and commercial areas;
- Estimate the volume of shipments within, entering and exiting Aroostook County that may be positively impacted by shorter shipping times, improved reliability and increased safety, and
- Estimate the degree to which alternative corridors could cause business dislocation or bypass effects by diverting customers away from existing businesses that depend on through-traffic as a source of sales.

Each of these methodologies is described in greater detail below.

1. Quantify Measurable Economic Impacts

The estimation of economic impacts from each alternative was undertaken using the Regional Economic Models Inc. (REMI) econometric modeling system. The REMI model is a well-known and widely accepted model for conducting the kind of economic impact analysis required in this study. The models used for this study are maintained and updated by the Center for Business and Economic Research (CBER) at the University of Southern Maine. The CBER REMI models actually comprise nine separate models of regions in Maine, including an individual model for Aroostook County. The economic model of the Maine economy is represented by the sum of the economic forecasts for the nine individual regions.

In order to estimate the economic impacts of a particular action using the REMI Model, a series of changes are made to a “baseline” economic forecast. The model then re-estimates economic growth with the specified changes and the difference between the two forecasts (baseline and simulation) comprises the economic impacts that can be attributed to the changes.

In the case of simulating investments in new highways, five major types of changes were made to the model:

- Changes in Trucking Costs
- Tourism Impacts
- Investment in Highway Construction
- Annual Highway Maintenance Expenditures
- Changes in the Value of Commuting Amenity

In this analysis, all changes to the baseline forecast were made to the Aroostook County region. The model then re-estimated economic growth in Aroostook County and calculated the effects of the

change upon the nine other regions. The economic impacts in all regions were then summed to determine the total change in the Maine economy and outputs were generated for both Aroostook County and Maine.

The Aroostook County Transportation Study addresses a 30-year forecast period and all transportation effects associated with the proposed corridors have been projected to the year 2030. Therefore, the economic forecasts used in the screening process were also projected to 2030. Because of the varying and lengthy time periods that would be required to complete the construction of some corridors, as well as the time lag effects for economic impacts to occur, REMI model outputs for years prior to 2030 had limited usefulness in the screening process and were not relied upon. Unless otherwise noted, all data reported in this section are for 2030.

Specific methodologies used to develop the five changes to the REMI baseline forecast, for each of the 31 corridors, are described in the following sections.

a. Changes in Trucking Costs

The change in trucking cost for each industry was computed using the change in truck vehicle hours traveled and the proportion of each industry's total costs accounted for by trucking. The equation is:

$$K_i^y = (k_i (\Delta VHT_i)) C^y$$

Where:

K_i^y = Change in trucking costs in industry i in year y.

k_i = Proportion of total costs accounted for by trucking in industry i.

ΔVHT_i = Change in trucking vehicle hours traveled (as a percentage of baseline VHT for the corridor) estimated by VHB. These truck VHT changes are estimated for each corridor in a separate technical memorandum prepared by VHB, which describes the transportation screening process.

C_y = A construction period factor. It is assumed that each corridor will be opened to traffic as construction proceeds (except in the case of Corridor H, which is not opened until it reaches Presque Isle.) C ranges from 0.1 in the second year of construction to 1.0 when construction is completed for a 10-year project. It is proportionately estimated for projects of shorter construction periods.

The proportion of total costs accounted for by the trucking industry (k_i) is taken from the Transportation Satellite Accounts of the National Income and Produce Accounts estimated by the U.S. Bureau of Economic Analysis. The baseline values of this variable are:

Durable Goods Manufacturing	0.03457
Nondurable Goods Manufacturing	0.03457
Mining	0.04263
Construction	0.0769
Transportation and Public Utilities	0.05053
Finance, Insurance, and Real Estate	0.0069
Retail	0.0489
Wholesale	0.0489
Services	0.02851
Agriculture, Forestry, and Fishing	0.070094

The input values for k , assumed that 95% of transportation costs for Aroostook County firms were in trucking, based on the results of the survey of Aroostook County firms conducted for this project.

b. Tourism Effects

Tourism impacts are measured in the REMI Model as a change in visitor days, defined as one person visiting for one day. The types of visitor days measured in the Model are of five different types, including day trippers and four categories of overnight visitors. Overnight visitor days are classified based on the type of overnight accommodation used. These four types of overnight visitors include the following:

- Hotels/motels
- Campgrounds
- Home rental/summer home
- Visiting friends or relatives

Tourist spending patterns are strongly related to the type of overnight accommodation used. Therefore, the REMI Model calculates different per capita spending levels for each type of visitor day and translates changes in visitor days into changes in aggregate tourism spending in retail and service industries. The following process was used to estimate changes in visitor days resulting from each of the proposed study area corridors.

The first step in estimating the impacts of each corridor on tourism visitation involved preparing a baseline 2030 forecast of visitor days under the No Build Alternative. This baseline 2030 forecast was prepared by RKG Associates, Inc., using a number of data sources. Secondary research was used to estimate the current total numbers, travel characteristics, types of accommodations used and spending patterns of Canadian and Northeast US visitors to Maine and to Aroostook County in particular.

Secondary sources used included a survey of Maine's travel market during 1999, prepared by Longwoods International (LI), a Toronto-based research firm and consultant to the Maine Office of Tourism. LI conducted comparable tourism surveys in 1997 and 1996, which focused on Maine's Canadian visitor markets only. The Consultants also reviewed a statewide economic impact of analysis of expenditures by tourists during calendar year 1991, prepared

by Davidson-Peterson Associates, Inc. (DPA) for the Maine Tourism Coalition. Finally, the Consultants examined the “Evaluation of Tourism Related Impacts” (Chapter 7) in the 1993 Economic and Transportation Impact Study for Aroostook County Maine. Davidson-Peterson Associates also prepared the tourism analysis contained in that report. DPA’s analysis included an inventory of lodging facilities that existed in Aroostook County at the time.

These sources contained estimates of annual visitation to Maine in each of the years surveyed and provided distributions of total visits by in-state destination and by type of accommodations used. In addition, the Consultants obtained trend data on retail sales for Maine, Aroostook County and five sub-districts within the county, from the Maine State Planning Office. This data was reported by store type and included specific annual sales totals for restaurants and lodging facilities, which are important indicators of tourism spending. This source was used as a check to test the reasonableness of current (2000) estimates of visitor patterns within Aroostook County, particularly overnight stays in paid lodging. Historical growth rates of tourism visitation, along with the 2030 baseline traffic forecasts, were also used to project tourism visitor days to 2030 under the No Build Alternative.

The tourism data supplied by these sources were sufficient to derive specific visitor estimates for Aroostook County and to convert the data into the format used by the REMI Model. This exercise involved translating trip data into estimates of additional visitor days by type of travel (day trip or overnight stay) and by types of accommodations used. A number of assumptions were used to make this conversion, and are discussed below.

Step 1: Estimate of Current Tourism Travel Patterns to Maine

In 2000, Longwoods International conducted a survey for the Maine Office of Tourism to estimate trends in U.S. visitation to Maine during the preceding calendar year. LI estimated that there were 43.7 million recreational and business trips made to Maine during 1999, including Maine resident and US non-resident visitors.¹ The same report estimated that these travelers spent \$5.2 billion while visiting Maine. LI also found that the number of tourist visits to Maine and total expenditures by travelers had grown by more than 8% per year between 1997 and 1999.

An earlier (1998) survey conducted by the same company concluded that Maine attracted 6.7 million Canadian visitors during 1997, and that Canadians represented roughly 12 percent of the state’s tourism market at that time. LI estimated that Canadians spent \$440 million in Maine during 1997. Due to weaknesses in the Canadian dollar and changes in tax policy, Canadian travel to Maine was essentially flat over the prior year.

LI did not update its Canadian travel survey in 1999 to provide a comparable estimate to the US market research. However, if recent Canadian travel to Maine has been flat, then adding the findings of the two surveys would provide a reasonable estimate of Maine’s total current travel market. According to LI, annual tourism travel to Maine,

¹ The term “trip” used in the Longwoods International study, refers to a person making a visit to Maine. (A family of four on vacation would be counted as four trips.) This is a different measurement than “tourism visitor days” used by the REMI Model. The number of trips must be multiplied by an average length of stay in order to estimate the total number of visitor days spent within the State.

including US and Canadian sources, totals approximately 50.5 million annual trips and \$5.7 billion in tourism spending.² The number and distribution of annual trips to Maine by origin and purpose are summarized in Table 1.

**Table 1
 Number and Distribution of US and Canadian Trips to Maine**

Trip Purpose	Day Trips (in millions)				Overnight Trips (in Millions)				All Trips
	Maine Residents	US Non-Residents	Canadian Visitors[1]	Total Day Trips	Maine Residents	US Non-Residents	Canadian Visitors[1]	Total Overnight Trips	
Marketable Pleasure Trips	9.1	10.9	4.6	24.6	0.7	3.6	0.9	5.2	29.8
Visit Friends or Relatives	5	6.5	0.7	12.2	0.6	3.5	0.2	4.3	16.5
Business Travel	1.8	1	0.3	3.1	0.2	0.8	0.1	1.3	4.2
Total:	15.9	18.4	5.7	40.0	1.5	7.9	1.1	10.5	50.5
NOTE: [1] Canadian visitor data is reported for calendar year 1997, all other estimates are 1999.									

Source: Longwoods International. Toronto, Canada.

The vast majority of annual visitors to Maine (roughly 40 million trips) are day trippers. Roughly 46% of these day trippers (18.4 million) are from other US states, primarily Massachusetts and New Hampshire. Maine residents make an additional 15.9 million in-state recreational and business day trips (40% of the total) and Canadian visitors represent the remaining 14% of the day trip market. An estimated 5.7 million Canadian visitors made day trips to Maine in 1997, with about 88% of these day trips originating in New Brunswick. Due to Aroostook County’s proximity to New Brunswick, a large share of these Canadian day trips could have Aroostook County destinations or involve a trip through the region on the way to other nearby destinations. At the same time, it can be assumed that relatively few recreational day trips are made to Aroostook County from other New England States or from Southern Maine, due its remoteness from those population centers.

Canadian visitors make up a slightly smaller share (9.5%) of Maine's 10.5 million overnight visitor market. An estimated 1.5 million Maine residents and 7.9 million visitors from other parts of the US made overnight trips to or within Maine in 1999, compared to roughly 1.1 million Canadians. Of these overnight trips, nearly half or about 5.2 million, were classified as “marketable pleasure” or tourism-related trips.

² Because Canadian visitation to Maine has been growing at a slow rate in recent years, the Consultants did not attempt to update the 1997 Canadian survey data to be comparable to the 1999 estimates of Maine’s US travel Market. It is assumed that these two studies, combined, provide a reasonable estimate of total tourism travel to Maine from both US and Canadian sources.

Another 4.3 million trips (41%) involved visits to friends or relatives and the balance of 1.3 million trips (12%) were business travel. In total, the LI data show that Maine currently attracts nearly 30 million marketable pleasure trips per year. About 17% of these trips involve overnight stays in paid lodging and the balance represent recreational day trips.

Step 2: Conversion of Statewide Visitor Data to Tourism Visitor Days

Having established a rough estimate of total visitation to Maine from all sources, the next step involved converting trips to “visitor days” and allocating those visitor days among the five trip types that are recognized by the REMI Model. RKG Associates relied upon the sources cited above to allocate total overnight stays by type of accommodations used and then multiplied the number of overnight visits by an average length of stay.

According to the 1999 LI survey, overnight (US) pleasure travelers (using paid accommodations) reported spending an average of 4.2 nights in Maine. LI’s earlier survey of Canadian travel patterns reported that Canadian overnight visitors (including business travelers) spent an average of 3.2 nights in Maine. DPA’s 1992 study provided more detailed length of stay data by type of accommodation. According to that source, overnight travelers spent an average of 2.4 nights at hotels, motels or resort properties, 5.2 nights at cabins, cottages or condominiums and 3.7 nights at campgrounds. Because DPA surveyed facility operators rather than visitors, that report does not account for travelers who may stay at more than one accommodation during a trip to Maine.

After considering these data sources, RKG Associates prepared a baseline (1999) estimate of total visitor days in Maine, for purposes of forecasting future visitor volumes to 2030. This estimate is consistent with the trip data presented above and appears in Table 2. As shown, total 1999 visitor days were estimated at 73.4 million, of which roughly 45% are associated with overnight travel. Total tourism travel was estimated to have grown by an average of 2.7% annually during the 1990’s, with overnight travel growing at a slightly faster annual rate than day trips.

Table 2
Estimate of Annual Maine Tourism Visitor Days
by Type and Accommodation Used: 1991-1999

Type of Visit	Visitor Days (Millions)		Change: 1991-1999	
	1991	1999	Number	Percent
Hotel/Motel	11.0	13.8	2.8	25.5%
Rent Apt/Summer Home	2.1	2.6	0.5	25.5%
Stay w/Friends or Relatives	6.8	8.5	1.7	25.5%
Camper	6.6	8.3	1.7	25.5%
Day Tripper	32.7	40.1	7.3	22.5%
Total Visitor Days	59.2	73.4	14.1	23.8%
Overnight Visitor Days	26.5	33.3	6.8	25.5%

Sources: Longwoods International, Davidson Peterson Associates and RKG Associates, Inc.

Step 3: Allocation of Tourism/Travel Patterns to Aroostook County

Once the overall size of Maine’s travel market was quantified, the next step involved estimating the portion of the statewide travel market that is being captured by Aroostook County. LI’s 1999 survey, as well as an earlier 1992 survey conducted by DPA, provided limited information on the destinations of travelers when visiting Maine. DPA’s prior work included a comprehensive inventory of lodging rooms by type of facility and by travel regional. This data, coupled with trends in lodging industry sales, provide a reasonable indicator of the amount of statewide tourism travel (particularly overnight travel) that is currently going to Aroostook County.

Summary findings from these sources include the following:

- According to DPA’s research for the 1993 Aroostook County Economic and Transportation Impact Study, the inventory of overnight accommodations at that time totaled 2,600 rooms/sites/units and the number of annual visitors to the study area totaled 143,000. Aroostook County contained about 3.2% of Maine’s accommodations inventory and captured about 1.7% of its overnight visitor market in 1991. DPA also estimated that Loring AFB, which was still operational at the time, generated about 10% of all overnight visits to the region. The 1991 accommodations inventory and estimated distribution of overnight visits appear in Table 3.

**Table 3
 Estimated Aroostook County Lodging Inventory and
 Annual Overnight Visitors: 1991**

Type of Accommodations	Number of Properties	Total Units [1]	Estimated Annual Visitors	Avg. Annual Visitors/Property	Average Annual Visitors/Unit
Hotels/Motels/Resorts	45	1,025	59,029	1,312	58
Cabins/Cottages/Condos	8	59	2,002	250	34
Wilderness Lodges/Camps	18	598	3,667	204	6
Campgrounds	14	905	77,990	5,571	86
Totals:	85	2,587	142,688	1,679	55
NOTE: [1] Totals in this column may represent individual rental units, rooms or sites.					

Source: Davidson Peterson Associates.

- Same day auto trips by Canadian visitors traveling through Aroostook County border crossings were estimated at 3.1 million vehicles in 1991. DPA assumed that these vehicles had an average occupancy rate of nearly 3 and that 90% were bound for Aroostook County destinations. These assumptions produced an estimated 8.2 million Canadian day trips to Aroostook County in 1991. (No estimate was given for day trips to the study area from other parts of Maine). This figure is substantially higher than the more recent 1997 estimate of 5.7 million Canadian day trips to all Maine destinations, reported by Longwoods International.
- LI's study estimated that of the roughly 4.3 million US tourists who made "marketable" overnight trips to Maine in 1999, about 6% (258,000) visited Aroostook County at some point during their stay.³ LI did not report the destinations of Canadian visitors to Maine.
- According to the Maine State Planning Office, total 2000 taxable lodging sales in the "Northern Maine District" (Aroostook County) exceeded \$7.9 million. This total represented less than 1.7% of statewide lodging sales of \$479.2 million for the same year. Since 1996, annual lodging sales in Aroostook County have increased by an average of more than 8.5% per year, faster than the 7.2% annual growth rate for Maine as a whole.

³ "Marketable" overnight pleasure trips exclude business travelers or visits to friends or relatives. Many overnight travelers to Maine reported visiting multiple regions while in the State. Therefore, a portion of the visitors to Aroostook County may not have purchased lodging there. LI did not report destinations of day trippers.

Table 4
Estimate of Annual Aroostook County Visitor Days
By Type and Accommodations Used: 1991-1999

Type of Visit	Visitor Days (Millions)		Change: 1991-1999	
	1991	1999	Number	Percent
Hotel/Motel	388,593	461,747	73,155	18.8%
Rent Apt/Summer Home	28,969	34,423	5,454	18.8%
Stay w/Friends or Relatives	362,983	431,317	68,333	18.8%
Camper	211,257	251,027	39,770	18.8%
Day Tripper [1]	8,200,000	1,954,098	(6,245,902)	-76.2%
Total Visitor Days	9,191,802	3,132,611	(6,059,190)	-65.9%
Overnight Visitor Days	991,802	1,178,514	186,712	18.8%

NOTE:
 [1] 1991 day trip estimate provided by Davidson Peterson Associates.

Sources: Longwoods International, Davidson Peterson Associates and RKG Associates, Inc.

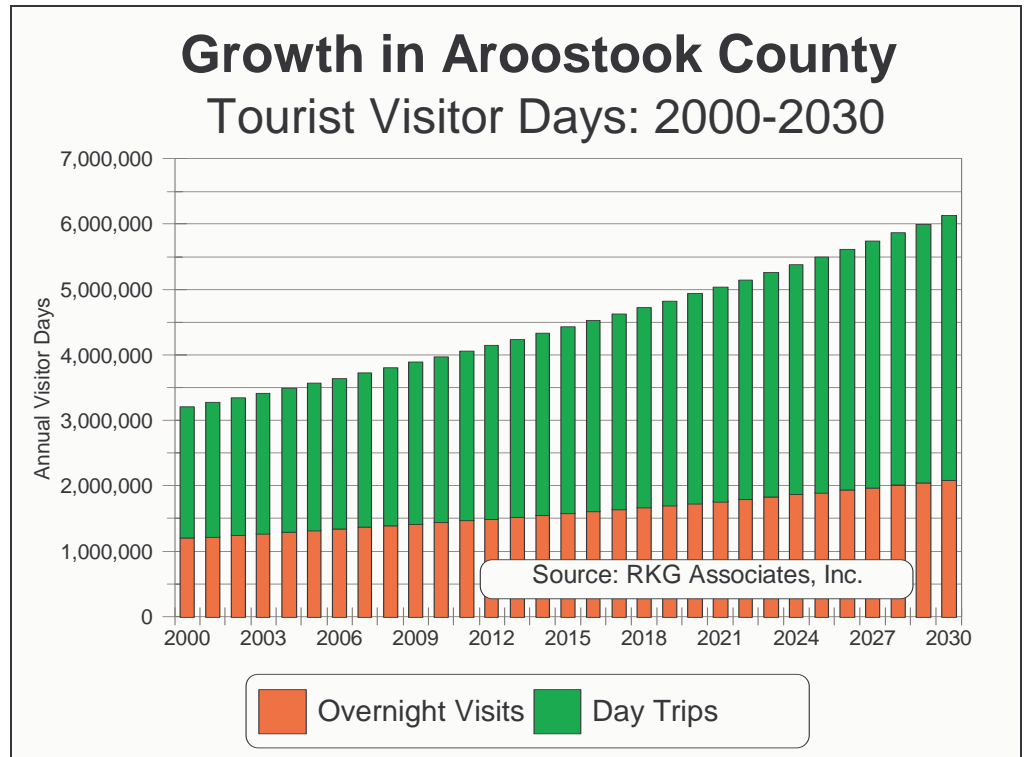
Based on DPA's 1991 research and the limited information described above, RKG Associates produced a 1999 estimate of annual tourist visitor days to Aroostook County and distributed those visits by type. This distribution appears in Table 4. Based on Aroostook County's estimated share of the Maine travel market, RKG estimated total 1999 visitation at roughly 3.1 million visitor days, including roughly 1.2 million overnight stays and 1.9 million day trips. Between 1991 and 1999, the rate of growth in overnight stays is estimated to have averaged about 2.2% annually. Day trip volumes show a substantial decline, however, due to reduced Canadian shopping patterns in the region since the early 1990's. These growth rates, which are slightly lower than the state average, are reasonable given the closure of Loring AFB in 1993 and the subsequent loss of visitor traffic that had been generated by that facility.

Step 4: 2030 Baseline Tourism Forecast

After estimating current levels of tourism visitation to Aroostook County, it was necessary to prepare a reasonable forecast of future visitor days to 2030 under the baseline or No Build Alternative. A number of factors were considered in preparing the forecast of baseline growth in tourism visitor days. Among these factors were (1) actual growth rates in local and statewide visitor patterns over the past decade as reported above, (2) recent Aroostook County growth trends in lodging and restaurant sales, (3) the status of tourism development efforts in the region (as discussed in the Existing Conditions report), (4) projected near-term growth rates in statewide tourism and (5) the 2030 No Build average daily traffic growth rates for existing corridors in the study area. The Consultants also evaluated the tourism growth forecasts contained

in the 1993 Economic and Transportation Impact Study for Aroostook County Maine as a starting point for developing new forecasts.

Figure 1



Overnight, day trip and total annual tourist visitor days to Aroostook County are forecast in Figure 1. Figure 1 shows that total visitor days are projected to increase to roughly 6.1 million by 2030, representing an overall annual growth rate of 2.2% for the period. Overnight visits are projected to grow at an average rate of 1.8% per year (slower than recent trends) and reach nearly 2.1 million by 2030. Day trips are projected to grow at a faster annual rate of 2.4%, and reach 4.0 million by 2030. This latter projection is based on the assumption that Canadian cross-border traffic will stabilize and resume moderate levels of growth within the next several years. Although this may be an optimistic assumption, projected day trip volumes to Aroostook County in 2030 are still only half of the actual total that was estimated for 1991.

The Consultants believe that these growth rates are reasonable in light of ongoing regional efforts to expand and develop additional tourism attractions, particularly winter sports facilities, in Aroostook County. The forecast growth rates for overnight visits are slightly more conservative than recent trends and are also projected to

remain below statewide levels throughout the forecast period. It is also assumed that the estimated current percentage distribution of overnight stays by type of accommodation will remain constant through 2030. While it is possible that some categories of overnight stays may grow at faster rates than others, there is insufficient information available to forecast growth rates for specific categories of overnight visits. The current percentage distribution of overnight stays by type of accommodation was therefore applied to the 2030 forecast to provide future estimates of annual overnight visits in hotel/motel rooms, campgrounds, vacation rentals, seasonal/second homes or stays with friends or relatives.

Step 5: Impacts of Corridor Improvements on Future Tourism Visitation

After the overall size of these potential markets was estimated, it was necessary to estimate the potential of the proposed corridors to change annual visitation to and through Aroostook County in comparison to the No Build Alternative. In essence, the analysis assumes that each corridor has the potential to impact tourism visitation in proportion to the percentage change in travel time saved as a result of the improvements. Therefore, once the baseline visitor day data was estimated for each type of tourist for each year from 2005-2030, these were increased by the following equation:

$$T_t^i = V_t^i (1 + \Delta VHT_{nt}) C^y$$

Where:

T_t^i = Change in tourist visitor days of type t in year i .

V_t^i = Baseline visitor day estimate

ΔVHT_{nt} = Change in non-truck Vehicle Hours Traveled (as a percentage of baseline VHT for the corridor) estimated by VHB.

C^y = A construction period factor.

Again, the construction period factor assumes that each corridor would be opened to traffic as construction proceeds (except in the case of Corridor H, which is not opened until it reaches Presque Isle.) C ranges from 0.1 in the second year of construction to 1.0 when construction is completed for a 10-year project. It is proportionately estimated for projects of shorter construction periods.

c. Highway Construction Costs and Annual Maintenance Expenditures

Construction expenditures in a region result in the hiring of labor and purchases of construction materials, which in turn generate increased sales for companies that supply the construction industry. The REMI model calculates the effects of increased construction spending on both construction employment and construction-dependent industries. The inputs required to make these forecasts are simply the total construction cost and the phasing of expenditures over the term of the forecast.

Total corridor construction costs were estimated by VHB. Given the wide range of corridors considered, construction costs fall within a wide range, from roughly \$18.4 million to nearly \$635 million in 2000 dollars. These costs are reported in Table 5, which appears in the reporting of the REMI model results in Section 3.

The assumed construction-phasing period for each corridor varied with the size of the project. It was assumed that the smallest corridors, defined in terms of length and cost, could be constructed in as little as two years, while the largest corridors would require a maximum of ten years to complete. The total construction cost was then divided evenly among the number of years of construction.

Annual construction expenditures were input to the REMI model as an increase in construction demand within Aroostook County. Adjusting demand, rather than applying increased spending directly to the local construction industry, accounts for the possibility that firms headquartered outside of Aroostook County could undertake a major portion of the work. This would be particularly likely for the larger-scale corridors.

Future annual maintenance expenditures for new highways are estimated as \$17,000 per mile for a four-lane corridor. This figure is multiplied by the number of miles in each corridor and adjusted for the construction period, in the same manner as used for construction spending.

The above changes, including trucking cost savings, tourism impacts, highway construction costs and annual maintenance expenses, were all entered as inputs to the REMI model. A fifth model change accounted for the economic value of improved commuting access for Aroostook County residents, and is described in the next section.

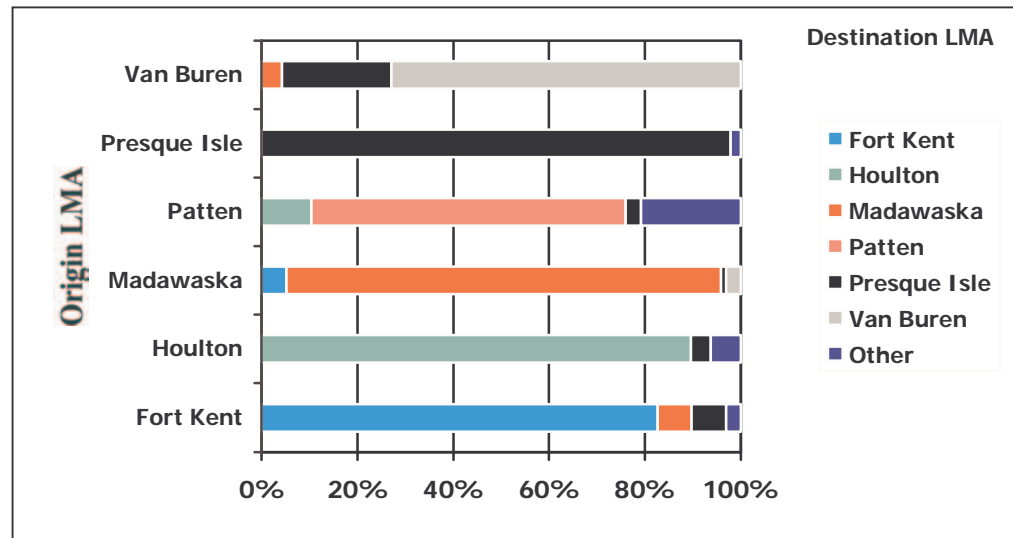
d. Economic Value of Shortened Commuting Times

In addition to lowering the costs of transporting goods to and from Aroostook County, improved highways can make it easier for residents to commute to jobs within the region. The effects of improved highways can reduce commuting time, enable workers to access a greater variety of employment opportunities or reduce overall vehicle operating costs. Commuting enhancements also increase the attractiveness of a region to potential employers and in-migrants.

This issue is particularly important in the case of Aroostook County, since as is shown in Figure 2, residents overwhelmingly stay within their own local area for work. The lack of labor mobility between labor market areas can indicate fewer employment opportunities for workers, as well as recruitment challenges for larger employers.

The REMI model allows the effects of improved commuting to be modeled through a variable called the commuting amenity. In the model, this variable increases the attractiveness of a region to in-migrants. The result is faster population growth than would otherwise occur.

Figure 2
Aroostook County Commuting Patterns by Labor Market Area



Source: University of Southern Maine, CBER

The calculation of the commuting amenity value for this study was conducted using survey data recently developed by the University of Southern Maine Center for Business and Economic Research. This data consisted of roughly 900 random sample phone interviews of households in Aroostook County conducted for the Maine Labor Force Analysis project. Data on commuting time, distance, and wage rates were collected and used to estimate a commuting amenity value, which was calculated for each corridor using the following equation:

$$\Delta CV = \sum \left((W_{ij} * 0.4) T_{ij} \right) \Delta_{vht}^c (E_i C_{ij}) C^y$$

Where:

ΔCV = Change in commuting amenity value

W_{ij} = Average wage rate of residents of labor market area i commuting to labor market area j.

T_{ij} = Average time of commuting between labor market area i and labor market area j.

Δ_{vht}^c = Change in vehicle hours traveled for passenger vehicles (excluding trucks)

E_i = Employment in labor market area i.

C_{ij} = Proportion of employees in labor market area I commuting to labor market area j.

C^y = Construction adjustment as defined above.

0.4 = discount of wage rate to reflect value of commute time.

In calculating the commuting amenity for any given corridor, this equation was used for all labor market areas through which a proposed corridor transited. The six labor market areas for Aroostook County include (from south to north):

- Patten-Island Falls
- Houlton
- Presque Isle-Caribou
- Van Buren
- Madawaska
- Fort Kent-Allagash

The total annual value of the commuting amenity ranged from a low of roughly \$10,000 per year to a maximum of nearly \$1.2 million. Resulting commuting amenity values for each of the 31 corridors, along with the resulting REMI outputs, appear in Table 5 below.

2. REMI Forecast Results

Using the methodology outlined in the preceding sections, the Consultants developed REMI model simulations for 31 separate corridors and corridor segments that were identified during the course of the screening process. These corridors have been described in other technical memoranda and are identified in Table 5. The estimated current total construction cost, estimated annual commuter amenity value and resulting 2030 REMI outputs for the 31 corridor simulations are summarized in the table. These outputs quantify the economic impacts of the proposed corridors on Aroostook County in the year 2030, in comparison to the No Build Alternative. Outputs provided in the table include the net change in total county population, employment, disposable personal income, total annual retail sales and gross regional product (GRP).

As shown, the maximum 2030 employment effects on the Aroostook County economy, for any corridor total slightly less than 600 jobs and 2030 population impacts exceed 1,000. Corridors with the largest employment impacts have similar proportional effects on personal income, retail sales and GRP. Corridors H and K and Composites 1 through 5 have comparable economic effects, with 2030 employment impacts varying within a range of roughly 80 jobs.

**TABLE 5:
Summary of 2030 REMI Forecast Results: Aroostook County**

Simulation Number	Corridor Description	Total Construction Cost (Mil \$)	Annual Value Commuting Amenity (Mil \$) [1]	REMI Model Outputs: Aroostook County				
				Population Change [2]	Employment Change [3]	Disposable Pers. Inc. Mil \$92 [4]	Aggregate Retail Sales Impact [5]	GRP Change Mil \$92 [6]
13 ORIGINAL CORRIDORS								
1	Corridor A	\$281.80	\$0.60	635	340	\$14.78	\$5.67	\$17.47
2	Corridor B	\$390.30	\$0.48	594	312	\$13.58	\$5.04	\$16.04
3	Corridor C	\$337.70	\$0.09	222	126	\$5.76	\$1.78	\$6.68
4	Corridor D	\$220.00	\$0.22	61	35	\$1.22	\$0.53	\$1.52
5	Corridor E	\$232.90	\$0.51	121	61	\$2.70	\$0.98	\$2.20
6	Corridor F	\$94.20	\$0.09	54	32	\$1.16	\$0.58	\$1.51
7	Corridor G	\$553.50	\$0.05	269	150	\$7.64	\$1.75	\$8.53
8	Corridor H	\$439.40	\$0.93	1,089	564	\$24.50	\$9.52	\$28.99
9	Corridor I	\$434.90	\$0.31	422	229	\$10.15	\$3.55	\$11.92
10	Corridor J	\$423.00	\$0.63	793	419	\$18.45	\$6.84	\$21.69
11	Corridor K	\$426.60	\$0.99	1,012	529	\$22.68	\$9.01	\$26.94
12	Corridor L	\$40.50	\$0.09	0	1	\$0.07	\$0.02	\$0.06
13	Corridor M	\$18.40	\$0.01	0	1	\$0.05	\$0.01	\$0.05
CORRIDOR SEGMENTS								
<i>Southern Options</i>								
14	So. 1 (Portion of Corridors A and B)	\$138.30	\$0.38	188	109	\$3.13	\$1.77	\$4.34
15	So. 2 (Portion of Corridor H)	\$155.00	\$0.20	196	114	\$3.29	\$2.38	\$4.54
16	So. 3 (Portion of Corridor K)	\$173.80	\$0.40	133	82	\$2.40	\$2.50	\$3.30
<i>Middle Options</i>								
17	Mid. 1 (Portion of Corridor A)	\$187.30	\$0.18	118	45	\$2.17	\$1.59	\$3.00
18	Mid. 2 (Portion of Corridor B)	\$197.90	\$0.10	65	100	\$1.36	\$0.87	\$1.83
19	Mid. 3 (Portion of Corridor K and upgrades of Rte. 1)	\$113.40	\$0.17	151	63	\$2.70	\$1.46	\$3.94
20	Mid. 4 (Corridor L with upgrades of Route 1)	\$113.20	\$0.28	93	56	\$1.74	\$2.37	\$2.51
21	Mid. 5 (Corridor M with upgrades of Route 1)	\$118.10	\$0.15	83	70	\$1.57	\$1.28	\$2.24
<i>Northern Options</i>								
22	No. 1 (D, E and Portion of I)	\$345.70	\$0.28	91	70	\$2.09	\$1.38	\$2.88
23	No. 2 (Portion of H and K)	\$166.80	\$0.15	77	55	\$1.56	\$1.19	\$2.20
24	No. 3 (Portion of B)	\$148.10	\$0.05	27	22	\$0.70	\$0.41	\$0.92
COMPOSITES AND MODIFIED CORRIDORS								
25	Composite 1 (So:A/B/Mid:L/No:D,E,I)	\$599.50	\$1.07	970	515	\$21.27	\$8.78	\$25.56
26	Composite 2 (So:A/B/Mid:L/No:D(2Lane),E(2Lane),I)	\$477.80	\$1.07	966	509	\$21.04	\$8.84	\$25.30
27	Composite 4 (So:H/Mid:L/No:D,E,I))	\$634.96	\$1.07	959	498	\$21.52	\$8.12	\$25.36
28	Composite 5 (So:K/Mid:L/No:D,E,I)	\$616.15	\$1.19	965	504	\$21.33	\$8.45	\$25.34
29	Composite 6 (So:A/B/Mid:K/No:D,E,I)	\$599.24	\$1.19	735	385	\$15.52	\$6.61	\$18.74
30	H Modified	\$434.24	\$0.93	1,096	578	\$24.48	\$9.98	\$29.32
31	K Modified	\$415.22	\$0.99	1,090	571	\$24.32	\$9.81	\$29.05

TABLE NOTES:

- [1] Estimated dollar value of annual commuter amenity in Millions of dollars. See Section 2.d for methodology.
- [2] Difference in total Aroostook County Population in 2030, compared to the No-Build Alternative.
- [3] Difference in total Aroostook County 2030 employment, compared to the No-Build Alternative.
- [4] Difference in real aggregate disposable personal income in 2030, compared to the No-Build Alternative. Values are expressed in millions of 1992 constant \$.
- [5] Difference in total Aroostook County retail sales in 2030, compared to the No-Build Alternative. Values are expressed in millions of current dollars.
- [6] Difference in real Gross Regional Product in 2030, compared to the No-Build Alternative. Values are expressed in millions of 1992 constant \$.

3. Other Economic Screening Criteria

As previously noted, the Consultants developed four additional economic screening criteria that were not generated using the REMI model. In general, these other criteria are intended to measure the potential of each corridor to improve highway access and service to existing employers and areas of potential future employment growth, such as industrial parks or central business districts. The three criteria used to quantify the level of improved transportation service were (a) the relative effectiveness of each corridor in improving highway access to existing industrial parks and employment centers; (b) the number of existing jobs (based on employer locations) that could be better accessed by the region's work force and (c) the degree to which existing freight generators would be likely to use each corridor as a shipping/receiving route for truck shipments.

A fourth variable was developed to consider the possible negative sub-regional effects of certain corridors. Because the REMI Model only measures economic impacts on Aroostook County as a whole, it is not sensitive to "sub-regional" effects, such as the internal relocation of population, employment or retail sales within the County. While the overall county economy may grow in the aggregate, some corridors may benefit certain areas of the region at the expense of others, or cause the internal dislocation of businesses due to changes in regional traffic patterns. This type of impact, which is sometime referred to as bypass effects, was also considered in the screening process.

Specific methodologies to address these criteria are described below, with resulting values for each corridor reported at the conclusion of the Section.

a. Improve Access to Existing Industrial Parks and Regional Employment Centers

Using information contained in the Existing Socioeconomic Conditions: Technical Memorandum, as well as resource mapping and other available information, RKG Associates identified the general locations of industrial parks, downtown and village business districts, highway commercial centers (i.e. Route 1 near Houlton, Presque Isle and Caribou), major employers, airports and similar economic resources within the study area. RKG Associates also obtained estimates of population and employment by municipality to further show the geographic distribution of existing economic activity within the region. To the extent possible, the consultants considered the comparative size of these existing activity centers, their relative importance to the region's economy today, and their long-range expansion potential in the future.

For screening purposes, long-range expansion potential was simply defined by physical capacity. That is, an industrial park with 100 available acres was assumed to have greater expansion potential than a park with only 25 acres remaining. RKG Associates also considered the potential for these activity centers to realize major access improvements. Because the primary direction of freight flows out of the region is from north to south via I-95, businesses located in Madawaska were expected to receive relatively greater transportation costs savings from Corridor K to Houlton for example, than would businesses located in Presque Isle or Mars Hill. Similarly, Corridor K would offer fewer access benefits to industrial park land located in Houlton, because improved connections to the north are less important to employers in that location.

RKG Associates then examined the 31 transportation improvements to determine which Study Area communities would be most likely to be served by each individual proposal. These communities were separated between those that were served directly by a given corridor, and those that were remote from the corridor but could be expected to benefit from it. For example,

Corridor H could have a secondary benefit to population/employers in Van Buren, who could access the section of the highway improvements from Caribou south, but would offer virtually no benefits to Ashland, whose businesses would continue to use Route 11.

After identifying the communities that would be served, RKG Associates used two indicators as a “proxy” measure to estimate that portion of the Study Area’s economy which could be enhanced by each improvement. The first was the amount of available industrial park acreage and the second was the current total non-farm wage and salary employment by community. (This employment measure indicates where existing jobs in Aroostook County are physically located.)

The number of jobs located in the areas served by a proposed transportation improvement, provides an indicator of both the concentration of local industries and potential numbers of commuters that would be likely to use the improvement. It was considered to be a useful measure of each Corridor’s capacity to better integrate the region’s labor market areas and enhance the ability of major employers to draw labor from wider commuting ranges. It is a similar concept to the commuting amenity value described above.

Available industrial park acreage is a comparable indicator to employment, due to the fact that most of the region’s major employers are also located either within or very near industrial parks. However, it is also a different measure in that it focuses on where the region has available capacity to support future economic growth. For example, due to the location of Loring Commerce Centre and other available industrial acreage in Fort Fairfield, Limestone and Easton, that part of Aroostook County is likely to capture a much larger share of future Aroostook County employment growth, than is indicated by the current number of jobs which are located in these communities.

The industrial land and employment inventories for all affected communities were then adjusted using a weighting matrix to distinguish between (a) the effects of new corridors versus upgrades, (b) impacts between communities which are physically located on the corridors, compared to more remote locations that might receive a “secondary” benefit and (c) northern and southern portions of the Study Area. The “weighted” values of existing acreage and jobs in the Study Area that could be potentially served by each are listed in Table 5. As could be expected, the more extensive improvements, which are designed to link the region to I-95 and Canada, serve a larger share of the region’s economic base than do the more limited improvements that are designed to alleviate local bottlenecks.

b. Improve Truck Freight Services to/from and Within Aroostook County

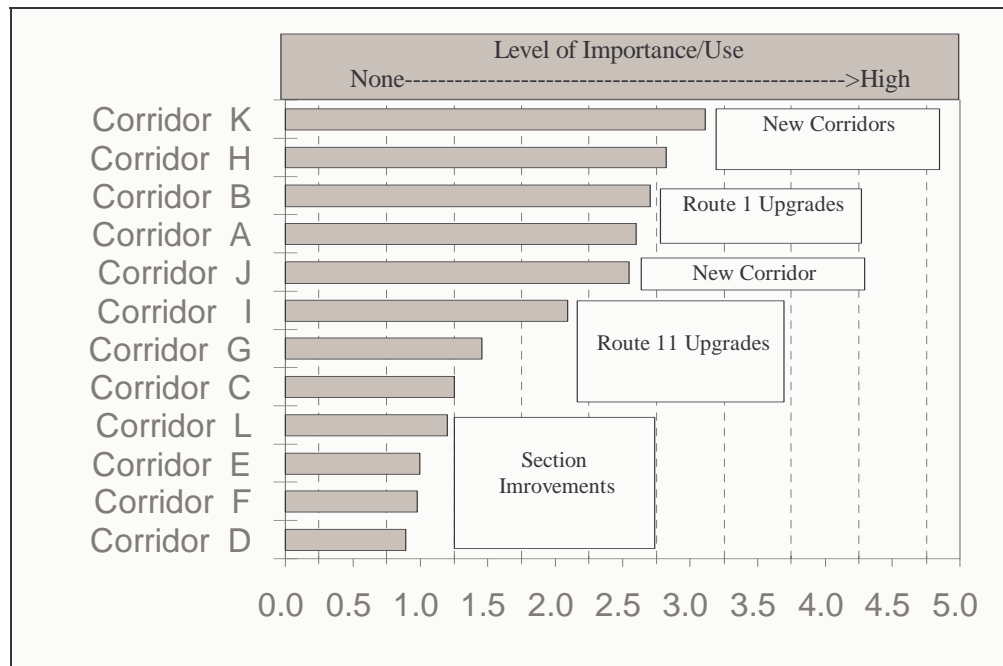
The third screening criteria specifically addressed the extent to which existing Aroostook County generators of truck shipments would be likely to use each proposed corridor as a shipping or receiving route. This is a similar measure to the calculation of trucking cost savings to local industries that was described in the previous section, but is intended to provide a more direct indicator of local industries’ expected usage of the proposed corridors and the transportation benefits they would be likely to derive.

As part of the Aroostook County Transportation Study, RKG Associates, Inc. composed and distributed an extensive transportation issues survey to more than 300 Aroostook County companies in early 2001. The survey sample included the region’s largest employers and was targeted to companies that were likely to send or receive significant volumes of inbound/outbound freight. The purpose of the survey was to gather information from

companies concerning shipping volumes and directional flows, current transportation issues and expected responses to proposed corridors. Respondents were also asked to evaluate the 13 original corridors that survived the initial screen process (A through M) in terms of their expected usage of the each corridor if it existed today and the expected benefits of each corridor to their business (if any). Respondents were also asked to express any concerns they might have regarding possible detrimental effects of any corridor on their business operations.

In total, 64 Aroostook County businesses responded to the survey (21%), including several of the region's largest employers. Respondents employed a total of nearly 3,700 workers and either sent/received nearly 6,500 shipments per week, 95% by truck. The respondents provided fairly detailed information concerning directional flows, origins and destinations of freight movements, mode of shipments, truck fleet characteristics and perceived transportation deficiencies in the region. Respondents were also asked to rate each corridor in terms of its potential to carry shipments to/from their place of business. A 1-to-5 rating scale was provided, with 5 indicating an expected high level of use. The average ratings applied to all corridors by all survey respondents, are summarized in Figure 3.

Figure 3
Business Survey Rankings of 13 Original Corridors



Note: Corridors ranked by 57 Aroostook County businesses on a scale of 1 to 5, with 5 indicating an expected high level of use.
 Source: Aroostook County Transportation Study Business Survey

Using the raw survey data, RKG Associates was able to geographically distribute responses from various locations within the Study Area. Data was grouped for companies located along the Route 1 Corridor between Madawaska, Ft. Kent and Van Buren, the Route 11 Corridor south of Ft. Kent, the Limestone/Ft. Fairfield area (including Loring), the Presque Isle/Caribou area and the Route 1 Corridor from Houlton to Mars Hill. For each of these sub-areas, weekly

freight shipments were summed and extrapolated to a 100 percent sample. Surveys were cross-tabulated to determine which corridors were rated as most important to companies located in each sub-area. The survey data was used to forecast potential numbers of shipments that might travel over those corridors which were expected to receive higher levels of use (i.e. were rated 3 or higher on the scale provided). Corridors were then ranked for each sub-area based on the projected volume of shipments they would be likely to carry, with the highest ranking corridor assigned a (1) and each remaining corridor assigned progressively larger numeric values. In order to provide equal weight to companies located in each part of the Study Area, individual rankings for all sub-areas were summed to provide a countywide index value for all corridors. The resulting “shipping demand” index appears in Table 5 and ranges from a “best” of 17 for Corridors H and K, to a “worst” of 49 for D and E.

Because the survey only addressed the 13 original corridors, the original data had to be interpreted for application to the individual north/middle/south segments, as well as the composite and modified corridors. Because the segments and composites generally consisted of portions or combinations of the 13 original corridors, it was relatively easy to determine how respondents would have reacted to these additional options. It should also be noted that separate rankings were developed for each set of corridor segments (i.e. northern options were only compared to each other), and that the 7 composite/modified corridors were only ranked against each other. Therefore, the ranking matrix should not be used to compare one of the original corridors to a composite.

c. Potential Retail Dislocation Effects

While the preceding criteria are generally considered to positive economic impacts, the effects of highway investments do not always “benefit” all businesses or distribute economic benefits equally among all communities. Potential harmful economic effects associated with highway investments may include takings of individual properties, physical disruptions to existing neighborhoods or business districts, or the diversion of customer traffic from existing roads to new or upgraded corridors. For businesses that provide roadside services or depend on through-traffic as an important source of customers and sales, traffic diversion caused by highway investments can result in lower sales and resulting business dislocation effects.

The removal of through-traffic from an existing corridor may not necessarily cause roadside businesses to lose sales in all cases, nor will all “bypassed” businesses be affected equally. In high-traffic areas or well established commercial/retail corridors, removal of through-traffic can sometimes help businesses by removing congestion and making it more convenient for customers to access stores. In other cases, increased economic activity and local population growth generated by the highway investment may help to replace lost sales to through-travelers with higher revenues from local residents or nearby workers. In rural locations and areas with weak economies, however, bypass effects tend to be longer lasting and are more likely to result in permanent business closures.

In order to quantify the potential business dislocation effects of the proposed corridors, RKG Associates also distributed surveys to nearly 140 smaller retail/service businesses located along or near the existing Route 1 Corridor between Downtown Caribou and Houlton. This survey was targeted to traveler-oriented businesses such as gas stations, convenience stores, restaurants, lodging facilities and specialty stores that are dependent upon Route 1 traffic. The purpose of the survey was to gather data to quantify the total volume of sales generated by these traffic-dependent businesses, the percentage of total sales attributed to through traffic and the degree of concern local business operators had regarding specific corridors.

The survey effort produced 39 responses (a 28% return). Responses were representative of the Route 1 corridor both geographically and among most business types. Respondents employed a total of nearly 400 workers and reported roughly \$40.5 million in aggregate annual sales. Survey respondents were asked to report their total annual sales volume and to estimate the percentage of total sales that could be reasonably attributed to through-travelers as opposed to local residents. Approximately 89% of all businesses surveyed indicated that they were dependent to varying degrees on sales generated from through traffic. The reported percentage of sales attributed to through traffic averaged 32% for all respondents, with a reported median of 25%.

Additional detail was also provided concerning numbers of daily customers and the specific types of through-traffic served (i.e. tourists, truckers, business travelers, etc.). Respondents were also asked to evaluate Corridors A through M and express their preferences and/or concerns. For those corridors that posed the greatest concern, business owners were asked to assess the potential severity of expected impacts on their business operations.

Using the survey data, RKG Associates was able to estimate the total annual retail sales generated along the Route 1 corridor, as well as provide an estimate of the share of that business volume that can be attributed to through traffic. Results were compared for reasonableness against annual retail sales data compiled by the Maine State Planning Office.⁴ This data tracks taxable retail sales by store type and geographic area. For the Northern Maine Region (Aroostook County) sales data are reported for the Houlton, Patten, Presque Isle, Madawaska and Fort Kent Districts. In 2000, consumer retail sales attributed to all store types in the Houlton and Presque Isle Districts totaled \$350.2 million.

From the survey sample, RKG estimated that annual retail sales generated by businesses located along or near the Route 1 Corridor between Caribou and Houlton totaled roughly \$160.2 million in 2000. This figure represents roughly 46% of the total consumer sales attributed to all store types in the Houlton and Presque Isle Districts for that year. Given the fact that nearly all of the region's largest retailers are located on Route 1, this percentage appears to be reasonable, after excluded automobile sales.

The actual estimate of traffic dependent sales by Route 1 businesses, based upon the survey findings, was estimated at roughly \$32.4 million in 2000. This represents about 20% of all sales on the Route 1 corridor and 9.2% of total consumer retail sales in the combined Houlton and Presque Isle Districts. Of this \$32 million in sales, roughly 37% is attributed to businesses in Houlton, 40% to businesses in Presque Isle and Caribou and the remaining 23% (\$7.4 million) to businesses located from Littleton to Mars Hill. In essence, this \$32 million figure represents the maximum dollar value of retail sales that could be subject to potential redistribution within the region due to changing traffic patterns. Although a relatively small number of businesses are located in the Littleton-Mars Hill area, the high share of "at risk" sales reflects a greater dependency by local businesses on through traffic than either Houlton or Presque Isle/Caribou, which have larger resident populations and are established retail destinations for surrounding communities.

After estimating the total dollar value of retail sales that could be potentially subject to disruption by changing traffic patterns, it was necessary to devise a methodology to estimate and compare the potential impacts of each corridor on these traffic-dependent sales. To provide a consistent basis for comparison, it was determined that these sales should be

⁴ Source: Maine Retail Sales Quarterly Report: 2000 Annual Review, Maine State Planning Office, February 2001.

adjusted by the same percentage as future changes in Route 1 traffic flows, as estimated by VHB. This was done by comparing 2030 ADT estimates for each Corridor at various representative Route 1 locations and then calculating the percentage change in traffic compared to the No Build condition. Where traffic changes were negative, the same percentage reductions were applied to traffic-dependent sales to derive an estimate of the potential magnitude of losses by the affected businesses. Where 2030 traffic projections were projected to be higher than the No-Build condition, no business dislocation effects were assumed to occur.

The resulting estimated of potential lost sales to Route 1 businesses for each corridor are reported in Table 6. As shown, maximum potential sales losses of \$19.5 million are attributed to Corridor K, because it removes the highest volume of existing traffic from Route 1. Lesser sales reductions are attributed to the remaining corridors.

**Table 6
 Summary of Other Economic Screening Criteria**

Simulation Number	Corridor Description	Improved I-Park Access (Total Acres) [1]	Employment Base Served (No of Jobs) [2]	Shipping Demand Score (1=Highest) [3]	Sales Dislocation Effects on Rt. 1 Businesses [4]
13 ORIGINAL CORRIDORS					
1	Corridor A	1,014	15,525	23	(\$4.14)
2	Corridor B	705	16,776	23	(\$0.52)
3	Corridor C	394	14,936	45	(\$2.36)
4	Corridor D	29	4,817	49	(\$0.07)
5	Corridor E	38	5,275	49	\$0.00
6	Corridor F	438	8,925	40	(\$4.14)
7	Corridor G	367	11,800	41	(\$1.88)
8	Corridor H	600	17,969	17	(\$4.92)
9	Corridor I	614	14,640	36	(\$2.97)
10	Corridor J	610	17,614	29	(\$9.25)
11	Corridor K	638	20,765	17	(\$19.51)
12	Corridor L	249	7,551	33	\$0.00
13	Corridor M	142	7,551	Na	\$0.00
CORRIDOR SEGMENTS					
Southern Decision					
14	So. 1 (Portion of Corridors A and B)	622	12,790	11	\$0.00
15	So. 2 (Portion of Corridor H)	586	17,982	12	(\$3.77)
16	So. 3 (Portion of Corridor K)	622	12,790	10	(\$13.80)
Middle Decision					
17	Mid. 1 (Portion of Corridor A)	856	4,723	8	(\$2.24)
18	Mid. 2 (Portion of Corridor B)	498	3,053	8	\$0.00
19	Mid. 3 (Portion of Corridor K and upgrades of Rte. 1)	446	9,316	16	(\$1.24)
20	Mid. 4 (Corridor L with upgrades of Route 1)	471	9,680	16	\$0.00
21	Mid. 5 (Corridor M with upgrades of Route 1)	546	11,581	18	\$0.00
North Decision					
22	No. 1 (D, E and Portion of I)	132	2,627	8	\$0.00
23	No. 2 (Portion of H and K)	21	3,705	14	\$0.00
24	No. 3 (Portion of B)	252	3,800	13	(\$0.15)
COMPOSITES AND MODIFIED CORRIDORS					
25	Composite 1 (So:A/B/Mid:L/No:D,E,I)	1,225	24,299	17	\$0.00
26	Composite 2 (So:A/B/Mid:L/No:D(2Lane),E(2Lane),I)	1,225	24,299	17	\$0.00
27	Composite 4 (So:H/Mid:L/No:D,E,I)	1,189	25,887	21	(\$4.92)
28	Composite 5 (So:K/Mid:L/No:D,E,I)	1,225	24,328	22	(\$15.48)
29	Composite 6 (So:A/B/Mid:K/No:D,E,I)	1,200	25,028	17	\$0.00
30	H Modified	1,078	17,982	31	(\$4.92)
31	K Modified	1,089	14,188	27	(\$15.48)
NOTES					
[1]	Total estimated acreage within existing Study Area industrial parks that could experience improved regional access from implementation of the proposed corridors.				
[2]	Estimated job base located within the region's existing employment centers, which could potentially gain improved transportation service from implementation of the proposed corridors.				
[3]	Demand index which measures the relative ranking of each corridor by major freight shippers/receivers located throughout Aroostook County. 1 equals maximum rank.				
[4]	Estimated current (2000) value of potential lost retail sales among existing Route 1 businesses located between Caribou and Houlton, based upon projected 2030 changes in Route 1 traffic volumes.				

4. Corridor Indexing

The preceding screening criteria, including the REMI model outputs and additional indicators in Table 5, each provide a different method or perspective from which to evaluate and compare the potential economic performance of the 31 corridors. In the form presented above, the data do not facilitate an evaluation of the corridors across multiple measures of performance or economic impact. In order to provide a means to combine screening criteria and measure the relative performance of each corridor, the results reported in Tables 5 and 6 were also indexed. For each factor assessed, the best corridor performance was indexed to 1.0 and all other corridor outcomes were referenced to that value, resulting in indices between 0 and 1. In the case of negative variables such as business dislocation effects, the worst performing corridor was indexed to -1.0 and less disruptive alternatives were indexed to a maximum value of zero. Consequently, corridors that caused internal dislocation of business activity within the region were adjusted downward in the comparative process.

The resulting index values for all screening criteria appear in Table 7 on the following pages. The table provides separate sets of index values for the 13 original corridors, the 11 north/middle/south segments and the seven, composite/modified corridors. Explanatory notes are provided at the conclusion of the Table.

D. Cost-Effectiveness Analysis

The final step in the economic screening analysis involved comparing all of the corridors in terms of their construction cost and overall cost effectiveness. In this case, “cost effectiveness” compares the relative value of future economic benefits against the size of the investment or public cost required to generate those benefits. This measure should not be confused with a benefit/cost ratio, because it does not attempt to quantify the economic value of all user benefits or the full range of costs (including environmental costs) associated with each corridor. It should also be noted that the purpose of this analysis is to provide a basis for comparing the relative effectiveness of corridors that may have widely varying construction costs. The analysis is useful to help narrow the range of corridor options to a preferred alternative. However, no effort is made to set a threshold for determining whether any individual corridor can be economically justified (or not justified) as a stand-alone investment.

**Table 7
 Index Values of Corridor Performance in Meeting the Project Statement of Purpose and Need**

Simulation Number	Corridor Description	Population Change [1]	Employment Change [2]	Disposable Pers. Inc. Mil \$92 [3]	Retail Sales Impact [4]	Sales Dislocation Effects on Rt. 1 Businesses [5]	Improved I-Park Access (Total Acres) [6]	Employment Base Served [7]	Value of Commuting Amenity [8]	Shipping Demand Score [9]
<i>13 ORIGINAL CORRIDORS</i>										
	Index Value [*]	1,089	564	\$ 24.50	\$ 9.52	(\$ 19.51)	1,014	20,765	\$ 0.99	17
1	Corridor A	0.58	0.60	0.60	0.60	-0.21	1.00	0.75	0.60	0.74
2	Corridor B	0.55	0.55	0.55	0.53	-0.03	0.70	0.81	0.49	0.74
3	Corridor C	0.20	0.22	0.24	0.19	-0.12	0.39	0.72	0.09	0.38
4	Corridor D	0.06	0.06	0.05	0.06	0.00	0.03	0.23	0.22	0.35
5	Corridor E	0.11	0.11	0.11	0.10	0.00	0.04	0.25	0.52	0.35
6	Corridor F	0.05	0.06	0.05	0.06	-0.21	0.43	0.43	0.09	0.43
7	Corridor G	0.25	0.27	0.31	0.18	-0.10	0.36	0.57	0.05	0.41
8	Corridor H	1.00	1.00	1.00	1.00	-0.25	0.59	0.87	0.93	1.00
9	Corridor I	0.39	0.41	0.41	0.37	-0.15	0.61	0.71	0.31	0.47
10	Corridor J	0.73	0.74	0.75	0.72	-0.47	0.60	0.85	0.64	0.59
11	Corridor K	0.93	0.94	0.93	0.95	-1.00	0.63	1.00	1.00	1.00
12	Corridor L	0.00	0.00	0.00	0.00	0.00	0.25	0.36	0.10	0.52
13	Corridor M	0.00	0.00	0.00	0.00	0.00	0.14	0.36	0.01	0.00

NOTE: * Index values are the values of those Corridors which ranked highest in each category. All other Corridors are compared to the index. For definitions of column headings, see notes at the end of the table.

Table 7 (Continued)
Index Values of Corridor Performance in Meeting the Project Statement of Purpose and Need

Simulation Number	Corridor Description	Population Change [1]	Employment Change [2]	Disposable Pers. Inc. Mil \$92 [3]	Retail Sales Impact [4]	Sales Dislocation Effects on Rt. 1 Businesses [5]	Improved I-Park Access (Total Acres) [6]	Employment Base Served [7]	Value of Commuting Amenity [8]	Shipping Demand Score [9]
<i>CORRIDOR SEGMENTS</i>										
<i>Southern Decision</i>										
Index Value [*]		196	114	\$ 3.29	\$ 2.50	(\$ 13.80)	622	17,982	\$ 0.40	10
14	So. 1 (Portion of Corridors A and B)	0.96	0.96	0.95	0.71	0.00	1.00	0.71	0.95	0.91
15	So. 2 (Portion of Corridor H)	1.00	1.00	1.00	0.95	-0.27	0.94	1.00	0.51	0.83
16	So. 3 (Portion of Corridor K)	0.68	0.72	0.73	1.00	-1.00	1.00	0.71	1.00	1.00
<i>Middle Decision</i>										
Index Value [*]		151	100	\$ 2.70	\$ 2.37	(\$ 2.24)	856	11,581	\$ 0.28	8
17	Mid. 1 (Portion of Corridor A)	0.78	0.45	0.80	0.67	-1.00	1.00	0.41	0.64	1.00
18	Mid. 2 (Portion of Corridor B)	0.43	1.00	0.50	0.37	0.00	0.58	0.26	0.35	1.00
19	Mid. 3 (Portion of Corridor K and upgrades of Rte. 1)	1.00	0.63	1.00	0.62	-0.55	0.52	0.80	0.61	0.50
20	Mid. 4 (Corridor L with upgrades of Route 1)	0.62	0.56	0.64	1.00	0.00	0.55	0.84	1.00	0.50
21	Mid. 5 (Corridor M with upgrades of Route 1)	0.55	0.70	0.58	0.54	0.00	0.64	1.00	0.53	0.44
<i>North Decision</i>										
Index Value [*]		91	70	\$ 2.09	\$ 1.38	(\$ 0.15)	252	3,800	\$ 0.28	8
22	No. 1 (D, E and Portion of I)	1.00	1.00	1.00	1.00	0.00	0.52	0.69	1.00	1.00
23	No. 2 (Portion of H and K)	0.85	0.79	0.75	0.87	0.00	0.08	0.98	0.52	0.57
24	No. 3 (Portion of B)	0.30	0.31	0.33	0.29	-1.00	1.00	1.00	0.16	0.62

NOTE: * Index values are the values of those Corridors which ranked highest in each category. All other Corridors are compared to the index. For definitions of column headings, see notes at the end of the table.

Table 7 (Continued)

Index Values of Corridor Performance in Meeting the Project Statement of Purpose and Need

Simulation Number	Corridor Description	Population Change [1]	Employment Change [2]	Disposable Pers. Inc. Mil \$92 [3]	Retail Sales Impact [4]	Sales Dislocation Effects on Rt. 1 Businesses [5]	Improved I-Park Access (Total Acres) [6]	Employment Base Served [7]	Value of Commuting Amenity [8]	Shipping Demand Score [9]
COMPOSITES AND MODIFIED CORRIDORS										
Index Value [*]		1,096	578	\$ 24.48	\$ 9.98	(\$ 15.48)	1,225	25,887	\$ 1.19	17
25	Composite 1 (So:A/B/Mid:L/No:D,E,I)	0.89	0.89	0.87	0.88	0.00	1.00	0.94	0.90	1.00
26	Composite 2 (So:A/B/Mid:L/No:D(2Lane),E(2Lane),I)	0.88	0.88	0.86	0.89	0.00	1.00	0.94	0.90	1.00
27	Composite 4 (So:H/Mid:L/No:D,E,I)	0.88	0.86	0.88	0.81	-0.32	0.97	1.00	0.90	0.81
28	Composite 5 (So:K/Mid:L/No:D,E,I)	0.88	0.87	0.87	0.85	-1.00	1.00	0.94	1.00	0.77
29	Composite 6 (So:A/B/Mid:K/No:D,E,I)	0.67	0.67	0.63	0.66	0.00	0.98	0.97	1.00	1.00
30	H Modified	1.00	1.00	1.00	1.00	-0.32	0.88	0.69	0.78	0.55
31	K Modified	0.99	0.99	0.99	0.98	-1.00	0.89	0.55	0.83	0.63

NOTES

- [1] Difference in total Aroostook County Population in 2030, compared to the No-Build Alternative.
- [2] Difference in total Aroostook County 2030 employment, compared to the No-Build Alternative.
- [3] Difference in real aggregate disposable personal income in 2030, compared to the No-Build Alternative. Values are expressed in millions of 1992 constant dollars.
- [4] Difference in total Aroostook County retail sales in 2030, compared to the No-Build Alternative. Values are expressed in millions of current dollars.
- [5] Estimated current (2000) value of potential lost retail sales among existing Route 1 businesses located between Caribou and Houlton, based upon projected 2030 changes in Route 1 traffic volumes.
- [6] Weighted index of Study Area industrial park land that would benefit from improved regional access from implementation of the proposed corridors.
- [7] Estimated job base located within the region's existing employment centers, which could potentially gain improved transportation service from implementation of the proposed corridors.
- [8] Estimated annual economic value of time savings to the region's commuters in 2030, in millions of current dollars.
- [9] Demand index which measures the relative ranking of each corridor by major freight shippers/receivers located throughout Aroostook County. 1 equals maximum rank.

Cost effectiveness was determined by first calculating the present dollar value of anticipated future economic benefits from each corridor, measured in terms of impact on gross regional product (GRP). GRP impacts for the corridor were generated using the REMI model. The present value of future benefits was then compared to the present value of the estimated construction cost for each corridor (exclusive of right-of-way acquisition costs). The resulting measure compares the present value change in GRP returned from each dollar of construction cost. Alternatives with a higher present value return on GRP per dollar invested are more cost-effective than those with lower returns. Cost effectiveness measures were calculated for both Aroostook County, using county change in GRP, and the State of Maine. The latter measure recognizes that the economic impacts of each corridor will not be confined exclusively to the Aroostook County economy, and that other areas of the State may also benefit.

Results of the cost effectiveness analysis appear in Table 8. As shown, the resulting economic benefits to Aroostook County range from a low of \$0.28 per dollar of construction cost (Corridor D) to a maximum return of \$0.74 (Corridor A). When economic impacts are considered across the entire Maine economy, the cost effectiveness measures range from \$0.37 per dollar of construction cost to a maximum return of \$0.95. Among the larger Composite and Modified Corridors, Corridor K Modified is most cost effective with a return to Aroostook County of \$0.72 per dollar of construction cost.

E. Conclusion

The methodologies outlined in this memorandum were developed to provide a quantifiable set of criteria to evaluate a large number of alternative corridors, in terms of their effectiveness in meeting the stated economic purpose and need for the project. These corridors are wide ranging in scale and cost, and impact varying locations within Aroostook County. Although there are obvious limitations to the data sources and methods used, every effort was made to provide a comprehensive, objective and consistent set of criteria with which to evaluate economic impacts.

Table 8
Comparative Cost Effectiveness of Corridors in Meeting the Project Statement of Purpose and Need

Simulation Number	Corridor Description	Total Construction Cost [1]	Aroostook GRP Change [2]	Maine GRP Change [3]	Cost Effectiveness PV of GRP/1\$ Const. Cost		Rank [6]
					Aroostook [4]	Maine [5]	
13 ORIGINAL CORRIDORS							
1	Corridor A	\$281.80	\$17.47	\$21.72	\$0.74	\$0.95	1
2	Corridor B	\$390.30	\$16.04	\$19.99	\$0.51	\$0.66	6
3	Corridor C	\$337.70	\$6.68	\$8.40	\$0.38	\$0.50	8
4	Corridor D	\$220.00	\$1.52	\$2.11	\$0.28	\$0.38	12
5	Corridor E	\$232.90	\$2.20	\$3.62	\$0.32	\$0.42	11
6	Corridor F	\$94.20	\$1.51	\$1.98	\$0.37	\$0.49	9
7	Corridor G	\$553.50	\$8.53	\$10.64	\$0.33	\$0.43	10
8	Corridor H	\$439.40	\$28.99	\$35.93	\$0.66	\$0.84	2
9	Corridor I	\$434.90	\$11.92	\$14.94	\$0.41	\$0.53	7
10	Corridor J	\$423.00	\$21.69	\$27.02	\$0.63	\$0.82	4
11	Corridor K	\$426.60	\$26.94	\$33.51	\$0.66	\$0.85	2
12	Corridor L	\$40.50	\$0.06	\$0.11	\$0.28	\$0.37	12
13	Corridor M	\$18.40	\$0.05	\$0.11	\$0.56	\$0.71	5
CORRIDOR SEGMENTS							
Southern Decision							
14	So. 1 (Portion of Corridors A and B)	\$138.30	\$4.34	\$5.86	\$0.55	\$0.74	1
15	So. 2 (Portion of Corridor H)	\$155.00	\$4.54	\$6.15	\$0.44	\$0.59	3
16	So. 3 (Portion of Corridor K)	\$173.80	\$3.30	\$4.52	\$0.53	\$0.71	2
Middle Decision							
17	Mid. 1 (Portion of Corridor A)	\$187.30	\$3.00	\$4.12	\$0.40	\$0.54	4
18	Mid. 2 (Portion of Corridor B)	\$197.90	\$1.83	\$2.57	\$0.34	\$0.45	5
19	Mid. 3 (Portion of Corridor K and upgrades of Rte. 1)	\$113.40	\$3.94	\$5.38	\$0.48	\$0.82	2
20	Mid. 4 (Corridor L with upgrades of Route 1)	\$113.20	\$2.51	\$3.45	\$0.61	\$0.65	1
21	Mid. 5 (Corridor M with upgrades of Route 1)	\$118.10	\$2.24	\$3.09	\$0.45	\$0.61	3
North Decision							
22	No. 1 (D, E and Portion of I)	\$345.70	\$2.88	\$4.09	\$0.32	\$0.43	2
23	No. 2 (Portion of H and K)	\$166.80	\$2.20	\$3.06	\$0.38	\$0.52	1
24	No. 3 (Portion of B)	\$148.10	\$0.92	\$1.34	\$0.32	\$0.43	2
COMPOSITES AND MODIFIED CORRIDORS							
25	Composite 1 So:A/B/Mid:L/No:D,E,I	\$599.50	\$25.56	\$32.15	\$0.53	\$0.69	4
26	Composite 2 So:A/B/Mid:L/No:D(2Lane),E(2Lane),I	\$477.80	\$25.30	\$31.72	\$0.60	\$0.78	3
27	Composite 4 So:H/Mid:L/No:D,E,I	\$634.96	\$25.36	\$31.68	\$0.50	\$0.65	6
28	Composite 5 So:K/Mid:L/No:D,E,I	\$616.15	\$25.34	\$31.75	\$0.51	\$0.67	5
29	Composite 6 So:A/B/Mid:K/No:D,E,I	\$599.24	\$18.74	\$23.79	\$0.44	\$0.58	7
30	H Modified	\$434.24	\$29.32	\$36.50	\$0.70	\$0.90	2
31	K Modified	\$415.22	\$29.05	\$36.13	\$0.72	\$0.93	1
NOTES							
[1] Estimated corridor construction cost in millions of 2000 dollars.							
[2] Difference in total Aroostook County 2030 Gross Regional Product compared to the No-Build Alternative. Values are expressed in Millions of 1992 Constant \$.							
[3] Difference in total Maine 2030 Gross Regional Product (including Aroostook County) compared to the No-Build Alternative. Values are expressed in Millions of 1992 Constant \$.							
[4] Ratio of the present value of 2030 Aroostook County GRP growth per dollar of construction cost.							
[5] Ratio of the present value of 2030 Maine GRP growth per dollar of construction cost.							
[6] Rankings are based on cost effectiveness relative to Aroostook County GRP. Numeric rankings are among corridors in the same category.							